

# **Bijlagen bij Leidraad Organisatie van Intensive Care in Nederland**

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## Bijlage - Verantwoording

### Autorisatie en geldigheid

Autorisatiedatum:	[datum]
Eerstvolgende beoordeling actualiteit	[datum] [en evt. de reden dat de herbeoordeling/herziening dan plaats zou moeten vinden].
Geautoriseerd door:	[Vereniging 1], initiatiefnemer [Vereniging 2], etc. [alle overige verenigingen (NB. Uitschrijven, geen afkortingen) en (patiënt) organisaties noemen die de leidraad hebben geautoriseerd of geaccordeerd]
Belangrijkste wijzigingen t.o.v. vorige versie:	Het betreft een herziening van de hele leidraad.
Herbevestiging:	[datum] [onderbouwing waarom module niet herzien is]
Regiehouder(s):	[Betreffende vereniging]

### Algemene gegevens

De ontwikkeling/herziening van deze module werd ondersteund door het Kennisinstituut van de Federatie Medisch Specialisten ([www.demedischspecialist.nl/kennisinstituut](http://www.demedischspecialist.nl/kennisinstituut)) en werd gefinancierd uit de Kwaliteitsgelden Medisch Specialisten (SKMS). De financier heeft geen enkele invloed gehad op de inhoud van de module.

### Samenstelling werkgroep

Voor het ontwikkelen van de module is in 2023 een multidisciplinaire werkgroep ingesteld, bestaande uit vertegenwoordigers van alle relevante specialismen (zie hiervoor de Samenstelling van de werkgroep) die betrokken zijn bij de zorg voor patiënten die zijn opgenomen op de Intensive Care.

### Belangenverklaringen

De Code ter voorkoming van oneigenlijke beïnvloeding door belangenverstremgeling is gevolgd. Alle werkgroepleden hebben schriftelijk verklaard of zij in de laatste drie jaar directe financiële belangen (betrekking bij een commercieel bedrijf, persoonlijke financiële belangen, onderzoeksfinanciering) of indirecte belangen (persoonlijke relaties, reputatiemanagement) hebben gehad. Gedurende de ontwikkeling of herziening van een module werden wijzigingen in belangen aan de voorzitter doorgegeven. De belangenverklaring wordt opnieuw bevestigd tijdens de commentaarfase.

Een overzicht van de belangen van werkgroepleden en het oordeel over het omgaan met eventuele belangen vindt u in onderstaande tabel. De ondertekende belangenverklaringen zijn op te vragen bij het secretariaat van het Kennisinstituut van de Federatie Medisch Specialisten.

Werkgroep lid	Functie	Nevenfuncties	Gemelde belangen	Ondernomen actie
Meynaar, voorzitter	Intensivist, HagaZiekenhuis	Bestuurslid Nederlandse Vereniging voor Intensive Care, onbetaald behoudens een onkostenvergoeding, onderzoeker	Leren van Juiste Diagnoses, door ZonMw gesubsidieerd onderzoek 160.000 euro (inmiddels afgerond 2021-2023) ZonMw Leren van Juiste Diagnoses	Geen restricties
De Jong	Internist-intensivist Saxenburgh Medisch Centrum	- Cliëntenraad Prinses Maxima Centrum (onkostenvergoeding) - Clinical research committee Prinses Maxima Centrum (onkostenvergoeding) - Incidentele waarneming op intensive care afdelingen in de regio Zwolle	Eenmalige deelname binnen adviesraad voor Paion t.a.v. positionering van giapreza binnen intensive care geneeskunde	Geen restricties
Veenstra	Intensivist UMCG	Instructeur NVIC bronchoscopie cursus (onbetaald) Lid NVIC commissie pulmonale diagnostiek en interventies (onbetaald) Lid NVIC commissie simulatie (onbetaald) FCCS instructeur (vergoeding wordt overgemaakt naar het UMCG) Medisch visitator externe kwaliteitsvisitaties NVIC (vergoeding wordt overgemaakt naar het UMCG) Lid Zinnige Zorg traject Zorginstituut VTE (NVIC	Geen	Geen restricties

		afgevaardigde, onbetaald) Secretaris sectie IC, NVALT (onbetaald) Lid sectie pulmonale interventies, NVALT (onbetaald)		
Zijlstra	Longarts- Intensivist, Dijklander Ziekenhuis, betaald	Geen	Geen	Geen restricties
Van Bommel	Intensivist, Erasmus Medisch Centrum Rotterdam. Werkzaam als stafid op de Intensive Care Volwassenen (betaald).	Geen	Geen	Geen restricties
Meijer	Chirurg-intensivist bij de Noordwest Ziekenhuisgroep (1,0 FTE)	Lid toelatingscommissie binnen Noordwestziekenhuisgro ep (onbetaald) Instructeur bij stichting ALSG voor de cursussen ATLS, MedicALS en MRMI (betaald, d.w.z.het ziekenhuis krijgt mijn vergoeding). Lid van de GIC (gemeenschappelijke intensivisten commissie), namens de Nederlandse Vereniging voor Heelkunde. Bestuurslid stichting “ For Wis(h)dom Foundation (onbetaald) zie forwishdom.org. Een goede doelen stichting die een bijdrage levert naar de	Geen	Geen restricties

		behandeling van zeldzame ziektes.		
Van Duijvenbode – den Dekker	IC verpleegkundige, Amphia Ziekenhuis	Docent Erasmus MC Academie Bestuurslid V&VN IC Commissielid NKIC	Geen	Geen restricties
Van Mol	Assistent Professor Erasmus MC, Intensive Care Volwassenen	Bestuurslid Stichting FCIC (onbezoldigd) Bestuurslid V&VN-IC (onbezoldigd) Commissielid N&AHP bij ESICM (onbezoldigd)	1. ZonMw - hoofdonderzoeker van de ICNaVen-studie, ontwikkelen digitale ondersteuning in IC-nazorg voor naasten van een IC-patiënt. Dit is een multicenter studie (nationale en internationale samenwerking) waarbij eerst de behoeften en prioritering wordt verkend en vervolgens een daarop aangepaste interventie wordt ontwikkeld. (Projectleider) 2. ZonMw - hoofdonderzoeker van de DIPIC-studie, een implementatiestudie voor een digitaal dagboek op de IC, als opmaat naar persoonsgerichte zorg. Dit is een multicenter studie in een multi-methods benadering, om het gebruik van een	Geen restricties

			<p>digitaal dagboek op de IC te stimuleren. (Projectleider)</p> <p>3. ZonMw - Ik ben mede-onderzoeker bij het ontwikkelen van een PGO-IC(na)zorg. Hierbij wordt in co-creatie met verschillende stakeholders en Quli een digitale omgeving specifiek ingericht op de voormalig IC-patiënt. Stichting FCIC is penvoerder. (Projectleider)</p>	
Zegers	Associate Professor Radboudumc	Geen	<p>1. Zorginstituut - Evaluatie van IC Nazorg (Projectleider)</p> <p>2. ZonMw/NWO- Evaluatie van de kosten-effectiviteit van IC-zorg (Projectleider)</p> <p>3. NFU-Zire (Projectleider)</p> <p>4. ZonMw - Safety 2 (Projectleider)</p>	Geen restricties
Koning	Anesthesioloog-intensivist, Rijnstate Ziekenhuis, Arnhem	Geen	Geen	Geen restricties
Moviat	Intensivist Jeroen Bosch ziekenhuis	FCCS instructeur	Geen	Geen restricties
Rood (tot 11-03-2024)	Senior onderzoeker - Projectleider, HAN	Vicevoorzitter, V&VN-IC, beroepsvereniging van IC verpleegkundigen	Ja, NWO Raak SIA NWO RAAK SIA Familieparticipatie op de IC	Geen restricties

	University of applied sciences			
Stilma (vanaf 11-03-2024)	Hogeschool hoofddocent bij cluster verpleegkunde, Hogeschool van Amsterdam, Amsterdam (0,8 FTE)	Bestuurslid V&VN-IC Betrokken bij: De Duurzame Verpleegkundige en De Groene IC	1. NWO - NWO docentenbeurs - promotietraject (Projectleider) 2. KIEM-MV - Circulaire kansen beademingszorg (Projectleider)	Geen restricties
Van Vliet	Intensivist / Haaglanden Medisch Centrum	Bestuursvoorzitter MuzIC (onbetaald) Docent RTG: docent voor de practitioner opleiding, specifiek gericht op uitstroomprofiel 'neural practitioner' (betaald) Docent opleiding IC-verpleegkundigen LUMC: docent voor de onderwerpen 'neuro-IC' (betaald) ATLS instructeur (onbetaald) Docent bij de Hogeschool Utrecht bij de PA-opleiding (betaald)	Geen	Geen restricties
Weyer	Cardioloog-intensivist Elkerliek ziekenhuis Helmond	FCCS instructeur	Geen	Geen restricties
De Kleijn	Physician assistant Intensive care Catharina ziekenhuis Eindhoven	Commissielid NVIC richtlijnontwikkeling lid NAPA vakgroep intensive care	Geen	Geen restricties
Droogh	Intensivist, UMCG	Voorzitter commissie transport NVIC, onbetaald Hoofd MICU UMCG	Geen	Geen restricties
Van Westeloo	Intensivist LUMC	MICU Zuidwest Nederland	Circadiaan onderzoek Philips	Geen restricties

		Eurocross		
Jacobs	Intensivist Elkerliek Ziekenhuis Helmond	Geen	Geen	Geen restricties
Heij	Intensivist, Sparne Gasthuis	Bestuurslid NVIC, onkostenvergoeding Voorzitter cie Beroepsbelangen NVIC Lid ledenraad LAD, onkostenvergoeding	Geen	Geen restricties
Rozendaal	Verpleegkundig Specialist IC/MC St. Antoniusziekenhui s	Docent respiratie en beademing, St. Antoniusacademie (parttime)	Geen	Geen restricties
Janssen	Adviseur Kennisinstituut FMS	Promovendus UMCU	Geen	Geen restricties
Hofstede	Senior adviseur Kennisinstituut FMS	Geen	Geen	Geen restricties

### Inbreng patiëntenperspectief

Er werd aandacht besteed aan het patiëntenperspectief door een afgevaardigde patiëntenvereniging in de werkgroep (FCIC/IC-Connect). De verkregen input is meegenomen bij het opstellen van de uitgangsvragen, de keuze voor de uitkomstmaten en bij het opstellen van de overwegingen. De conceptleidraad is tevens voor commentaar voorgelegd aan de FCIC/IC-Connect en de eventueel aangeleverde commentaren zijn bekeken en verwerkt.

### Kwalitatieve raming van mogelijke financiële gevolgen in het kader van de Wkkgz

Bij de leidraad is conform de Wet kwaliteit, klachten en geschillen zorg (Wkkgz) een kwalitatieve raming uitgevoerd of de aanbevelingen mogelijk leiden tot substantiële financiële gevolgen. Bij het uitvoeren van deze beoordeling zijn modules op verschillende domeinen getoetst (zie het [stroomschema](#) op de Richtlijndatabase).

Uit de kwalitatieve raming blijkt dat er geen substantiële financiële gevolgen zijn, zie onderstaande tabel.

Module	Uitkomst raming	Toelichting
Module 1 Definitie van de intensive care patiënt	geen financiële gevolgen	Aanbeveling is weinig veranderd t.o.v. vorige versie. Het overgrote deel van de IC's voldoet al aan de norm.

Module 2.1 Professionals werkzaam op de IC	geen financiële gevolgen	Aanbevelingen zijn weinig veranderd t.o.v. vorige versie. Het overgrote deel van de IC's voldoet al aan de norm. Enige wijziging is het toevoegen van 2 scholingsdagen per IC-verpleegkundige. Dit betekent een kleine, niet substantiële, toename in kosten.
Module 2.2 Personeelsbeleid en -behoud	geen financiële gevolgen	De leidraad is een aanpassing van bestaande aanbevelingen en regels. Deze aanbevelingen zijn ter overweging.
Module 3.1 Formatie verpleegkundigen	geen financiële gevolgen	De norm van 3,5 fte is onveranderd gebleven. Nieuw is dat maximaal 10% ook uit andere opgeleide verpleegkundigen mag bestaan. Dit zal naar verwachting een geringe, niet substantiële kostenbesparing opleveren.
Module 3.2 Formatie intensivisten	geen financiële gevolgen	De leidraad is een aanpassing van bestaande aanbevelingen en regels. Het minimum was 4,2 fte in 2017 en is nu 4,5 fte geworden. Na een inventarisatie blijkt dat 4,5 fte ongeveer de gangbare formatie is. Slechts enkele IC's doen het met minder, maar er zijn ook IC's die hier ver boven zitten. Dit betekent een kleine, niet substantiële, toename in kosten.  Wat betreft de 0,6 fte voorwacht betekent dit voor kleine IC's dat ze iets duurder uit zijn, terwijl grote IC's met minder af kunnen. Onder de streep blijven de kosten vergelijkbaar.
Module 3.3 Aanrijtijd intensivist	geen financiële gevolgen	De aanrijdtijd was 60 minuten en is nu 30 minuten geworden. De 4,5 fte is gebaseerd op dat je al aanwezig bent. Dit is al dagelijkse praktijk voor de meerderheid van de IC's en zal voor enkele IC's betekenen dat iemand in huis moet slapen i.p.v. thuis en dat betekent mogelijk iets in de toeslagen (ORT) en een kleine, niet substantiële, toename in kosten.  Aanbeveling over de IC-voorwacht is onveranderd t.o.v. de vorige versie.

Module 4.1 MDO en perioperatieve MDO	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 4.2 Communicatie	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 4.3 Overplaatsing rondom IC-opname en IC-ontslag	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 5.1 Minimale aantal bedden op de IC	geen financiële gevolgen	Het overgrote deel van de IC's voldoet al aan de norm. Dit is organisatorisch en gaat geen extra geld kosten of opleveren.
Module 5.2 Weigeringspercentage	geen financiële gevolgen	Aanbeveling is weinig veranderd t.o.v. vorige versie. Het overgrote deel van de IC's voldoet al aan de norm.
Module 5.3 Minimals bedbezettingspercentage op de IC	geen financiële gevolgen	Aanbeveling is weinig veranderd t.o.v. vorige versie. Het overgrote deel van de IC's voldoet al aan de norm.
Module 6 Rol van IC professionals buiten de IC	geen financiële gevolgen	Aanbeveling is weinig veranderd t.o.v. vorige versie. Het overgrote deel van de IC's voldoet al aan de norm.
Module 7 Regionale samenwerking van IC zorg in Nederland	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 8 (Interklinisch) transport	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 9.1 Kwaliteitssysteem	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 9.2 Veiligheidscultuur	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 10 Werkwijze tijdens een crisis	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.
Module 11 Zorgbeleidsplan	geen financiële gevolgen	Deze aanbevelingen zijn onveranderd t.o.v. de huidige aanbeveling/huidige zorg.

## **Werkwijze**

### Achtergrond voor de herziening

In 2006 is de eerste kwaliteitsstandaard over de organisatie van de intensive care gepubliceerd en in werking getreden (NVA, 2006). In 2016 werd een herziene kwaliteitsstandaard gepubliceerd door het Zorginstituut Nederland (2016). Deze kwaliteitsstandaard werd vanuit de NVIC aangevuld met de zogenaamde blauwdruk (NVIC, 2021). Daaruit werd een visitatie normenkader ontwikkeld, wat deel uit maakt van de feitelijke handhaving en controle op de kwaliteit door de NVIC (NVIC, 2022).

De kwaliteitsstandaard uit 2016 had een looptijd van vijf jaar en moest na vijf jaar worden geëvalueerd en herzien. Door de COVID-19 pandemie kon de evaluatie pas in 2022 plaatsvinden. De NVIC benoemde een werkgroep die de evaluatie uitvoerde door middel van een enquête die werd gevolgd door interviews (NVIC, 2023). Het Kennisinstituut van de Federatie Medisch Specialisten ondersteunde deze evaluatie. In **bijlage 2** staat de samenvatting van de evaluatie met de aanbevelingen, gegroepeerd volgens de oorspronkelijke paragrafen in de kwaliteitsstandaard uit 2016. In 2023 is gestart met de herziening van de kwaliteitsstandaard. Gezien de organisatorische aard van de uitgangsvragen, wordt de herziene versie een leidraad genoemd. Dit sluit aan bij de beschreven definities in het rapport Medisch Specialistische Richtlijnen 3.0. **Bijlage 3** beschrijft de opdracht die de werkgroep kreeg van de NVIC.

### AGREE

Deze leidraad is opgesteld conform de eisen vermeld in het rapport Medisch Specialistische Richtlijnen 3.0 van de adviescommissie Richtlijnen van de Raad Kwaliteit. Dit rapport is gebaseerd op het AGREE II instrument (Appraisal of Guidelines for Research & Evaluation II; Brouwers, 2010).

### Knelpuntenanalyse en uitgangsvragen

Tijdens de voorbereidende fase voor deze herziening inventariseerde de werkgroep middels de evaluatie van kwaliteitsstandaard en een invitationale conference de knelpunten met betrekking tot de organisatie van intensive care afdelingen. Een verslag van deze invitationale conference is opgenomen onder aanverwante producten.

Op basis van de uitkomsten van de knelpuntenanalyse zijn door de werkgroep concept-uitgangsvragen opgesteld en definitief vastgesteld.

### Uitkomstmaten

Na het opstellen van de zoekvraag behorende bij de uitgangsvraag inventariseerde de werkgroep welke uitkomstmaten voor de patiënt relevant zijn, waarbij zowel naar gewenste als ongewenste effecten werd gekeken. Hierbij werd een maximum van acht uitkomstmaten gehanteerd. De werkgroep waardeerde deze uitkomstmaten volgens hun relatieve belang bij de besluitvorming rondom aanbevelingen, als cruciaal (kritiek voor de besluitvorming), belangrijk (maar niet cruciaal) en onbelangrijk. Tevens definieerde de werkgroep tenminste voor de cruciale uitkomstmaten welke verschillen zij klinisch (patiënt) relevant vonden.

### Methode onderbouwing

Aan de start van het proces is met de werkgroep besproken hoe de uitgangsvragen onderbouwd kunnen worden. De werkgroep heeft gekozen voor een combinatie van

uitgangsvragen met en zonder literatuursearch. Dit vanwege het organisatorische karakter van de leidraad en specifieke situaties die alleen in Nederland van toepassing zijn. Een uitgebreide beschrijving van de strategie voor zoeken en selecteren van literatuur is te vinden onder 'Zoeken en selecteren' onder Onderbouwing. beoordeling van de kracht van het wetenschappelijke bewijs wordt hieronder toegelicht. Daar waar de literatuur geen antwoord leverde, **werd gebruik gemaakt van expert opinie.**

#### Beoordelen van de kracht van het wetenschappelijke bewijs

De kracht van het wetenschappelijke bewijs werd bepaald volgens de GRADE-methode. GRADE staat voor 'Grading Recommendations Assessment, Development and Evaluation' (zie <http://www.gradeworkinggroup.org/>). De basisprincipes van de GRADE-methodiek zijn: het benoemen en prioriteren van de klinisch (patiënt) relevante uitkomstmaten, een systematische review per uitkomstmaat, en een beoordeling van de bewijskracht per uitkomstmaat op basis van de acht GRADE-domeinen (domeinen voor downgraden: risk of bias, inconsistentie, indirectheid, imprecisie, en publicatiebias; domeinen voor upgraden: dosis-effect relatie, groot effect, en residuele plausibele confounding). GRADE onderscheidt vier gradaties voor de kwaliteit van het wetenschappelijk bewijs: hoog, redelijk, laag en zeer laag. Deze gradaties verwijzen naar de mate van zekerheid die er bestaat over de literatuurconclusie, in het bijzonder de mate van zekerheid dat de literatuurconclusie de aanbeveling adequaat ondersteunt (Schünemann, 2013; Hultcrantz, 2017).

GRADE	Definitie
Hoog	<ul style="list-style-type: none"> <li>er is hoge zekerheid dat het ware effect van behandeling dichtbij het geschatte effect van behandeling ligt;</li> <li>het is zeer onwaarschijnlijk dat de literatuurconclusie klinisch relevant verandert wanneer er resultaten van nieuw grootschalig onderzoek aan de literatuuranalyse worden toegevoegd.</li> </ul>
Redelijk	<ul style="list-style-type: none"> <li>er is redelijke zekerheid dat het ware effect van behandeling dichtbij het geschatte effect van behandeling ligt;</li> <li>het is mogelijk dat de conclusie klinisch relevant verandert wanneer er resultaten van nieuw grootschalig onderzoek aan de literatuuranalyse worden toegevoegd.</li> </ul>
Laag	<ul style="list-style-type: none"> <li>er is lage zekerheid dat het ware effect van behandeling dichtbij het geschatte effect van behandeling ligt;</li> <li>er is een reële kans dat de conclusie klinisch relevant verandert wanneer er resultaten van nieuw grootschalig onderzoek aan de literatuuranalyse worden toegevoegd.</li> </ul>
Zeer laag	<ul style="list-style-type: none"> <li>er is zeer lage zekerheid dat het ware effect van behandeling dichtbij het geschatte effect van behandeling ligt;</li> <li>de literatuurconclusie is zeer onzeker.</li> </ul>

Bij het beoordelen (graderen) van de kracht van het wetenschappelijk bewijs in richtlijnen of leidraden volgens de GRADE-methodiek spelen grenzen voor klinische besluitvorming een belangrijke rol (Hultcrantz, 2017). Dit zijn de grenzen die bij overschrijding aanleiding zouden geven tot een aanpassing van de aanbeveling. Om de grenzen voor klinische besluitvorming te bepalen moeten alle relevante uitkomstmaten en overwegingen worden meegewogen. De

grenzen voor klinische besluitvorming zijn daarmee niet één op één vergelijkbaar met het minimaal klinisch relevant verschil (Minimal Clinically Important Difference, MCID). Met name in situaties waarin een interventie geen belangrijke nadelen heeft en de kosten relatief laag zijn, kan de grens voor klinische besluitvorming met betrekking tot de effectiviteit van de interventie bij een lagere waarde (dichter bij het nuleffect) liggen dan de MCID (Hultcrantz, 2017).

#### Overwegingen (van bewijs naar aanbeveling)

Om te komen tot een aanbeveling zijn alle aspecten die randvoorwaardelijk zijn voor het verlenen van zorg, naast de (wetenschappelijke) onderbouwing, belangrijk en worden meegewogen, zoals coördinatie, communicatie, (financiële) middelen, mankracht en infrastructuur. Aanvullende argumenten uit bijvoorbeeld aanvaardbaarheid, haalbaarheid en implementatie zijn ook meegewogen, indien van toepassing. Hierbij is gebruik gemaakt van een gestructureerd format gebaseerd op het evidence-to-decision framework van de internationale GRADE Working Group (Alonso-Coello, 2016a; Alonso-Coello 2016b). Dit evidence-to-decision framework is een integraal onderdeel van de GRADE methodiek.

#### Formuleren van aanbevelingen

De aanbevelingen geven antwoord op de uitgangsvraag en zijn gebaseerd op de (wetenschappelijke) onderbouwing en de belangrijkste overwegingen. De sterkte van de aanbeveling wordt altijd bepaald door weging van alle relevante argumenten tezamen. De werkgroep heeft bij elke aanbeveling opgenomen hoe zij tot de richting en sterkte van de aanbeveling zijn gekomen.

#### Commentaar- en autorisatiefase

Relevante modules zijn vóór de commentaar- en autorisatiefase eerst nog langs partijen uit de klankbordgroep gestuurd voor input. Binnen de NVIC en de V&VN betrof het de beroepsbelangen commissie, de visitatiecommissie NKIC, de richtlijncommissie, de werkgroep beroepsprofiel, het landelijk netwerk van ICs, de transportcommissie van de NVIC, de V&VN-IC, de V&VN-VS en de besturen van NVIC en V&VN. Buiten de NVIC betrof het, VPned (de vereniging voor practitioners) en NAPA (Nederlandse Associatie Physician Assistants), de NICE (Nationale Intensive Care Evaluatie), en de LHIC (landelijke IC hoofden overleg).

De conceptleidraadmodule werd aan de betrokken (wetenschappelijke) verenigingen en (patiënt) organisaties voorgelegd ter commentaar. De commentaren werden verzameld en besproken met de werkgroep. Tijdens de commentaarfase heeft tevens een Webinar plaatsgevonden (d.d. 07-01-2025). Naar aanleiding van de commentaren werd de conceptleidraadmodule aangepast en definitief vastgesteld door de werkgroep. De definitieve leidraadmodule werd aan de deelnemende (wetenschappelijke) verenigingen en (patiënt) organisaties voorgelegd voor autorisatie en door hen geautoriseerd dan wel geaccordeerd.

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## **Bijlage - Module 1 Definitie van de intensive care patiënt**

### **Onderbouwing**

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroep leden op basis van kennis uit de praktijk, de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet systematisch literatuuronderzoek.

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
Alle aanbevelingen uit module 1 - definitie van de intensive care patiënt.	<1 jaar (reeds geïmplementeerd)	Geen	Geen	Geen	Geen	Geen	

## **Bijlage - Module 2.1 Professionals werkzaam op de IC**

### **Onderbouwing**

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie : < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
<p>De verpleegkundige zorg voor IC-patiënten wordt verricht door specifiek en aantoonbaar opgeleide IC-verpleegkundigen.</p> <p>Deze IC-verpleegkundigen:</p> <ul style="list-style-type: none"> <li>• zijn BIG-geregistreerd;</li> <li>• zijn aantoonbaar bevoegd en bekwaam voor het gebruik van de aanwezige apparatuur;</li> <li>• staan ingeschreven in het kwaliteitsregister V&amp;VN met</li> </ul>	2-3 jaar	Tijd en geld voor scholing.	Mogelijkheden om opgedane kennis en expertise te delen met het hele team.	<p>Geringe capaciteit in verpleegkundig team.</p> <p>Geen tijd voor scholing.</p> <p>Geen prioriteit, leidinggevenden zien hier geen meerwaarde in.</p> <p>Onvoldoende interesse.</p> <p>Onvoldoende financiële ruimte</p>	<p>Opnemen in visitatiekader.</p> <p>Uitdragen en ondersteunen door V&amp;VN-IC.</p> <p>Bespreken tijdens bijeenkomst(en) LHIC.</p> <p>Gevarieerd aanbod aan scholing en congressen bieden.</p> <p>Bespreken in de regio.</p>	(Team)managers en eigen regie van IC-verpleegkundigen	

<p>deskundigheidsgebied IC of een lokaal registratiesysteem met dezelfde kenmerken en vergelijkbare eisen als een kwaliteitsregister;</p> <ul style="list-style-type: none"> <li>• worden gefaciliteerd in tijd en budget om minimaal twee dagen externe of geaccrediteerde scholing te volgen tijdens werktijd op kosten van de werkgever. Dit betreft andere scholing dan de afdelingsspecifieke basisbijscholing.</li> </ul> <p>Ondersteunende zorgprofessionals kunnen bepaalde zorgtaken overnemen onder de verantwoordelijkheid van IC-verpleegkundigen.</p>						
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<p>Zorgtaken kunnen ook door andere zorgprofessionals dan IC-verpleegkundigen zelfstandig worden uitgevoerd, mits is vastgelegd welke EPA's behaald moeten zijn om aantoonbaar bevoegd en bekwaam te zijn. Voor de zelfstandige uitvoering van deze zorgtaken gelden vergelijkbare eisen op het gebied van opleiding, registratie en bijscholing als voor IC-verpleegkundigen, passend bij de zorgtaken die deze zorgprofessionals zelfstandig uitvoeren.</p>							
<p>Alle resterende aanbevelingen in module 2.1 - professionals werkzaam op de IC.</p>	<p>&lt;1 jaar</p>	<p>geen</p>	<p>Geen, is reeds hoe het geregeld is</p>	<p>geen</p>	<p>geen</p>	<p>n.v.t.</p>	

## Bijlage - Module 2.2 Personeelsbeleid- en behoud

### Onderbouwing

#### Method

A systematic review of the literature was performed to answer the following question:  
*Which (adjustable) factors and interventions affect workforce sustainability in intensive care?*

Two PICO's were formulated and a broad search was performed to include both PICO's.

#### *PICO 1 (prognostic)*

<b>P (Population):</b>	ICU healthcare professionals (particularly nurses and doctors)
<b>I (Intervention):</b>	Factors affecting professional satisfaction and well-being
<b>C (Control):</b>	None
<b>O (Outcome):</b>	Workforce sustainability, intention to leave, vitality, burnout, teamwork

#### *PICO 2 (intervention)*

<b>P (Population):</b>	ICU healthcare professionals (particularly nurses and doctors)
<b>I (Intervention):</b>	Intervention X that aims to affect professional satisfaction and well-being
<b>C (Control):</b>	Intervention Y or no intervention
<b>O (Outcome):</b>	Workforce sustainability, intention to leave, vitality, burnout, teamwork

#### *Search and select*

A broad search was conducted in Embase.com, Ovid/Medline, Ovid/PsycInfo and Cinahl to include both PICO's. These databases were searched from 2000 until November 16<sup>th</sup>, 2023. The search was updated on March 6<sup>th</sup>, 2024. The detailed search strategy is depicted under the tab Methods. The systematic literature search resulted in 1889 hits, of which 390 studies were systematic reviews. The search aimed to find studies describing factors affecting professional satisfaction and well-being in ICU healthcare professionals. Because of the high search load, the decision was made to focus only on systematic reviews. Therefore, 390 studies were included for title and abstract screening.

A total of 25 of the 390 systematic reviews were initially selected based on title and abstract screening. After reading the full text, 19 were excluded (see the table with reasons for exclusion under the tab Methods), and seven systematic reviews were included. However, these results were not graded, due to the fact that it were systematic reviews. An overview of these results without GRADE assessment is given in tables.

## Results

Results of desired general working conditions and reasons to leave are outlined in **table 1**. Associations between burnout and job satisfaction are outlined in **table 2**. Results of specific interventions concerning ICU working conditions are summarized in **table 3**.

**Table 1. Desired general working conditions and reasons to leave**

Systematic review	Methods	Population	Findings
Adnan, 2022	Umbrella realist review for types of interventions that are effective to improve well-being and decrease burn-out among critical care healthcare professionals defined by the American Association of Critical Care Nurses	N/A	<p>Effective type of context of interventions:</p> <ul style="list-style-type: none"> <li>- tailoring interventions to individual needs;</li> <li>- structured education;</li> <li>- engagement with the intervention;</li> <li>- quiet mental space and awareness;</li> <li>- individual-focused interventions should not replace work stressors;</li> <li>- unity of interventions and measures help to determine effective interventions in the future.</li> </ul>
Khan, 2019	Systematic mixed-method literature review	Nurses in adult critical care	<p>Reasons for intention to leave ICU nurses:</p> <ul style="list-style-type: none"> <li>- working conditions (USA);</li> <li>- organizational climate (USA) was significantly inversely related to intention to leave. Average nurses' wages, hospital profitability and magnet status had strong positive and statistically significant effects on organizational climate and hospital teaching status had a significantly negative effect;</li> <li>- Nurses who perceived adequate staffing were less likely to leave their job in the next year and were less likely to be dissatisfied with their job or highly burnt out (Korea);</li> <li>- AACN-certified nurses were less likely to leave their current job and were more empowered than nurses who were not AACN certified (USA)</li> <li>- Staff were empowered by internal processes, such as feelings of doing good, increased knowledge and skills, and by external processes such as nourishing meetings, well-functioning team work and a good atmosphere (Sweden);</li> </ul>

			<ul style="list-style-type: none"> <li>- Important relationships of turnover intention with age, night shifts, emotional demands and development opportunities (the Netherlands);</li> <li>- Statistically significant association noted between burnout indices and professional satisfaction (Greece);</li> <li>- Nurses with limited autonomy and poor relationships with physicians experience greater levels of emotional exhaustion, which can negatively influence their perception of quality of care and an intention to leave (Brazil);</li> <li>- Work environment was strongly correlated with job satisfaction and intent to leave (Canada)</li> <li>- The severity of moral distress was associated with nurse–physician collaboration, dissatisfaction on care decision and intention to resign (Italy)</li> <li>- Two themes emerged as major influences on job dissatisfaction: (1) stress experienced from excessive workload demands and the ICU work environment, and a lack of respect and recognition (China).</li> </ul>
Dilig-Ruiz, 2019	Systematic review	Critical care nurses	<p>Associations between individual, employment, and organizational factors and critical care nurses’ job satisfaction:</p> <ul style="list-style-type: none"> <li>- Significant negative relationship with burnout- emotional exhaustion (5 studies)</li> <li>- Significant negative relationship with job stress (7 studies)</li> <li>- Significant positive relationship with shift worked (flexibility) (5 studies)</li> <li>- significant positive relationship with autonomy (4 studies)</li> <li>- Significant positive relationship with personnel resources and staffing (Having an adequate number and mix of staff) (6 studies)</li> <li>- Significant positive relationship with teamwork and group cohesion (The general sense of individuals wanting to stay in a particular group) (4 studies).</li> <li>- Equivocal/mixed results with respect to whether or not there is a relationship with career experience (8 studies)</li> </ul> <p>No relationship with critical care nurses’ job satisfaction:</p> <ul style="list-style-type: none"> <li>- age (8 studies)</li> </ul>

			<ul style="list-style-type: none"> <li>- gender/sex (7 studies)</li> <li>- education (7 studies)</li> </ul>						
Cucolo, 2024	Systematic review and meta-analysis	<p>Intensive care units (ICU)(5 studies); hospitalisation units (5 studies); both ICU and HU (1 study); emergency department (1 study) and different departments of the hospital (4 studies). Only one study included the primary care service.</p>	<p>Characteristics of interprofessional work and dimensions of nursing workload identified in the included studies (n=17):</p> <p>Interprofessional work:</p> <ul style="list-style-type: none"> <li>• Collaboration, partnership, trust, interaction between professionals, teamwork;</li> <li>• Good relationship between physicians and nurses and collaboration between physicians and nurses;</li> <li>• Professional communication;</li> <li>• Clarity of roles, responsibilities or professional functions;</li> <li>• Autonomy;</li> <li>• Interdependence and definition of common objectives.</li> </ul> <p>Nurse's workload:</p> <ul style="list-style-type: none"> <li>• Quantitative: Number of patients and complexity of cases versus demand for care required; ratio of patients per nurse; time dedicated to professional communication; work overtime;</li> <li>• Emotional: Stress, fear, guilt, and dietary imbalance; moral distress; burnout;</li> <li>• Cognitive: learning, specific knowledge/specialisation and interruptions (by patient, family, teams and telephone calls);</li> <li>• Qualitative: Lack of personnel and other resources</li> </ul> <p>Thematic categories, subthemes and codes identified from included studies:</p> <table border="1"> <thead> <tr> <th>Thematic categories</th> <th>Subthemes</th> <th>Codes</th> </tr> </thead> <tbody> <tr> <td></td> <td>N/A</td> <td>Professional relationship and suffering</td> </tr> </tbody> </table>	Thematic categories	Subthemes	Codes		N/A	Professional relationship and suffering
Thematic categories	Subthemes	Codes							
	N/A	Professional relationship and suffering							

			Interprofessional practice in coping with emotional overload		Teamwork and burnout Collaboration and suffering
			Time dedicated by nurses to professional communication	N/A	Time and communication
			Working conditions and patient care	Conflict and flexibility in the context of practice	Conflicts and flexibility
				Working conditions and interprofessional practice	Complexity of care, working hours, number of professionals
				Effects on patient care	Patient/family and safe care

**Table 2. Associations between burnout and job satisfaction**

Systematic review	Publication and study population	Prevalence of burnout	Results and conclusions
<p>Quesada-Puga, 2024</p> <p><i>Abbreviations used:</i>  <i>EE: Emotional exhaustion; D: Depersonalisation; PA: Personal Accomplishment;</i></p>	<p>Aragão, 2021</p> <p>65 ICU nurses in Bahía (Brazil)</p>	<p>Burnout: 53.6 %</p>	<p>Burnout is positively associated with age, employment relationship, ICU specialist qualification, income, tobacco use, alcohol use, night shift working, number of patients per shift, and perceptions of the work as very demanding.</p>
	<p>Bruyneel, 2021</p> <p>1135 ICU nurses, Belgium</p>	<p>Burnout: 68 %; D: 29 %; PA: 31 %; EE: 38 %.</p>	<p>Two thirds of ICU nurses are at risk of burnout, which is associated with working conditions during the COVID-19 pandemic. Recommendations: monitor nurses and implement measures to prevent and manage burnout syndrome.</p>
	<p>Das Neves Borges, 2021</p> <p>1052 hospital and primary care nurses in Portugal, Spain and Brazil</p>	<p>42 % of nurses presented moderate/high levels of burnout. D was higher in Spain than in Portugal.</p>	<p>Burnout affects nurses worldwide due to daily stressors and the harshness of the profession. Policies should be implemented to reduce burnout as it impacts on health nurses' health and on the healthcare provided.</p>
	<p>Fernandes, 2017</p> <p>47 ICU nurses, Brazil</p>	<p>High level of burnout: 74.5 %; Low level of job satisfaction: 93.7 %.</p>	<p>Stringent working conditions in the ICU favour the development of burnout in the nurses who work there. Risk factors include working 12 h a day and not being physically active. Gender is not a relevant factor.</p>

	<p>Friganovic and Selic, 2021</p> <p>620 ICU nurses at 5 university hospitals in Croatia</p>	<p>N.R.</p>	<p>A negative association was found between burnout and job satisfaction, and a positive one between passive coping and burnout. The evident association between burnout in nurses and their job satisfaction means hospitals should take steps to enhance workplace conditions. Training to promote active, rather than passive, coping should be provided</p>
	<p>Guirardello, 2017</p> <p>114 ICU nurses, Brazil</p>	<p>Less prevalent among nurses with greater autonomy, who enjoy good relations with the ICU team and perceive greater control in the work environment.</p>	<p>When working conditions are favourable, burnout is reduced, and quality of care and attitudes regarding patient safety are enhanced.</p>
	<p>Kashtanov, 2022</p> <p>1259 ICU doctors and nurses, Russia</p>	<p>In ICUs without COVID-19: EE = 54.6 %, D = 71.9 %, PA = 36.2 %. In ICUs with COVID-19: EE = 52 %, D = 83.1 %, PA = 29.1 %.</p>	<p>Strong correlation between EE, D and PA in non-COVID-19 ICU workers. EE and occupational stress are related to age.</p>
	<p>Kelly, 2021</p> <p>779 nurses in 24 ICUs at 13 hospitals (Arizona, USA)</p>	<p>Moderate burnout: 61 %.</p>	<p>Staffing levels should be raised, nurses' contributions acknowledged and decision making enhanced. Also, support activities to develop personal resilience, especially for younger nurses.</p>
	<p>Kim and Yeom, 2018</p> <p>318 ICU nurses at 3 hospitals in South Korea</p>	<p>Level of burnout: 3.15 / 5.</p>	<p>Burnout is associated with relative youth, low educational level, single status, atheism, less work experience and previous employment in palliative care. Higher levels of spiritual well-being are associated with lower levels of burnout. Therefore, younger nurses</p>

			should receive more attention to combat the risk of burnout
	Mohr, 2021 111 ICU nurses, USA	Low level of burnout: n = 37; Moderate burnout: n = 68; High level of burnout: n = 6.	In nurses, burnout has a negative impact on ICU colleagues and on patients. Policies aimed at reducing burnout would improve outcomes for all.
	Ntantana, 2017 149 doctors and 320 nurses in 18 ICUs (Greece)	Burnout: 32.8 % among all respondents, greater among nurses (p < 0.001)	Job satisfaction: 63.4 % among nurses. Neuroticism and extraversion are predictors of burnout. Personality traits, job satisfaction and the way in which end-of-life care is provided all influence burnout in the ICU.
	Omar, 2022 1222 workers in 8 ICUs (Qatar)	Burnout: 64.5 %	PA is lower in ICUs where extracorporeal membrane oxygenation is performed
	Salimi, 2020 400 ICU nurses at hospitals in Iran	Burnout: 42 %; Stress: 96 %.	It is important to assess the quality of professional life within the cultural context. ICU nurses in Iranian hospitals are at risk of burnout and stress. Organisations should create programmes to develop personal selfcare and well-being in order to reduce the negative effects of a stressful work environment.
	Srinivas, 2022 194 ICU workers (Wales, UK)	Burnout: 76 %	Post-pandemic burnout could have been reduced by acknowledging staff input, improving communication and encouraging nurses to seek emotional support.
	Swamy, 2020	Up to one third of the nurses	The work environment was the greatest predictor of burnout, followed by the quality of the hospital, its

	2352 ICU nurses at various hospitals (USA)		location and the nurse's permanence in the workplace. Conclusion: an inadequate work environment is the main cause of burnout.
	Vincent, 2019 996 ICU workers (UK)	One third of the ICU team at high risk of burnout.	Female nurses are more at risk of EE than men. Men and younger people are more likely to present D
	Yarad, 2022 128 ICU workers (Australia)	Burnout: 44 %; Depression: 21 %; Anxiety: 23 %; Stress: 27 %.	Interventions should be made to reduce levels of burnout in the ICU.
	Yildiz, 2021 164 ICU nurses (Turkey)	Post-traumatic stress: $40.60 \pm 13.77$ ; Anxiety: $17.14 \pm 12.90$ ; Depression: $13.28 \pm 9.75$ ; Burnout: $41.39 \pm 14.87$ .	In nurses, burnout is related to posttraumatic stress, anxiety, D, PA and EE.

**Table 3. Specific interventions concerning ICU working conditions.**

Systematic review	Publication and study population	Intervention	Findings
Imbulana, 2021	Abassi, 2019 60 ICU nurses, Iran	<p>Type of intervention: moral empowerment program. The intervention addressed constrained action as a component of moral distress.</p> <ul style="list-style-type: none"> <li>• Intervention group: 2-day workshop (6hrs/day) employing Alvita K. Nathaniel's Theory of Moral Reckoning in Nursing (Nathaniel, 2006) which helped clinicians develop personal action plans to address the constraints.</li> <li>• Control group: received a pamphlet explaining moral distress symptoms and complications during a 2-hr session</li> </ul> <p>The invention group: N = 30 The control group: N = 30</p> <p>Measurements took place before, 2 weeks and one month after the intervention.</p> <p>Used Corley's Moral Distress Scale or Hamric's</p>	<ul style="list-style-type: none"> <li>- Measured distress at three-time points, pre-intervention, 2 weeks post and 1 month post intervention.</li> <li>- Moral distress scores significantly decreased after 1 month post-intervention compared with moral distress scores before the intervention in the experimental group.</li> </ul>

		Moral Distress Scale-Revised (MDS-R) to quantify the intensity and frequency of moral distress levels in participants.	
	Molazem, 2013	<p>Type of intervention: moral empowerment (focused on constrained action).</p> <p>A total of 60 Cardiac Care Unit Nurses in Iran were included.  Intervention group: N = 30  Control group: N = 30</p> <p>Intervention: Educational workshop about moral distress and the use of “4A model” (framework developed by the American Association of Critical-Care Nursing in 2004).</p> <ul style="list-style-type: none"> <li>• Two 4-hour sessions during two consecutive weeks</li> <li>• 1st session involved discussion about the concept, causes, symptoms of moral distress</li> <li>• 2nd session involved discussion of strategies to reduce moral distress, role play to demonstrate the use of “4A model”</li> </ul> <p>Primary outcome measure was the MDS-R. Used Corley’s Moral Distress Scale or Hamric’s</p>	<ul style="list-style-type: none"> <li>- Moral distress scores in the intervention group reduced at 1 and 2 months post-intervention compared with pre-intervention.</li> <li>- Control group had increased moral distress score post-intervention at 1 and 2 months compared with pre-intervention.</li> </ul>

		<p>Moral Distress Scale-Revised (MDS-R) to quantify the intensity and frequency of moral distress levels in participants.</p> <p>Measurements to measure moral distress took place pre-intervention and then again at two or more weeks post intervention.</p>	
	<p>Saeedi, 2019 120 ICU nurses, Iran</p>	<p>Type of intervention was categorized as reflective exercises through narrative writing. The intervention addressed a component of moral distress: moral judgement.</p> <p>A total of 106 nurses completed the study: Intervention group: N = 55 Control group: N = 51</p> <p>Description of the intervention: Narrative writing, asked to write about:</p> <ul style="list-style-type: none"> <li>• Their thoughts and emotions at least once a week for 8 weeks</li> <li>• Best/worst moral experience</li> </ul> <p>Primary outcome measure was the Corley's Moral Distress questionnaire completed by all participants at baseline and at the end of 8 weeks.</p>	<ul style="list-style-type: none"> <li>- Narrative writing had no significant effect on mean or frequency of moral distress, including on subgroup analysis</li> <li>- Themes such as the lack of respectful working relations, pressures imposed by physicians and managers, financial problems, and the workload were all expressed by the participants.</li> </ul>

		Measurements to measure moral distress took place pre-intervention and then again at two or more weeks post intervention.	
	Beumer, 2008 34 ICU nurses, USA	5 workshops on moral distress were given to regularly scheduled nurses over the course of 4 weeks: Intervention group: N = 21 Control group: N = 13 Attendees completed a pre- workshop survey and post-workshop survey 7 to 10 weeks later. Primary outcome measure: unvalidated moral distress survey consisting of 8 questions using a 5- point Likert scale and 4 true/false statements.	<ul style="list-style-type: none"> <li>- 23% strongly agreed with having adequate resources to cope with morally distressing situations postworkshop compared with 12% preworkshop.</li> <li>- Results from moral distress survey suggests decrease in moral distress.</li> <li>- Nurses did not feel more empowered to express opinions of perceived 'futile' treatment.</li> <li>- Feedback suggests importance of recognition and validation of moral distress for nurses.</li> </ul>
	Legett, 2013 13 Burns ICU nurses, USA	Phase 1: Seven key informants across four burn centres were interviewed Phase 2: Implementation of intervention at single, burns ICU: Group A: N = 6 Group B: N = 7 Primary outcome measure (used in phase two): Corley's Moral Distress Scale-Revised (MDS-R) and Self-efficacy Scale completed preintervention (Group A), immediately post-	<p>Phase 1:</p> <ul style="list-style-type: none"> <li>- Expressed need for organized debriefing.</li> <li>- Highlighted existing Employee Assistance Program for stress management.</li> <li>- Suggestions of different approaches eg. annual retreats for staff and burn survivors, regular debriefing sessions on the unit, and a mentoring program.</li> </ul> <p>Phase 2:</p> <ul style="list-style-type: none"> <li>- Higher median MDS-R scores observed in Group B than Group A post-intervention.</li> <li>- No significant difference for Group A or B MDS-R scores at 6 weeks post-intervention.</li> </ul>

		intervention (Group B) and 6 weeks post-intervention (both Group A&B).	
	Browning, 2018 36 ICU nurses, USA	Questionnaire completed at the beginning and end of a 6-month period. Intervention group: N = 6 Control group: N = 30 Primary outcome measure: MDS-R	<ul style="list-style-type: none"> <li>- Levels of moral distress in the experimental group were lower (but not significant) than in the control group.</li> <li>- Improved constructive confrontation and voicing opinion about a patient's care.</li> <li>- 85% respondents reported most benefit from case discussions with colleagues, recognition of nursing concerns (76%), and the opportunity to discuss emotions (70%).</li> </ul>
	Meziane, 2018 19 ICU nurses with palliative care experience, Canada	Moral distress measured pre- and post-intervention, and again 2 weeks after. Primary outcome measure: MDS-R	<ul style="list-style-type: none"> <li>- No significant difference in level of moral distress pre-and postintervention.</li> <li>- 3 nurses who intended to leave their- position at pre-intervention changed their minds at post-intervention.</li> </ul>
	Reiley, 2017 49 Cardiac ICU nurses, USA	Focus groups- all sessions audiotaped	<ul style="list-style-type: none"> <li>- Participants report intervention: decreased moral distress, allowed opportunity to identify emotions and debrief thus improving the ethical practice environment.</li> <li>- Structured ethical group discussion allowed for new perspective of colleagues, patients and families viewpoints.</li> <li>- Highlighted importance of ethical facilitator role and nursing leadership presence.</li> </ul>
Alkhawaldeh, 2020	Gholizadeh, 2017 Nurses working in intensive care units of Imam Hussein (SA)	A total of 60 participants were included.	<ul style="list-style-type: none"> <li>- Findings supported aforementioned results in terms of the effect of mindfulness meditation on reducing occupational stress among nurses working in ICUs.</li> </ul>

	<p>hospital in Kermanshah</p>	<p>The intervention consisted of mindfulness meditation (eight 90-min sessions once per week for 8 weeks).</p> <p>The evaluation occurred immediately after the intervention.</p> <p>Occupational stress measured using an Expanded Nursing Stress Scale (ENSS).</p>	<ul style="list-style-type: none"> <li>- The mean ENSS score in the intervention group before intervention was 165.28 (SD = 21.35), which immediately decreased to 118.20 (SD = 17.52) after intervention.</li> </ul>
	<p>Nazari, 2015 Nurses working in intensive care units (dialysis, ICU, and CCU) in the treatment centers of Alzahra, Chamran, Kashani, and Noor hospitals affiliated to Isfahan University of Medical Sciences, Iran</p>	<p>A total of 66 participants were included.</p> <p>The intervention consisted of a general Swedish massage (twice a week for 4 wk) each session lasted 25 minutes.</p> <p>The evaluation occurred immediately and after 2 wk of the intervention.</p> <p>Outcome measurement was OSI (Occupational Stress Inventory).</p>	<ul style="list-style-type: none"> <li>- Found that using a general Swedish massage twice a week for 4 weeks is effective in reducing occupational stress immediately and 2 weeks after intervention among ICU nurses.</li> </ul>
	<p>Bernstein, 2015 Employees of the Cleveland Clinic's ICUs</p>	<p>A total of 13 participants were included.</p> <p>The intervention consisted of Hatha Yoga which includes breathing exercises</p>	<ul style="list-style-type: none"> <li>- Hatha yoga is effective at reducing the stress level among nurses working in ICUs.</li> <li>- The stress scores were not statistically different between pre-intervention and post-intervention, the stress scores tended to be lower after yoga than before yoga.</li> </ul>

		<p>(pranayama), physical movements (asana), and deep relaxation (shavasana) (six sessions a week for 6 wk) each session lasted 15 min.</p> <p>The evaluation occurred immediately after the intervention.</p> <p>Outcome measurement was PSS (Perceived Stress Scale).</p>	
	<p>Lan, 2014 Critical care nurses</p>	<p>A total of 37 participants were included.</p> <p>The intervention consisted of Mindfulness-based cognitive therapy (2 h per week for 5 wk) using lectures, inter-group sessions educational booklets, and audio compact disc</p> <p>The evaluation occurred 1 wk after the intervention.</p> <p>Outcome measurement was PSS (Perceived Stress Scale) and DASS (Depression Anxiety Stress Scale).</p>	<p>- Findings showed that mindfulness-based cognitive therapy (MBCT) program, which included 5 to 10 minutes of independent daily practice, also resulted in a significant reduction in stress level after 1 week of the intervention when measured using the PSS.</p>
	<p>Hemmati Maslakkpak, 2016 Nurses working in the critical care units of</p>	<p>A total of 60 participants were included.</p> <p>The intervention consisted of neuro-Linguistic</p>	<p>- The use of neuro-linguistic programming can increase coping with stressful situations, and it can reduce occupational stress.</p>

	Urmia Imam Khomeini and Motahari educational–therapeutic centers	<p>Programming (18 sessions for 6 mo) each session lasted 3 h).</p> <p>The evaluation occurred 1 month after the intervention.</p> <p>Outcome measurement was the ENSS (Expanding Nursing Stress Scale).</p>	<ul style="list-style-type: none"> <li>- The mean ENSS (Expanding Nursing Stress Scale) score before the program was 120.88 and 121.36 for the intervention and control groups, respectively. After 1 month of the intervention, the score means of occupational stress decreased to 64.53 in the intervention group, while that of control remained relatively unchanged (120.96).</li> </ul>
	Saedpanah, 2016 Nurses working in the Intensive Care Unit (ICU) and Critical Care Unit (CCU) in two teaching hospitals in Sanandaj, Iran	<p>A total of 60 participants were included.</p> <p>The intervention consisted of Emotion regulation training (eight sessions of 2 h) .</p> <p>The evaluation occurred immediately after the intervention.</p> <p>Outcome measurement was the ENSS (Expanding Nursing Stress Scale).</p>	<ul style="list-style-type: none"> <li>- Findings support the aforementioned results in terms of the effect of education on reducing occupational stress using emotional intelligence components.</li> <li>- The mean ENSS score in the intervention group before intervention was 136.6 (SD = 24.6), which immediately decreased to 113.02 (SD = 16.2) after intervention.</li> </ul>
	Nooryan, 2011 Nurses working in the intensive care unit in Armenia	<p>A total of 76 participants were included. (70 participants were male nurses)</p> <p>The intervention consisted of Emotional intelligence items education (four sessions of general conference program, six inter-group sessions and educational booklets) each session lasted 2 h.</p>	<ul style="list-style-type: none"> <li>- Teaching emotional intelligence items, which consisted of five major elements and 15 subscales, is effective in reducing occupational stress and anxiety after 1 month of the intervention.</li> <li>- Nurses experiencing a high level of stress, and the ability to deal with emotion intelligence helps them in coping with occupational stress and should be developed in stress management trainings.</li> </ul>

		<p>The evaluation occurred 1 month after the intervention.</p> <p>Outcome measurement was Anxiety, stress (Bar-on emotional intelligence questionnaire).</p>	
	Babanataj, 2018 30 ICU nurses, Iran	Effect of the resilience training on occupational stress.	The mean score of the occupational stress of the participants decreased significantly after the intervention, and the mean score of resilience increased significantly after the intervention.
	Eren, 2017 45 ICU nurses, Turkey	Aromatherapy (Lavender oil inhalation for 10 or 15 min)	Nurses' stress scores were not significantly different between control and aromatherapy groups, but stress scores tended to be lower in the intervention group immediately after lavender oil inhalation for 10 or 15 minutes than the control group.

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijk en voor acties <sup>3</sup>	Overige opmerkingen
Het is verstandig dat IC-afdelingen werken aan het bevorderen van	1 tot 3 jaar	Afhankelijk van de actie(s) en	Prioritering onderwerp door management,	Weinig bewijskracht voor	Agenderen duurzame inzetbaarheid	Management team IC-afdeling	

<p>het mentaal welzijn van zorgverleners. Overweeg hierbij:</p> <ul style="list-style-type: none"> <li>• maatregelen om de ervaren werkdruk te verlagen;</li> <li>• het aanbieden van ontwikkelingsmogelijkheden;</li> <li>• het bevorderen van interprofessionele communicatie en samenwerking;</li> <li>• het verlagen van emotionele en morele stress door psychosociale ondersteuning voor IC-professionals en voorkomen van niet passende zorg (o.a. peer support, ondersteuning vanuit het management en moreel beraad)</li> <li>• het stimuleren van zelfzorg (o.a. vitaliteitsprogramma's) in gedeelde verantwoordelijkheid</li> </ul>		<p>interventie(s)</p>	<p>voldoende tijd en follow up.</p>	<p>succesvolle interventies</p>	<p>en werkplezier IC professionals</p>		
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<p>(zowel individu als organisatie);</p> <ul style="list-style-type: none"> <li>• interventies gericht op het beperken van de gevolgen van nachtwerk (o.a. voorwaarts roterend roosteren en herstelperiodes voor de circadiane klok, adviezen over voeding en slaaphygiëne en het faciliteren van powernaps op het werk);</li> <li>• het reduceren van administratieve lasten.</li> </ul>							
<p>Overweeg het structureel meten van mentaal welzijn van zorgverleners voor het (vroegtijdig) signaleren van klachten en voorkomen van uitval.</p>	< 1 jaar	Minimaal	Prioritering onderwerp door management, voldoende tijd en follow up.	Afwezig gevoel voor urgentie bij management/R vB	Agenderen duurzame inzetbaarheid en werkplezier IC professionals	Management team IC-afdeling	

**Table of excluded studies**

Reference	Reason for exclusion
Smith, Stephanie A. and Kokoczka, Lynne and Cottrell, Constance Utility of a "Lavender Lounge" to Reduce Stress Among Critical Care Registered Nurses: A Cross-Sectional Study. American Journal of Critical Care. 2023; 32 (3) :198-204	Fulltext not available
Iraizoz-Iraizoz, Andrea and García-García, Raquel and Navarrete-Muro, Andrea and Blasco-Zafra, Ana and Rodríguez-Beperet, Ane and Vázquez-Calatayud, Mónica Nurses' clinical leadership in the intensive care unit: A scoping review. Intensive & Critical Care Nursing. 2023; 75 :N.PAG-N.PAG	Wrong study design (scoping review)
Toscano F, Tommasi F, Giusino D. Burnout in Intensive Care Nurses during the COVID-19 Pandemic: A Scoping Review on Its Prevalence and Risk and Protective Factors. Int J Environ Res Public Health. 2022 Oct 9;19(19):12914. doi: 10.3390/ijerph191912914. PMID: 36232211; PMCID: PMC9564773.	Wrong study design (scoping review)
Koy, Virya and Yunibhand, Jintana and Turale, Sue Comparison of 12 and 24-hours shift impacts on ICU nursing care, efficiency, safety, and work-life quality. International Nursing Review. 2022; 69 (1) :38-46	Wrong study design (focus group discussions)
Chipu, M. and Downing, C. Professional nurses' facilitation of self-care in intensive care units: A concept analysis. International Journal of Nursing Sciences. 2020; 7 (4) :446-452	Wrong study design (concept analysis)
Beltrán, J. M. and Carvajal, A. B. Professional exhaustion in nursing staff and psychosocial risk factors. Archivos Venezolanos de Farmacología y Terapéutica. 2019; 38 (4) :501-508	Wrong study design and wrong population (descriptive study, no intensive care nurses)
Adams, A. M. N. and Chamberlain, D. and Giles, T. M. The perceived and experienced role of the nurse unit manager in supporting the wellbeing of intensive care unit nurses: An integrative literature review. Australian critical care : official journal of the Confederation of Australian Critical Care Nurses. 2019; 32 (4) :319-329	Wrong study design (integrative review)
Karanikola, Maria N. K. and Mpouzika, Meropi D. A. Time to create a healthy work environment in ICU: a review of current evidence and commentary.	Wrong study design (commentary)

CONNECT: The World of Critical Care Nursing. 2018; 12 (2) :44-47	
Schroyer, Coreena C. and Zellers, Rebecca and Abraham, Sam Increasing registered nurse retention using mentors in critical care services. The Health Care Manager. 2016; 35 (3) :251-265	Wrong study design (retrospective)
Mullarkey, M. and Duffy, A. and Timmins, F. Trust between nursing management and staff in critical care: a literature review. Nursing in Critical Care. 2011; 16 (2) :85-91	Wrong study design (non-systematic review)
Despres, Kimberly Katherine Perceived leadership styles of nurse managers' and nurses' job satisfaction: A correlational study. . 2011; :126 p-126 p	Wrong study design (doctoral degree)
Sandau, K. E. and Halm, M. A. Preceptor-based orientation programs: effective for nurses and organizations?. American Journal of Critical Care. 2010; 19 (2) :184-188	Wrong study design (non-systematic review)
Robnett, Michelle K. Critical care nursing: workforce issues and potential solutions. Critical care medicine. 2006; 34 (3) :S25-31	Wrong study design (non-systematic review)
Gibson, V. Does nurse turnover mean nurse wastage in intensive care units. Intensive & Critical Care Nursing. 1994; 10 (1) :32-40	Study published before 2000
Liu, Shuyang and Zhang, Yu and Liu, Yue and Han, Peng and Zhuang, Yugang and Jiang, Jinxia The resilience of emergency and critical care nurses: a qualitative systematic review and meta-synthesis. Frontiers in psychology. 2023; 14 :1226703	Wrong population (critical care)
da Silva, M. A. X. and Santos, M. M. A. and Araújo, A. B. and Galvão, C. R. C. and de Barros, M. M. M. and E Silva, A. C. O. and de Souza, M. B. C. A. and Bar Roso, B. I. L. Risk factors for healthcare professionals' mental health during the COVID-19 pandemic: a systematic review. Ciencia e Saude Coletiva. 2023; 28 (10) :3033-3044	wrong population (health professionals who care for or assist patients with COVID-19 infection and workers who work on the frontlines of hospitals, clinics and rehabilitation and screening centers for COVID-19)
Alshammari, W. S. T. and Alshammari, A. S. M. and Alshammari, T. K. D. and Alresheedi, R. A. A. and Alshammari, O. B. T. SITUATIONAL LEADERSHIP STYLE IN NURSING MANAGEMENT IN CRITICAL CARE UNITS. Journal of Population Therapeutics and Clinical Pharmacology. 2024; 31 (2) :8-26	Wrong outcome (he effects of nurse leadership philosophies on the quality indicators for intensive care units)

Somville, F. and Van Bogaert, P. and Wellens, B. and De Cauwer, H. and Franck, E. Work stress and burnout among emergency physicians: a systematic review of last 10 years of research. Acta Clinica Belgica: International Journal of Clinical and Laboratory Medicine. 2024; 79 (1) :52-61	Wrong population (emergency physicians)
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## Zoekverantwoording

### Algemene informatie

Cluster/richtlijn: NVIC Organisatie van zorg op de IC	
Uitgangsvraag/modules: UV3 werkplezier en behoud	
Database(s): Embase.com, Ovid/Medline, Cinahl, PsycInfo	Datum: 16-10-2023, 6-3-2024
Periode: vanaf 2000	Talen: geen restrictie
Literatuurspecialist: Ingeborg van Dusseldorp	Rayyan review: <a href="https://rayyan.ai/reviews/811782">https://rayyan.ai/reviews/811782</a> ,
BMI-zoekblokken: voor verschillende opdrachten wordt (deels) gebruik gemaakt van de zoekblokken van BMI-Online <a href="https://blocks.bmi-online.nl/">https://blocks.bmi-online.nl/</a> Bij gebruikmaking van een volledig zoekblok zal naar de betreffende link op de website worden verwezen.	
<b>Toelichting:</b> Voor deze vraag is gezocht met de concepten:  <b>Werkplezier EN IC EN zorgpersoneel</b>  Vanwege de hoge aantallen wordt gestart met de SRs.  Drie van de vijf sleutelartikelen worden niet gevonden omdat het geen artikelen betreft die over de IC setting gaan.  3. Hayes B, Bonner A, Pryor J. Factors contributing to nurse job satisfaction in the acute hospital setting: a review of recent literature. J Nurs Manag. 2010;18:804-14. 4. Li H, Shi Y, Li Y, Xing Z, Wang S, Ying J, et al. Relationship between nurse psychological empowerment and job satisfaction: A systematic review and meta-analysis. J Adv Nurs. 2018;74:1264-77. 5. Tett RP, Meyer JP. Job satisfaction, organizational commitment, turnover intention, and turnover: path analyses based on meta-analysis findings. Pers Psychol. 2010;46:259-93	
Te gebruiken voor richtlijntekst: In de databases Embase.com, Ovid/Medline, Ovid/PsycInfo en Cinahl, is systematisch gezocht vanaf 2000 naar systematische reviews en clinical trials over werkplezier bij IC personeel. De literatuurzoekactie leverde 1889 unieke treffers op.	

### Zoekopbrengst

4-3-2024	EMBASE	OVID/MEDLINE	OVID/PSYCINFO	CINAHL	Ontdubbeld t.o.v. 16-10-2023
SR	198	88	37	159	30
RCT	599	234	16	957	1499
Observationele studies					

<b>Totaal</b>					<b>1889</b>
16-10-2023	<b>EMBASE</b>	<b>OVID/MEDLINE</b>	<b>OVID/PSYCINFO</b>	<b>CINAHL</b>	<b>Ontdubbeld</b>
SR	181	80	35	183	360
RCT					
Observationele studies					
<b>Totaal</b>					<b>*360</b>

*\*in Rayyan*

### Zoekstrategie

Embase.com

6-3-2024

No.	Query	Results
#1	'the relationship between practice environment, job satisfaction and intention to leave in critical care nurses'	1
#2	'job satisfaction among critical care nurses: a systematic review'	1
#3	'factors contributing to nurse job satisfaction in the acute hospital setting: a review of recent literature'	1
#4	'relationship between nurse psychological empowerment and job satisfaction: a systematic review and meta-analysis'	1
#5	'job satisfaction, organizational commitment, turnover intention, and turnover: path analyses based on meta-analysis findings'	0
#6	'health care personnel'/exp OR 'critical care nurse*':ti,ab,kw OR 'physician*':ti,ab,kw OR 'intensivist*':ti,ab,kw OR 'nurse*':ti,ab,kw	2518484
#7	'intensive care unit'/exp OR 'intensive care'/exp OR 'intensive care*':ti,kw OR 'critical care*':ti,kw	1109142
#8	#6 AND #7	125578
#9	'job satisfaction'/exp OR 'workload'/exp OR 'turnover rate'/exp OR (('morality'/exp OR 'leadership'/exp OR 'leadership':ti,ab,kw OR 'immoral*':ti,ab,kw OR 'moral*':ti,ab,kw OR 'motivati*':ti,ab,kw OR 'demotivat*':ti,ab,kw OR ((ethic* NEAR/3 (dilemma* OR problem*)):ti,ab,kw) OR 'appreciat*':ti,ab,kw) AND ('work'/exp OR 'job':ti,ab,kw) OR ((job NEAR/3 (satisfaction OR dissatisfaction)):ti,ab,kw) OR 'turnover':ti,ab,kw OR 'workload':ti,ab,kw OR 'autonomy'/exp OR 'autonomy':ti,ab,kw OR 'solid team*':ti,ab,kw OR (((recognition OR satisf*) NEAR/6 (work OR job)):ti,ab,kw)	327152
#10	#8 AND #9	6327
#11	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR 'metaanaly*':ti,ab OR 'meta analy*':ti,ab OR 'metanaly*':ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR 'prisma':ti,ab OR 'prospero':ti,ab OR (((systemati* OR 'scoping' OR 'umbrella' OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR 'literature' OR 'database*' OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR 'comprehensive*' OR 'systemic*') NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*':ti,ab OR 'database*':ti,ab OR 'data base*':ti,ab)) OR (('data extraction*':ti,ab OR 'data source*':ti,ab) AND	969166

	'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasynthes*':ti,ab OR 'meta synthes*':ti,ab	
#12	#10 AND [2000-2024]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp)	4000
#13	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3982786
#14	#11 AND #12 SR	198
#15	#13 AND #12 NOT #14 Clinical trials	599

### 16-10-2023

No.	Query	Results
#1	'the relationship between practice environment, job satisfaction and intention to leave in critical care nurses'	1
#2	'job satisfaction among critical care nurses: a systematic review'	1
#3	'factors contributing to nurse job satisfaction in the acute hospital setting: a review of recent literature'	1
#4	'relationship between nurse psychological empowerment and job satisfaction: a systematic review and meta-analysis'	1
#5	'job satisfaction, organizational commitment, turnover intention, and turnover: path analyses based on meta-analysis findings'	0
#6	'health care personnel'/exp OR 'critical care nurse*':ti,ab,kw OR physician*':ti,ab,kw OR intensivist*':ti,ab,kw OR nurse*':ti,ab,kw	2518484
#7	'intensive care unit'/exp OR 'intensive care'/exp OR 'intensive care':ti,kw OR 'critical care':ti,kw	1109142
#8	#6 AND #7	125578
#9	'job satisfaction'/exp OR 'workload'/exp OR 'turnover rate'/exp OR (('morality'/exp OR 'leadership'/exp OR leadership:ti,ab,kw OR 'immoral*':ti,ab,kw OR 'moral*':ti,ab,kw OR motivat*':ti,ab,kw OR demotivat*':ti,ab,kw OR ((ethic* NEAR/3 (dilemma* OR problem*)):ti,ab,kw) OR appreciat*':ti,ab,kw) AND ('work'/exp OR job:ti,ab,kw)) OR ((job NEAR/3 (satisfaction OR dissatisfaction)):ti,ab,kw) OR turnover:ti,ab,kw OR workload:ti,ab,kw OR 'autonomy'/exp OR autonomy:ti,ab,kw OR 'solid team*':ti,ab,kw OR (((recognition OR satisf*) NEAR/6 (work OR job)):ti,ab,kw)	327152
#10	#8 AND #9	6327
#11	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*':ti,ab OR 'meta analy*':ti,ab OR metanaly*':ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured	969166

	literature') NEAR/3 (review* OR overview*):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasyntes*:ti,ab OR 'meta synthes*':ti,ab	
#12	#10 AND #11	227
#13	#12 AND [2000-2023]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp) SR	181
#14	#1 OR #2 OR #3 OR #4 OR #5 sleutelartikelen	4
#15	#10 AND #14 2 sleutelartikelen gevonden	2

**Ovid/Medline  
6-3-2024**

#	Searches	Results
1	Job Satisfaction/ or Workload/ or Work Schedule Tolerance/ or Personnel Turnover/ or ((Morals/ or Leadership/ or leadership.ti,ab,kf. or immoral*.ti,ab,kf. or moral*.ti,ab,kf. or motivat*.ti,ab,kf. or demotivat*.ti,ab,kf. or ethic* adj3 (dilemma* or problem*)):ti,ab,kf. or appreciat*.ti,ab,kf.) and (exp Work/ or job.ti,ab,kf.) or turnover.ti,ab,kf. or workload.ti,ab,kf. or autonomy.ti,ab,kf. or solid team*.ti,ab,kf. or ((recognition or satisf*) adj6 (work or job)).ti,ab,kf.	247752
2	exp Critical Care/ or exp Intensive Care Units/ or 'intensive care'.ti,kf. or 'critical care'.ti,kf.	187034
3	exp Health Personnel/ or (health personnel or nurse* or physician* or intensivist*).ti,ab,kf.	1207609
4	1 and 2 and 3	2473
5	limit 4 to yr="2000 -Current"	2100
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*)):ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or data-base*)):ti,ab,kf. or (("data extraction" or "data source*") and "study	730742

	selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*)).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*)).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	
7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2698590
8	5 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/)	2029
9	6 and 8 <b>SR</b>	88
10	(7 and 8) not 9 <b>Clinical trials</b>	234

## 16-10-2023

#	Searches	Results
1	exp Job Satisfaction/ or Work Satisfaction/ or Personnel Turnover/ or Employee Turnover/ or Turnover/ or ((Morality/ or exp Leadership/ or leadership.ti,ab,id. or immoral*.ti,ab,id. or moral*.ti,ab,id. or motivat*.ti,ab,id. or demotivat*.ti,ab,id. or (ethic* adj3 (dilemma* or problem*)).ti,ab,id. or appreciat*.ti,ab,id.) and ("Work (Attitudes Toward)"/ or job.ti,ab,id.)) or turnover.ti,ab,id. or workload.ti,ab,id. or autonomy.ti,ab,id. or solid team*.ti,ab,id. or ((recognition or satisf*) adj6 (work or job)).ti,ab,id.	219153
2	(intensive care or critical care).ti,ab,id.	217317
3	exp Health Personnel/ or (health personnel or nurse* or physician* or intensivist*).ti,ab,id.	1179946
4	1 and 2 and 3	2079
5	limit 4 to yr="2000 -Current"	1836
6	[((literature review or systematic review or meta analysis).md. or "literature review"/ or meta analysis/ or (((meta adj2 analy*) or metaanaly* or (synthes* adj2 (literature* or research* or studies or data)) or (pooled and analys*) or ((data adj1 pool*) and studies) or medline or medlars or embase or cinahl or scisearch or psychlit or psyclit or cinhal or cancerlit or cochrane or bids or pubmed or ovid or ((hand or manual or database* or computer*) adj1 search*) or (electronic adj1 (database* or data base or data	0

	bases)).ti,ab,id. or (review* or overview).ti. or (bibliograph* or relevant journals or ((review* or overview*) adj9 (systematic* or methodologic* or quantitativ* or research* or literature* or studies or trial* or effective*))).ab.) not (((retrospective* or record* or case* or patient*) adj1 review*) or ((patient* or review*) adj1 chart*)).ti,ab,id.]	
7	5 and 6	0
8	(job satisfaction, organizational commitment, turnover intention, and turnover).mp. sleutelartikel	1
9	7 and 8 sleutelartikel niet gevonden vanwege ontbreken setting IC	0
16	14 and 15	80
17	16 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/)SR	80

### OVID/ PsycInfo

6-3-2024

#	Searches	Results
1	exp Job Satisfaction/ or Work Satisfaction/ or Personnel Turnover/ or Employee Turnover/ or Turnover/ or ((Morality/ or exp Leadership/ or leadership.ti,ab,id. or immoral*.ti,ab,id. or moral*.ti,ab,id. or motivat*.ti,ab,id. or demotivat*.ti,ab,id. or (ethic* adj3 (dilemma* or problem*)).ti,ab,id. or appreciat*.ti,ab,id.) and ("Work (Attitudes Toward)"/ or job.ti,ab,id.) or turnover.ti,ab,id. or workload.ti,ab,id. or autonomy.ti,ab,id. or solid team*.ti,ab,id. or ((recognition or satisf*) adj6 (work or job)).ti,ab,id.	102806
2	(intensive care or critical care).ti,ab,id.	12391
3	exp Health Personnel/ or (health personnel or nurse* or physician* or intensivist*).ti,ab,id.	279081
4	1 and 2 and 3	477
5	limit 4 to yr="2000 -Current"	436
6	((literature review or systematic review or meta analysis).md. or "literature review"/ or meta analysis/ or (((meta adj2 analy*) or metaanaly* or (synthes* adj2 (literature* or research* or studies or data)) or (pooled and analys*) or ((data adj1 pool*) and studies) or medline or medlars or embase or cinahl or scisearch or psychlit or psyclit or cinhal or cancerlit or cochrane or bids or pubmed or ovid or ((hand or manual or database* or computer*) adj1 search*) or (electronic adj1 (database* or data base or data bases))).ti,ab,id. or (review* or overview).ti. or (bibliograph* or relevant journals or ((review* or overview*) adj9 (systematic* or methodologic* or quantitativ* or research* or literature* or studies or trial* or effective*))).ab.) not (((retrospective* or record* or case* or patient*) adj1 review*) or ((patient* or review*) adj1 chart*)).ti,ab,id.	489361
7	5 and 6 SR	37

8	exp clinical trial/ or randomized controlled trial/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	298072
9	(5 and 8) not 7 <b>Clinical trials</b>	16

16-10-2023

#	Searches	Results
1	exp Job Satisfaction/ or Work Satisfaction/ or Personnel Turnover/ or Employee Turnover/ or Turnover/ or ((Morality/ or exp Leadership/ or leadership.ti,ab,id. or immoral*.ti,ab,id. or moral*.ti,ab,id. or motivat*.ti,ab,id. or demotivat*.ti,ab,id. or (ethic* adj3 (dilemma* or problem*)).ti,ab,id. or appreciat*.ti,ab,id.) and ("Work (Attitudes Toward)"/ or job.ti,ab,id.) or turnover.ti,ab,id. or workload.ti,ab,id. or autonomy.ti,ab,id. or solid team*.ti,ab,id. or ((recognition or satisf*) adj6 (work or job)).ti,ab,id.	100466
2	(intensive care or critical care).ti,ab,id.	12072
3	exp Health Personnel/ or (health personnel or nurse* or physician* or intensivist*).ti,ab,id.	273940
4	1 and 2 and 3	463
5	limit 4 to yr="2000 -Current"	422
6	((literature review or systematic review or meta analysis).md. or "literature review"/ or meta analysis/ or (((meta adj2 analy* or metaanaly* or (synthes* adj2 (literature* or research* or studies or data)) or (pooled and analys*) or ((data adj1 pool*) and studies) or medline or medlars or embase or cinahl or scisearch or psychlit or psyclit or cinhal or cancerlit or cochrane or bids or pubmed or ovid or ((hand or manual or database* or computer*) adj1 search*) or (electronic adj1 (database* or data base or data bases))).ti,ab,id. or (review* or overview).ti. or (bibliograph* or relevant journals or ((review* or overview*) adj9 (systematic* or methodologic* or quantitativ* or research* or literature* or studies or trial* or effective*))).ab.) not (((retrospective* or record* or case* or patient*) adj1 review*) or ((patient* or review*) adj1 chart*)).ti,ab,id.	479871
7	5 and 6 <b>SR</b>	35
8	(job satisfaction, organizational commitment, turnover intention, and turnover).mp.	16
9	7 and 8	0

**Ebsco/ Cinahl  
6-3-2024**

Wednesday, March 06, 2024 12:45:06 PM

#	Query	Results
S1	MH ("Job Satisfaction+" OR "Workload" OR "Personnel Turnover") OR ((MH "Morals+" OR MH "Leadership" OR TI (leadership OR 'immoral*' OR 'moral*' OR motivat* OR demotivat* OR ((ethic* N3 (dilemma* OR problem*))) OR appreciat*) AND (work OR job)) OR ((job NEAR/3 (satisfaction OR dissatisfaction))) OR turnover OR workload OR 'autonomy'/exp OR autonomy OR 'solid team*' OR (((recognition OR satisf*) N6 (work OR job))) OR AB (leadership OR 'immoral*' OR 'moral*' OR motivat* OR demotivat* OR ((ethic* N3 (dilemma* OR problem*))) OR appreciat*) AND (work OR job)) OR ((job NEAR/3 (satisfaction OR dissatisfaction))) OR turnover OR workload OR 'autonomy'/exp OR autonomy OR 'solid team*' OR (((recognition OR satisf*) N6 (work OR job)))	230,882
S2	(MH "Intensive Care Units+") OR (MH "Critical Care Nursing+") OR (MH "Critical Care+") OR TI ("critical care" OR "intensive care) OR AB ("critical care" OR "intensive care)	119,768
S3	(MH "Health Personnel+") OR TI (nurse* OR physician* OR intensivist*) OR AB (nurse* OR physician* OR intensivist*)	987,128
S4	S1 AND S2 AND S3	2,827
S5	(MH "Meta Analysis") or TX (meta-analy* or metanaly* or metaanaly* or meta analy*) or TX (systematic* N5 review*) or (evidence* N5 review*) or (methodol* N5 review*) or (quantitativ* N5 review*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (systematic* N5 survey*) or (evidence* N5 survey*) or (methodol* N5 survey*) or (quantitativ* N5 survey*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (pool* N2 data) or (combined N2 data) or (combining N2 data) or (pool* N2 trials) or (combined N2 trials) or (combining N2 trials) or (pool* N2 studies) or (combined N2 studies) or (combining N2 studies) or (pool* N2 results) or (combined N2 results) or (combining N2 results)	326,547
S6	(MH "Clinical Trials+") OR (PT (Clinical trial)) OR (MH "Random Assignment") OR (MH "Quantitative Studies") OR (TX ((clini* N1 trial*) OR (singl* N1 blind*) OR (singl* N1 mask*) OR (doubl* N1 blind*) OR (doubl* N1 mask*) OR (tripl* N1 blind*) OR (tripl* N1 mask*) OR (random* N1 allocat*) OR placebo* OR ((waitlist* OR (wait* and list*)) and (control* OR group)) OR "treatment as usual" OR tau OR (control* N3 (trial* OR study OR studies OR group*)) OR randomized OR randomised))	2,004,701
S7	S4 AND S5 SR	159

S8	S4 AND S6 NOT S7 <b>Clinical trials</b>	957
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**23-10-2023**

#	Query	Results
S1	MH ("Job Satisfaction+" OR "Workload" OR "Personnel Turnover") OR ((MH "Morals+" OR MH "Leadership" OR TI (leadership OR 'immoral*' OR 'moral*' OR motivat* OR demotivat* OR ((ethic* N3 (dilemma* OR problem*))) OR appreciat*) AND (work OR job)) OR ((job NEAR/3 (satisfaction OR dissatisfaction))) OR turnover OR workload OR 'autonomy'/exp OR autonomy OR 'solid team*' OR (((recognition OR satisf*) N6 (work OR job))) OR AB (leadership OR 'immoral*' OR 'moral*' OR motivat* OR demotivat* OR ((ethic* N3 (dilemma* OR problem*))) OR appreciat*) AND (work OR job)) OR ((job NEAR/3 (satisfaction OR dissatisfaction))) OR turnover OR workload OR 'autonomy'/exp OR autonomy OR 'solid team*' OR (((recognition OR satisf*) N6 (work OR job)))	228,029
S2	(MH "Intensive Care Units+") OR (MH "Critical Care Nursing+") OR (MH "Critical Care+") OR TI ("critical care" OR "intensive care) OR AB ("critical care" OR "intensive care)	117,466
S3	(MH "Health Personnel+") OR TI (nurse* OR physician* OR intensivist*) OR AB (nurse* OR physician* OR intensivist*)	1,003,096
S4	S1 AND S2 AND S3	4,547
S5	(MH "Meta Analysis") or TX (meta-analy* or metanaly* or metaanaly* or meta analy*) or TX (systematic* N5 review*) or (evidence* N5 review*) or (methodol* N5 review*) or (quantitativ* N5 review*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (systematic* N5 survey*) or (evidence* N5 survey*) or (methodol* N5 survey*) or (quantitativ* N5 survey*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (pool* N2 data) or (combined N2 data) or (combining N2 data) or (pool* N2 trials) or (combined N2 trials) or (combining N2 trials) or (pool* N2 studies) or (combined N2 studies) or (combining N2 studies) or (pool* N2 results) or (combined N2 results) or (combining N2 results)	318,379
S6	S4 AND S5 <b>SR</b>	183

## **Bijlage - Module 3.1 Formatie en beschikbaarheid van zorgprofessionals**

### **Onderbouwing**

#### Method

A systematic review of the literature was performed to answer the following question:  
What is the effect of nurse-to-patient ratio X versus nurse-to-patient ratio Y in the ICU?

<b>P (Population):</b>	adult ICU patients (>17 years)
<b>I (Intervention):</b>	nurse-to-patient ratio X
<b>C (Control):</b>	nurse-to-patient ratio Y
<b>O (Outcome):</b>	mortality (ICU, hospital), length of (ICU, hospital) stay, morbidity, ICU readmission, patient satisfaction

#### Relevant outcome measures

The guideline development group considered mortality as a critical outcome measure for decision making; and length of stay, morbidity, ICU readmission, patient satisfaction as an important outcome measure for decision making.

A priori, the working group did not define the outcome measures listed above but used the definitions used in the studies.

The working group defined the following values as minimal clinically (patient) important difference:

- Mortality (ICU, hospital): 3% difference (absolute)
- Length of stay (ICU, hospital): ICU 1 day, hospital 3 days
- Morbidity: RR <0.8 or >1.25
- ICU readmission: RR <0.8 or >1.25
- Patient satisfaction: 10% difference

#### *Search and select*

The databases Medline (via OVID), Embase (via Embase.com) and Cinahl were searched with relevant search terms until 25 October 2023. The search was combined with the search for the module about the intensivist-to-patient ratio. The detailed search strategy is depicted under the tab Methods. The systematic literature search resulted in 2,021 hits. Studies were selected based on the following criteria: Systematic review, RCT or observational study comparing the effect of different nurse-to patient ratios on adults patients (>17 years) in the ICU, reporting at least one of the outcomes specified in the PICO, published after 2000. Initially, 42 studies were selected based on title and abstract screening. After reading the full text, 20 studies were excluded (see the table with reasons for exclusion under the tab Methods). Four individual studies were included in the analysis of the literature and the results of 18 studies were described in a table.

#### Results

Four comparative studies were included in the analysis of the literature. Important study characteristics and results are summarized in the evidence tables. The assessment of the risk of bias is summarized in the risk of bias tables.

## Summary of literature

### Description of studies

Four observational studies that compared the effect of different nurse-to-patient ratios were included in the literature analysis. Relevant study characteristics are presented in Table 1.

The results of the 19 non-comparative observational studies are described in Table 5.

**Table 1. Study characteristics**

Study	Design, country	Type of ICU patients	Patients, N, age, %M	NPR measure	Intervention	Comparison	Outcomes reported
Amaravadi, 2000	Retrospective cohort study of 35 (staffing data for 32) hospitals, Maryland, US	Patients admitted to ICU after esophageal resection	366 (353) patients (225/128), mean age 60/63 years, % male 79/77	Nighttime nurse-to-patient ratio	1 nurse cares for 1 or 2 patients: NNPR $\geq$ 1:2	1 nurse cares for 3 or more patients: NNPR < 1:2	Hospital mortality, length of hospital stay, postoperative complications
Dimick, 2001	Retrospective cohort study of 35 (staffing data for 33) hospitals, Maryland, US	Patients admitted to ICU after hepatic resection	569 (556) patients (316/240), mean age 56/57 years, % male 51/55	Nighttime nurse-to-patient ratio	More nurses: NPR 1:1 or 1:2	Fewer nurses: NPR 1:3 or 1:4	Hospital mortality, length of hospital stay, postoperative pulmonary complications
Pronovost, 2001	Retrospective cohort study of 46 (staffing data for 38) hospitals, Maryland, US	Patients admitted to ICU after abdominal aortic surgery	2,128/478 patients, mean age 68/68 years, 69/66% men	ICU nurse staffing during the day	More nurses: NPR 1:1 or 1:2	Fewer nurses: NPR 1:3 or 1:4	Inpatient mortality, length of ICU and hospital stay, postoperative complications
Blot, 2011	Prospective cohort study, 27 ICU's in 9 European countries	All patients who were admitted to the ICU for treatment of pneumonia or received invasive mechanical ventilation for more than 48 hours, irrespective of the admission diagnosis	1,658 patients (1,066/592), median age 59/69 years, %male 64/61	Routine staffing levels; nurse-to-patient ratio that is standard in a particular ICU	patient-to-nurse ratio $\leq$ 2:1	patient-to-nurse ratio > 2:1	Length of ICU and hospital stay, VAP

ICU = intensive care unit, (N)NPR = (nighttime) nurse-to-patient ratio, , VAP = ventilator-associated pneumonia

## Results

### Mortality

**Amaravadi (2000)** reported the unadjusted hospital mortality rate. The unadjusted mortality rate was 5.6% in the group with an NNPR of  $\geq$  1:2 compared with 15% in the group with an NPR of < 1:2. The odds ratio (OR) reported in the multivariate analysis was 0.7 (95% CI 0.3 to

2.0) after adjusting for other univariate predictors of mortality, which is considered clinically relevant in favor of the group with an NNPR of  $\geq 1:2$  (more nurses).

**Dimick (2001)** reported the unadjusted in-hospital mortality rate. The mortality rate was 2.5% in the group with more nurses compared with 7.1% in the group with fewer nurses. The unadjusted OR was 0.34 (95% CI 0.15 to 0.49). The for demographic factors, comorbid disease, severity of illness, type of procedure, hospital volume, and surgeon volume adjusted OR was 0.49 (95% CI 0.18 to 1.29), which is clinically relevant in favor of the group of patients with more nurses.

**Pronovost (2001)** reported the inpatient mortality rate. The mortality rate was 7% (95%CI 6.0 to 8.1) in the group with an NPR of 1:1 or 1:2 compared with 8% (95%CI 6.0 to 11.2) in the group with an NPR of 1:3 or 1:4. The difference of 1% is not considered clinically relevant.

**Blot (2011)** did not report the outcome mortality.

#### *Length of stay: ICU*

**Pronovost (2001)** reported median length of ICU stay in days. The median length of stay in the ICU was 2 days (range 0 to 118) for the group with an NPR of 1:1 or 1:2 compared with 3 days (range 0 to 112) for the group with an NPR of 1:3 or 1:4. The difference of 1 day is clinically relevant in favor of the group with an NPR of 1:1 or 1:2 (more nurses).

**Blot (2011)** reported the median length of ICU stay in days. The median length of stay in the ICU was 12 days (IQR 6 to 22) for the group with a patient-to-nurse ratio of  $\leq 2:1$  compared with 11 days (IQR 6 to 20) for the group with a patient-to-nurse ratio of  $> 2:1$ . The difference of 1 day is clinically relevant in favor of the group with a PNR of  $> 2:1$  (fewer nurses).

**Amaravadi (2000)** and **Dimick (2001)** did not report the outcome ICU length of stay.

#### *Length of stay: hospital*

**Amaravadi (2000)** reported median length of hospital in days. Median length of stay in the hospital was 9 days (IQR 1.8 to 13) for the group with an NNPR of  $\geq 1:2$  compared with 15 days (IQR 11 to 27) for the group with an NNPR of  $< 1:2$ . The difference of 6 days is clinically relevant in favor of the group with an NNPR of  $\geq 1:2$  (more nurses).

**Dimick (2001)** reported median length of hospital stay in days. For patients with more ICU nurses the median length of hospital stay was 7 days (IQR 6 to 10 days) and for patients with fewer ICU nurses the median length of hospital stay was 8 days (IQR 6 to 12 days). This difference is not considered clinically relevant.

**Pronovost (2001)** reported median length of hospital stay in days. Median length of stay in the hospital was 8 days (range 0 to 171) for the group with an NPR of 1:1 or 1:2 compared with 8 days (range 0 to 130) for the group with an NPR of 1:3 or 1:4. This difference is not clinically relevant.

**Blot (2011)** reported the median length of hospital stay in days. Median length of stay in the hospital was 22 days (IQR 12 to 42) for the group with a patient-to-nurse ratio of  $\leq 2:1$  compared with 17 days (IQR 9 to 31) for the group with a patient-to-nurse ratio of  $> 2:1$ . The difference of 5 days is clinically relevant in favor of the group with a PNR of  $>2:1$  (fewer nurses).

#### *Morbidity*

**Amaravadi (2000)** reported multivariate associations of postoperative complications and nighttime nurse-to-patient-ratios, see Table 2. Patients with an NNPR  $< 1:2$  had an increased risk of reintubation, pneumonia and septicemia.

**Table 2: associations between postoperative complications and NNPR**

Complication	NNPR $\geq 1:2$	NNPR $< 1:2$	OR (95%CI)
Pneumonia	8%	16%	2.4 (1.2 to 4.7)
Reintubation	12%	25%	2.5 (1.4 to 4.5)
Aspiration	22%	25%	1.2 (0.7 to 2.0)
Septicemia	1.8%	6.2%	3.7 (1.1 to 12.5)
Postoperative infection	4%	5.5%	1.4 (0.5 to 3.8)
Myocardial infarction	0.9%	0.8%	0.9 (0.08 to 9.7)
Cardiac arrest	0%	0.8%	1.2 (0.6 to 2.2)
Surgical complications	8%	17%	1.9 (0.9 to 3.8)
Acute renal failure	2.7%	5.5%	2.1 (0.7 to 6.4)

**Dimick (2001)** reported univariate associations of nighttime nurse staffing and postoperative pulmonary complications, see Table 3. In the multivariate analysis however, only reintubation remained significantly associated with fewer nurses at night.

**Table 3: postoperative complications associated with nighttime nurse staffing**

Complication	More nurses (NPR 1:1 or 1:2), n=316	Fewer nurses (NPR 1:3 or 1:4), n=240	OR (95%CI)
Pneumonia	2.8%	4.2%	1.4 (0.6 to 3.5)
Reintubation	1.9%	10.8%	5.7 (2.4 to 13.7)
Pulmonary failure	1.6%	5.8%	3.6 (1.3 to 10.1)
Aspiration	12.0%	7.5%	0.62 (0.4 to 1.1)
Septicemia	2.7%	5.4%	NR
Postoperative infection	2.9%	3.0%	NR
Cardiac arrest	0.6%	0.8%	NR
Myocardial infarction	6.6%	1.2%	NR
Acute renal failure	14.6%	4.2%	NR

**Pronovost (2001)** reported crude and adjusted relative risks for several medical and surgical complications, see Table 4. In the multivariate analysis adjusted for patient characteristics and hospital and surgeon volume, having fewer nurses was associated with an increased risk for any complication, any medical complication, pulmonary insufficiency after procedure, and reintubation.

**Table 4: postoperative complications**

Complication	Hospitals with fewer ICU nurses	Hospitals with more ICU nurses	Crude RR (95% CI)	Adjusted RR (95% CI) <sup>1</sup>
Any complication	47%	34%	1.4 (1.2 to 1.5)	1.7 (1.3 to 2.4)
<i>Medical complications</i>				
Any medical complication	43%	28%	1.5 (1.4 to 1.7)	2.1 (1.5 to 2.9)
Pulmonary insufficiency after procedure	24%	9%	2.6 (2.1 to 3.2)	4.5 (2.9 to 6.9)
Reintubation	21%	13%	1.5 (1.3 to 1.8)	1.6 (1.1 to 2.5)
Cardiac complications after procedure	15%	10%	1.4 (1.1 to 1.7)	1.3 (0.8 to 1.8)
Acute renal failure	6%	4%	1.3 (0.8 to 1.9)	1.6 (0.9 to 2.7)
Septicemia	4%	3%	1.4 (0.8 to 2.1)	1.9 (0.9 to 3.9)
Acute myocardial infarction	4%	3%	1.2 (0.8 to 2.4)	1.5 (0.9 to 2.2)
Cardiac arrest	2%	1%	1.4 (0.6 to 3.0)	1.7 (0.7 to 4.7)
<i>Surgical complications</i>				
Any surgical complication	10%	11%	0.9 (1.6 to 1.4)	0.7 (0.4 to 1.5)
Surgical complications after procedure	8%	9%	0.9 (0.6 to 1.2)	1.0 (0.6 to 1.4)
Surgical E codes	1%	0%	2.2 (0.4 to 10.5)	Insufficient data
Reoperation for bleeding	2%	3%	0.8 (0.4 to 1.6)	1.2 (0.4 to 3.5)

<sup>1</sup>adjusted for patient characteristics, hospital volume and surgeon volume

**Blot (2011)** reported the outcome ventilator-associated pneumonia (VAP). VAP developed in 393 of the 1,658 patients (23.7%) during their ICU stay; 220 of the patients with VAP had late-onset VAP (13.3%). In the group of patients with a patient-to-nurse ratio  $\leq$  2:1 262 patients (24.6%) developed VAP compared with 131 patients (22.1%) with a patient-to-nurse ratio  $>$  2:1. This difference is not clinically relevant.

#### *ICU readmission*

No results could be reported because none of the included studies reported the outcome ICU readmission.

#### *Patient satisfaction*

No results could be reported because none of the included studies reported the outcome patient satisfaction.

#### Level of evidence of the literature

The level of evidence regarding the outcome measure **mortality** started at **low** (observational studies) was downgraded to **very low** because of study limitations (risk of bias).

The level of evidence regarding the outcome measure **length of stay** started at **low** (observational studies) was downgraded to **very low** because of conflicting results (inconsistency).

The level of evidence regarding the outcome measure **morbidity** started at **low** (observational studies) was downgraded to **very low** because of study limitations (risk of bias).

The level of evidence regarding the outcome measure **ICU readmission** could not be determined because none of the included studies reported the outcome measure.

The level of evidence regarding the outcome measure **patient satisfaction** could not be determined because none of the included studies reported the outcome measure.

**Table 5. Results of the non-comparative observational studies**

First author, year	Study design, Population Setting Country	Definition variable 'nurse-patient ratio' / nurse-workload ratio'	Analysis, confounders	Results
Stone, 2007	Observational study, with patient outcome data collected using the National Nosocomial Infection Surveillance system protocols and Medicare files.  Elderly Medicare ICU patients (>65 years); 15,846 patients in 51 adult intensive care units in 31 hospitals; United States.	Staffing: registered nurse hours per patient day, in quartiles (higher quartiles = more RN hours per patient day)	Multivariate logistic regressions were constructed for each outcome. Robust variance estimators (Huber–White) were calculated and analyses were clustered at the hospital level to allow for an arbitrary variance– covariance matrix, adjusted odds ratios (OR) and 95% confidence intervals (CI) were examined.  All models are adjusted for a comprehensive set of (1) patient characteristics, including severity of illness, comorbidities, demographics, and socioeconomic status, and (2) setting characteristics, including hospital size and teaching status and ICU type and case-mix.	<u>30-day mortality (n=15,846)</u> The average 30-day mortality rate was 22% (3,185 of 15,846)  Adjusted OR (95% CI) Second quartile: 0.89 (0.77–1.02) Third quartile: 0.81 (0.69–0.95) Fourth quartile: 0.89 (0.76–1.05)  <u>VAP (n=5,462)</u> Overall rate: VAP 1.5% (81 of 5,462)  Adjusted OR (95% CI) Second quartile: 0.71 (0.43–1.19) Third quartile: 0.68 (0.39–1.21) Fourth quartile: 0.21 (0.08–0.53)
Cho, 2008	Observational study, retrospective; Using survey and administrative databases, this study included 27,372 ICU patients discharged from 42 tertiary and 194 secondary hospitals; Korea.	Staffing of RNs was quantified as the ratio of average daily census (ADC) to the total number of full-time equivalent (FTE) RNs in ICUs, termed the ADC/RN ratio, by dividing ADC by the number of fte RNs.	Data were treated as having a two-tiered structure to use multilevel analysis. The first tier was the hospital level, in which the variables of hospital and ICU characteristics were aggregated. The second tier was the patient level where patient characteristics were measured.	<u>Mortality</u> ADC/RN ratio, Adjusted OR (95%CI) Tertiary hospitals: 0.54 (0.22-1.33) Secondary hospitals: 1.43 (1.16-1.77)  This OR of 1.43 indicates that every additional patient per RN (i.e., an increase of 0.233 in the ADC/RN ratio) was associated with a 9% increase in the odds of death (OR = 1.09, 95%CI = 1.04-1.14). Two and three additional patients

		The RN staffing included not only staff nurses but also head nurses who would have no direct responsibility for patient care.	Using the patient as the unit of analysis, all variables of the two levels were included simultaneously into the regression model. This multilevel modeling allowed simultaneous examination of the effects of nurse staffing, ICU, hospital, and patient characteristics on mortality. Tertiary and secondary hospitals were analyzed separately under the assumption that they treated groups of patients with a different level of illness severity, clinical features, and ICU utilization patterns, including admission and discharge policies.  Patient characteristics: mortality, age, gender, source of payment, primary diagnosis, and comorbid disease were used for risk adjustment.	would be accompanied by 18% and 29% increases in mortality, respectively.
Graf, 2010	Observational study; data were collected prospectively on a cross-sectional (one-day) basis in a representative random sample of German hospitals. The final data set comprised information on 454 ICUs and 310 hospitals.	Nurse staffing (number of patients a nurse was responsible for)	For the analysis of a potential association between structural characteristics or associated processes of the ICU with the outcome (in-hospital mortality) of patients with severe sepsis or septic shock, multiple hypotheses testing was performed.	“For all patients with severe sepsis and septic shock we tested the hypothesis whether structural characteristics or associated processes of the ICU are related to outcomes, i.e., in-hospital mortality. We neither found any significant association with nurse staffing, physician presence, size of hospital or ICU, nor with diagnostic measures or applied therapeutic interventions, after correction for multiple hypothesis testing.”
Checkley, 2014	Observational study; 69 ICU’s participating in the United States Critical Illness and Injury Trials Group	bed-to-nurse ratio	The multivariable linear regression model included the following variables: average APACHE II score, ICU	<u>Annual ICU Mortality</u> Bed-to-nurse ratio (per 1:1 unit increase) % difference in annual ICU mortality (95% CI):

	Critical Illness Outcomes Study (USCIITG-CIOS) were surveyed; United States		type, case volume, bed capacity, 24-hour intensivist coverage, bed-to-nurse ratio, trainee-to-bed ratio, ICU organization (open vs. closed), computerized order entry, daily plan of care review, multidisciplinary rounding, and use of protocols guiding management of electrolytes, mobility, codes, neuroprotection, delirium, and transfusions.	<ul style="list-style-type: none"> <li>• Single variable analysis: 2.4 (1.8 to 3.1)</li> <li>• Adjusted for APACHE II and ICU type: 2.1 (-0.3 to 4.6)</li> <li>• Multivariable analysis: 3.7 (0.5 to 6.8)</li> </ul> <p>The adjusted annual ICU mortality was lower among ICUs that had a lower bed-to-nurse ratio (1.8% lower when the ratio decreased from 2:1 to 1.5:1; 95% CI 0.25%–3.4%).</p>
Talsma, 2014	Observational study; A 3-year (2003-2005) multisite study was designed to include all acute care cases that met the inclusion criteria of the AHRQ Patient Safety Indicator (PSI) FTR; Southeast Michigan, United States	<p>Nurse staffing data included total nursing direct HPPD, RN HPPD, and RN staffing mix: the proportion of registered nurses (RNs) on the unit.</p> <p>HPPD = Nursing Hours Per Patient Day</p>	Multilevel analyses were used to take into account the hierarchical structure of the database: patients clustered on nursing units, which are clustered within hospitals. Because the outcome variable (FTR rate) was defined as dichotomous, a multilevel logistic model was used. We were interested in examining the effect of nurse staffing measures (unit characteristics) on FTR rate, controlling for patient demographic and clinical conditions (patient characteristics), and other unit characteristics.	<p><u>Patient mortality because of complications (FTR, failure to rescue)</u></p> <p>OR (95% Wald CI)</p> <p>HPPD: 1.015 (0.935, 1.102)</p> <p>RN_HPPD: 1.031 (0.942, 1.130)</p> <p>RN_MIX: 1.037 (0.976, 1.101)</p> <p>The findings for the ICU discharges showed no significant associations between increased HPPD, RN_HPPD, and RN-mix and reduced FTR.</p>
West, 2014	Observational study; Data for the six months before and after March 1998, which had been collected prospectively, were merged onto organizational data on 65 ICUs surveyed by the Audit Commission. The matched dataset contained information only on ICUs in England.	Number of nurses per bed: This variable counts the number of full-time equivalent nurses on the permanent staff of the ICU on one specific date (the date of the Audit Commission survey). The question on the survey	<p>Multilevel logistic regression was used to perform all the analyses.</p> <p>Risk adjustment based on ICNARC score (physiology model, including blood pressure, respiratory rate, oxygenation, and acid base disturbance, along with a range of other factors known to be associated</p>	<p><u>ICU mortality</u></p> <p>Number of direct care nurses per bed, OR from multilevel logistic regression models [95%CI]</p> <p>Model 1: 0.90 [0.84,0.97]</p> <p>Model 2*: 0.90 [0.83,0.97]</p> <p>Model 3*: 0.90 [0.83,0.97]</p> <p><u>Mortality in acute hospital</u></p> <p>Model 1: 0.92 [0.87,0.98]</p>

		<p>asked for separate information on registered nurses and health care assistants. The variable used in these analyses is a count of the registered nurses at different grades who were in post on the census date. It is important to note that this is not the number of nursing staff available for duty when any particular patient is admitted.</p> <p>Two separate variables: the number of direct care nurses and the number of supernumerary nurses.</p>	<p>with mortality, including age, past medical history, and source of admission to an ICU).</p>	<p>Model 2*: 0.92 [0.86,0.98] Model 3*: 0.92 [0.86,0.98]</p> <p>*Further, as we believe that the effect of staffing might depend on the severity of a patient's illness; in the second column we add an interaction between the number of nurses and predicted log odds of mortality, while in column 3 we add an interaction between the number of consultants and predicted log odds of mortality.</p> <p>The most significant findings are that, controlling for patient characteristics and the workload of the unit, higher numbers of nurses per bed on the unit's establishment and higher numbers of consultants per bed were both associated with higher survival rates.</p>
Neuraz, 2015	<p>Multicenter longitudinal study using routinely collected hospital data, January to December 2013; 8 ICU's from 4 university hospitals in Lyon, France; 5,718 inpatient stays.</p>	<p>Patient-to-nurse (P/N) ratio by shift in five categories:</p> <ul style="list-style-type: none"> <li>• less than or equal to 1:1</li> <li>• greater than 1:1 to less than or equal to 1.5:1</li> <li>• greater than 1.5:1 to less than or equal to 2:1</li> <li>• greater than 2:1 to less than or equal to 2.5:1</li> <li>• greater than 2.5:1 (2:1 meaning two patients for one nurse).</li> </ul>	<p>To control for potential confounding variables, patients' characteristics were a priori selected as clinically important covariates. The proportion of surgical cases versus medical cases was used to adjust on the type of patient case-mix admitted to ICU. The final multivariate model included the following variables: P/N, P/P (patients/physician) and residents-to-physicians ratios, patient turnover, number of LSP, proportion of men, proportion of surgical cases, SAPSII, and number of comorbidities.</p>	<p><b>Mortality:</b> The primary outcome was mortality at time of ICU discharge by shift, excluding patients for whom a DFLST (decision to not forego life sustaining therapy) was made.</p> <p>The fully adjusted model, taking into account both staffing and workload levels, showed an increased risk of mortality, with the highest values for P/P and P/N. The ICU risk of death increased by a factor of 3.5 (1.3–9.1) when the number of patients was above 2.5 per nurse.</p>

Faisy, 2016	Prospective, observational, dynamic cohort study; January 2006 to December 2013; a 20-bed adult medical intensive care unit of a tertiary teaching hospital in France	Bed-to-nurse ratio	Negative binomial regression for over-dispersed count outcome variables was then used to model the rate of severe adverse events because of the spread of severe adverse events over time. In the univariate and multivariate analyses, covariates were adjusted by the bed-to-nurse ratio, which reflects nursing workload and intensive care unit activity (Massey et al., 2009), thereby limiting confounding factors. Bed-to-nurse ratio was preferred to patient-to-nurse ratio because of the monthly changes in nurse staff and bed availability. In addition, an offset has been included in the model (volume of intensive care unit activity on the basis of the number of billable journeys) because the higher the activity the higher the risk of adverse events.	<p><u>Severe adverse events:</u> Incidence rate ratio (95% CI) Univariate: 1.28 (0.99–1.66) Multivariate: 1.36* (1.05–1.75)</p> <p>*Indicates the estimated incidence rate ratio for a one-unit increase in the bed-to-nurse ratio. Thus, if the bed-to-nurse ratio was to increase by one point, the monthly rate for severe adverse events would be expected to increase by a factor of 1.36, i.e., 36%</p>
Lee, 2017	Retrospective analysis of prospectively collected data  Adult patients admitted to two multi-disciplinary Intensive Care Units; Hong Kong	Workload/nurse ratio: Nursing workload (TISS-score) / average number of bedside nurses	Pearson's r was used to test for collinearity between TISS and workload-to-staffing ratio.	<p>The lower 90% confidence interval crosses zero when the workload/staffing ratio is 40. This indicates that there is more than 95% probability that survival to hospital discharge is more likely to occur when the maximum workload to-nurse ratio is 52.</p> <p>Outcome: Survival Comparison: Workload/staffing &lt; 40 vs. 40 or higher APACHE III score of 60 OR 2.28, 95% CI 1.07–4.80 APACHE III score of 70-130</p>

				No sign difference between < 40 vs. 40 or higher APACHE III >130 OR 0.24, 95% CI 0.09–1.01
Kim, 2018	Observational; Retrospective database study  Patients admitted with cardiovascular (CV) disease;  Study data were obtained from National Health Insurance Service-Senior (NHIS-Senior) claim database from 2002 to 2013 which was released by the Korean National Health Insurance Service (KNHIS).	Nurse staffing*: nurse staffing grades were based on the nurse-to-bed ratio. The highest nurse staffing grade was grade 1 (beds/nurse ratio <0.5), with the lowest nurse staffing grade being grade 9 (beds/nurse ratio ≥2.0). Level of nurse staffing was categorized into 4 groups in each year: grade 1 to 2, grade 3 to 4, grade 5 to 6, and grade 7 to 9.	Cox proportional hazards models were used to investigate the association between nurse staffing and mortality; adjusted for all confounders.	<i>Tertiary hospital; per level of nurse staffing*</i> 30-day mortality after discharge Grade 1–2: HR 1.000 (ref) Grade 3–4: HR 1.038 (SE 0.120); p=.755 Grade 5–6: HR 1.382 (SE 0.323); p=.316 Grade 7–9: HR 0.967 (SE 0.106); p=.752 In-hospital 30-day mortality Grade 1–2: HR 1.000 (ref) Grade 3–4: HR 1.127 (SE 0.124); p=.333 Grade 5–6: HR 1.171 (SE 0.358); p=.658 Grade 7–9: HR 0.998 (SE 0.112); p=.982  <i>General hospital; per level of nurse staffing</i> 30-day mortality after discharge Grade 1–2: HR 1.000 (ref) Grade 3–4: HR 1.367 (SE 0.159); p=0.049 Grade 5–6: HR 1.353 (SE 0.180); p=0.093 Grade 7–9: HR 1.499 (SE 0.156); p= 0.010 In-hospital 30-day mortality Grade 1–2: HR 1.000 (ref) Grade 3–4: HR 1.277 (SE 0.160); p=.126 Grade 5–6 : HR 1.233 (SE 0.183); p=.250 Grade 7–9 : HR 1.377 (SE 0.157); p=.042
Verburg, 2018	Observational study, retrospective; data from the Dutch National Intensive Care Evaluation (NICE) registry.	Full-time equivalent ICU nurses	Mixed effects regression models; examined the association between ICU characteristics available in the NICE registry and ICU LoS, after correcting for patient characteristics.	<u>ICU length of stay</u> <i>Models including a single ICU characteristic</i> Full-time equivalent ICU nurses, coefficient (95%CI): -0.017 (-0.021 to -0.013)

	78,822 admissions, 38 ICU's; the Netherlands			<p><i>Final model including multiple ICU characteristics</i></p> <p>Full-time equivalent ICU nurses, coefficient (95%CI): -0.030 (-0.034 to -0.025)</p> <p>The coefficients represent the change in log transformed intensive care unit length of stay associated with the characteristic.</p> <p>We found that the ICU LoS increased as the number of ICU nurses decreased.</p>
Jansson, 2019	<p>prospective, observational cohort study</p> <p>consecutive adult patients who were admitted to the mixed medical-surgical ICU and received invasive ventilation over 48 hours were recruited and monitored daily for the development of VAP until ICU discharge or death</p> <p>900-bed tertiary-level teaching hospital; adult, closed, mixed medical-surgical ICU with 22 beds (four 1-bed rooms, three 2-bed rooms, four 3-bed rooms), Finland</p>	<p>Daily N/P ratio: dividing the total number of nurses by the total number of patients for each calendar day.</p> <p>ICNSS = Intensive Care Nursing Scoring System → nurse workload</p>	<p>Receiver operating characteristic (ROC) curve and the area under the curve (AUC) were used to determine the associations between nurse staffing and workload with VAP and mortality</p>	<p>N/P ratio</p> <p><i>Lowest</i></p> <p>Patients without VAP: 1.0 (1.0-1.1)</p> <p>Patients with VAP: 1.0 (0.9-1.0)</p> <p>P= 0.006*</p> <p>AUC: 0.3 (0.2-0.4)</p> <p><i>Median</i></p> <p>Patients without VAP: 1.2 (1.2-1.3)</p> <p>Patients with VAP: 1.2 (1.2-1.3)</p> <p>P=0.98</p> <p>AUC: 0.5 (0.4-0.6)</p> <p>ICNSS score</p> <p><i>Highest</i></p> <p>Survivor: 36.0 (33.0-39.0)</p> <p>Non-survivor: 38.0 (34.0-41.8)</p> <p>P=0.09</p> <p>AUC: 0.6 (0.5-0.8)</p> <p><i>Median</i></p> <p>Survivor: 30.0 (28.1-32.0)</p> <p>Non-survivor: 31.0 (30.0-34.0)</p> <p>P=0.03*</p>

				AUC: 0.7 (0.5-0.8)
Kim, 2019	Observational retrospective study; using NHI claim data on patient and hospital characteristics for 2140 patients undergoing craniotomy or percutaneous angioplasty from January to December 2009; Korea	The NHI claim data quantified nurse staffing levels using the nursing grade, which is based on the nurse-to-bed ratios in general wards and the ICUs; Nurse-to-bed ratio converted to nurse-to-patient ratio using an occupancy rate of 86%.  ICU nurse staffing level: - major adherence - adherence - violation	Logistic regression applied with a generalized estimation model in order to adjust clustered data was used to analyze the associations between the nurse staffing level and survival after cardiac arrest. The same analysis was performed for the hospital type. Hospitals and general hospitals were categorized into one group, with tertiary hospitals classified separately.	<u>Patient survival</u> Patients who were cared for in tertiary hospitals with major adherence ICUs nurse staffing were 2.35-fold more likely to survive than those in tertiary hospitals with adherence nurse staffing (95% CI = 1.27–4.36). The patient survival rate after cardiac arrest did not differ significantly between violation nurse staffing and adherence nurse staffing in general wards in tertiary hospitals.
Jansson, 2020	Cross-sectional study in a single tertiary-level teaching hospital during 2008–2017; 900-bed tertiary-level teaching hospital in Finland.  All admissions were identified from the hospital database. Patients were eligible for inclusion if they were adults (≥18 years), were admitted to the ICU between 1 January 2008 and 31 December 2017 (N = 13,720) and had complete data sets regarding nurse staffing and nursing workload. Because our focus was on high-risk critically ill patients, patients with low-risk elective surgery (e.g. cardiac surgery or neurosurgery) were	The level of nurse staffing was recorded by collecting the total number of nurses and patients throughout each calendar day (i.e. morning, evening and night shifts). The daily N/P ratio was determined by dividing the total number of nurses by the total number of patients for each calendar day. Only the daily lowest N/P ratios for each calendar day were considered. The daily ICNSS index was determined by dividing the sum of nurses needed by	Additionally, multivariable linear regression models were used to get adjusted results between MOF (no/yes), hospital mortality (no/yes) and a subgroup of MOF patients (early- vs. late-stage MOF) for TISS scores, ICNSS scores, N/P ratios and ICNSS indexes. Age, gender, APACHE II scores, admission type (emergency/elective), surgery (no/yes) and N/P ratios were used as adjustable variables, except for the N/P ratios for the models of the N/P ratio itself and the ICNSS index. The results for the Student's t test and linear regression model are presented as the difference between means with a 95% confidence interval (95% CI)	<u>Multiple organ failure (MOF):</u> In the subgroup analysis, the mean daily lowest N/P ratio prior to MOF was lower in patients with late-stage than those with early-stage MOF. In addition, the mean daily highest ICNSS index was higher in patients with late-stage MOF. The proportion of N/P ratio <1 and ICNSS index >1 was significantly more common in patients with MOF than in those without. In the subgroup analysis, the proportion of N/P ratio <1 and ICNSS index >1 was significantly more common in patients with late-stage than those with early-stage MOF. The proportion of understaffing did not differ between survivors and non-survivors.  <i>N/P ratio &lt; 1</i>

	<p>excluded to reduce case mix heterogeneity. In total, 10,230 patients met the inclusion criteria and were included for further analysis</p>	<p>the sum of available nurses during each day. Only the daily highest indexes for each calendar day were considered.</p>	<p>Shifts were categorized as understaffed (yes/no) if they had N/P ratios &lt;1 and ICNSS indexes &gt;1 and a shift's adjusted impact on MOF and hospital mortality was calculated using a multivariable logistic regression model. Age, gender, APACHE II score, admission type (emergency/elective) and surgery (no/yes) were used as adjustable variables. The results of the logistic regression model are presented as an odds ratio (OR) with a 95% CI.</p>	<p>4,612 of 8,204 (56.3%) patients without MOF; 1,578 of 2,026 (77.9%) patients with MOF. Adjusted OR=2.59 (2.29 to 2.92).</p> <p><u>In-hospital mortality</u> The AUC values for the mean daily lowest N/P ratios for in-hospital mortality were 0.51 (95% CI 0.47–0.54) in patients with early-stage MOF and 0.46 (95% CI 0.38–0.54) in patients with late-stage MOF respectively.</p>
Ding, 2022	<p>Observational; Retrospective database study;</p> <p>The data in this study were collected between January 1, 2019, and December 31, 2019.. The data source was the National Clinical Improvement System ((<a href="https://ncisdc.medidata.cn/login.jsp">https://ncisdc.medidata.cn/login.jsp</a>)), collected by the China-National Critical Care Quality Control Center (China-NCCQC), which is the official national department that regulates ICU quality control in China.</p>	<p>patient-to-bed ratio (calculated by the total number of ICU patients divided by the number of beds in the ICU), physician-to-bed ratio (calculated by the total number of ICU physicians divided by the number of beds in the ICU), nurse-to-bed ratio (calculated by the total number of ICU nurses divided by the number of beds in the ICU), patient-to-physician ratio (calculated by the total number of ICU patients divided by the number of ICU physicians),</p>	<p>Poisson regression analysis (generalized linear model for count data)</p>	<p><u>VAP incidence rate</u> (<math>\beta</math> (95% CI), p-value) Nurse-to-bed ratio: -0.146 (-0.229, -0.063), 0.0006 Patient-to-nurse ratio: -0.015 (-0.019, -0.011), &lt;0.0001</p> <p><u>VAP mortality</u> (<math>\beta</math> (95% CI), p-value) Nurse-to-bed ratio: 0.038 (-0.17, 0.246), 0.7186 Patient-to-nurse ratio: -0.002 (-0.014,0.009), 0.6918</p> <p>Structural factors associated with lower ICU VAP incidence rate included patient-to-bed ratio (<math>\beta</math>=-0.002 (-0.004,-0.001), p=0.0126), nurse-to-bed ratio (<math>\beta</math>=-0.146 (-0.229,-0.063), p=0.0006), patient-to-nurse ratio (<math>\beta</math>=-0.015 (-0.019, -0.011), p&lt;0.0001).</p>

		patient-to-nurse ratio (calculated by the total number of ICU patients divided by the number of nurse).		
Kim, 2022	<p>Retrospective cohort study design using the National Health Insurance Sampling (NHIS) cohort data from 2014 to 2015, Korea.</p> <p>A total of 13,135 ICU patients were included.</p>	<p>Nurse staffing level was classified as nine grades in the ICU at the time of this study.</p> <p>The level of nurse staffing by nurse-to-bed ratio in the ICU used data that was provided in insurance claims. If the nurse-to-bed ratio was less than 0.5, it was classified as 1st grade, 1 ~ 5th grade (5 grade: <math>\geq 1.00</math>), or 1 ~ 9th grade (9 grade, <math>\geq 2.00</math>) for ICU, tertiary hospitals, hospitals, and general hospitals, respectively. Since the nurse staffing level entered in the claim data was based on the nurse-to-bed ratio, the nurse-to-patients ratio was calculated based on the total number of in-patients and nurses in each hospital.</p> <p>Next, we classified nurse staffing level into eight grades based on the</p>	<p>The generalized estimating equation (GEE) model was used to evaluate the association between nurse staffing level and LOS; GEE model with a gamma distribution and log-link function because the hospital's LOS is right-skewed. In the fully adjusted model, all variables were entered simultaneously.</p>	<p><u>Length of stay:</u></p> <p>Per nurse staffing level (M<math>\pm</math>SD)</p> <p>Level 1 16.39 <math>\pm</math>17.49  Level 2 16.70 <math>\pm</math>15.50  Level 3 16.20 <math>\pm</math>16.20  Level 4 15.71 <math>\pm</math>15.51  Level 5 16.61 <math>\pm</math>15.44  Level 6 17.08 <math>\pm</math>18.37  Level 7 17.70 <math>\pm</math>21.30  Level 8 15.91 <math>\pm</math>14.36  Level 9 15.62 <math>\pm</math>15.75</p> <p>Significant differences in the LOS according to the nurse staffing grade were observed in ICUs, with a longer LOS in nurse staffing grade 6 (mean [M]: 17.08, standard deviation [SD]: 18.37) and grade 7 (M: 17.70, SD: 21.30) institutions. Depending on the hospital type, LOS was found to be longest in a hospital (M: 19.35, SD: 18.49) and shortest in a tertiary hospital (M: 16.37, SD: 16.28).</p> <p>Associations between nurse staffing level and length of stay, RR (95%CI):</p> <p>Level 1 0.919 (0.844 to 1.001)  Level 2 0.906 (0.871 to 0.942)  Level 3 0.913 (0.881 to 0.946)  Level 4 0.947 (0.907 to 0.995)</p>

		current nurse-to-patient ratio.		<p>Level 5 1.012 (0.951 to 1.076)  Level 6 1.115 (1.057 to 1.176)  Level 7 –  Level 8 1.031 (0.959 to 1.109)  Level 9 1.009 (0.931 to 1.094)</p> <p>In general, higher nurse staffing levels were associated with shorter LOS. In the ICU, the level of nurse staffing in grades 4 and above resulted in reduced LOS compared to grade 7; however, only grades 2 to 4 were statistically significant. Nurse staffing level grades 8 and 9 were associated with a higher LOS compared to grade 7; however, this result was not statistically significant</p>
Duclos, 2023	Retrospective multicenter observational study, Lyon, France; 8 academic ICUs over 6 years (43,479 ICU patients) between January 1, 2011 and December 31, 2016.	The patient-to-nurse ratio and the patient-to-assistant nurse ratio were defined as the number of patients per nurse and per assistant nurse by shift, respectively. According to the French law that recommends five ICU patients per two nurses and four ICU patients per one assistant nurse, the patient-to-nurse and patient-to-assistant nurse ratios were categorized as suboptimal when not complying with this guideline (i.e., more than five patients for two nurses and more than four	<p>Mortality assessment was systematically adjusted for patient characteristics (age, sex, admission context, SAPS II, and comorbidities), nursing team members' workload (patient turnover, number of LSPs per patient, and proportion of isolated patients), time periods (year, quarter, and weekend), and staffing (experience length of nursing team members and patient-to-staffing ratios).</p> <p>To identify the determinants of ICU mortality per shift and account for the clustering effect of patients within the ICU (i.e., patients treated and outcomes within a particular ICU</p>	<p><u>ICU mortality:</u>  There were 3,101 shifts (9%) during which at least one death without a DFLST occurred during the ICU stay, including 2,902 shifts (8%) with one death. The risk of shift with death increased in the case of suboptimal patient-to-nurse ratio (RR=1.35; 95%CI 1.02 to 1.77; P = 0.035).</p> <p><u>Shifts with death within 12 hours:</u>  There were 731 shifts (2%) during which at least one patient death occurred within 12 hours of their ICU admission. The risk of shift with death increased in the case of suboptimal patient-to-nurse ratio (RR, 1.84; 95% CI, 1.43–2.38; P &lt; 0.001) and suboptimal ratios for both nurses and assistant nurses (RR, 3.16; 95% CI, 1.94–5.14; P &lt; 0.001)</p>

		patients for one assistant nurse, respectively) and as optimal otherwise.	tended to be more similar than those in another ICU), we computed multivariate modified Poisson regression (with a robust standard error estimation) and applied a small sample correction factor to take into account the low number of clusters (19). The potential confounders described above were a priori entered in the model. We tested and included any significant interactions between variables in the model. The results were presented as adjusted relative risks (RRs) with their corresponding 95% confidence intervals (95% CIs). We plotted shifts with at least one death without DFLST according to nurse-to-nurse familiarity in an unadjusted and adjusted model. We estimated predicted probabilities with their 95% CIs from modified Poisson regression models with a robust error variance.	
Zhou, 2023	Retrospective study of single-center ICUs in China; 1,341 consecutive septic patients admitted to the emergency ICU, general ICU, or cardiovascular ICU in a tertiary teaching hospital.	In our hospital, during day time (08:00 to 16:59hr), the ICU team comprise three to four attending intensivists, two to three residents (critical care or other specialty fellows), and the average patient to nurse ratio (P/N ratio) is 2–3:1. In the other two time periods (17:00 to 23:59hr and 00:00	The potential confounders affecting the association with in-hospital mortality included admission/ discharge time and weekend admission, P/N ratio, compliance with SSC 1 hour, severity of illness, age, gender, Charlson index, mechanical ventilation, and shock. The causal relationships between the potential confounders were considered seriously before multivariate logistic regression	<p><u>In-hospital mortality:</u> When the admission time was removed from the model, a significant association between P/N ratio and in-hospital mortality was found in four models in which different disease severity scores were adjusted.</p> <p>Logistic regression models: Odds Ratio for In-Hospital Mortality by Patient to Nurse Ratio After Adjusting the Severity of the Illness:</p> <ul style="list-style-type: none"> <li>Unadjusted model: OR=2.22 (1.78–2.78)</li> </ul>

		<p>to 07:59hr), there is one senior intensivist, one resident, and the P/N ratio is 3–5:1. Imaging technical platform and surgical operating room are 24-hour available. Admissions may occur at any time of the day and night. This organization was maintained during the study period.</p>	<p>models. Multivariate models were fit using covariates found to be clinically relevant or significant in univariate analysis. Missing values of variables were imputed by multiple imputations.</p>	<ul style="list-style-type: none"> <li>• Adjusted for Acute Physiology Score III: OR=2.01 (1.57–2.61)</li> <li>• Adjusted for Sequential Organ Failure Assessment score: OR=1.98 (1.56–2.55)</li> <li>• Adjusted for Logistic Organ Dysfunction Score: OR = 2.04 (1.59–2.64)</li> <li>• Adjusted for Oxford Acute Severity of Illness Score: OR=2.06 (1.62–2.64)</li> </ul>
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## Conclusions

<b>Very low GRADE</b>	<p>The evidence is very uncertain for the effect of nurse-to-patient ratio X compared with nurse-to-patient ratio Y on <b>ICU and hospital mortality</b> in adult ICU patients.</p> <p><i>Source: Amaravadi, 2000; Dimick, 2001; Pronovost, 2001</i></p>
<b>Very low GRADE</b>	<p>The evidence is very uncertain for the effect of nurse-to-patient ratio X compared with nurse-to-patient ratio Y on <b>ICU and hospital length of stay</b> in adult ICU patients.</p> <p><i>Source: Amaravadi, 2000; Dimick, 2001; Pronovost, 2001; Blot, 2011</i></p>
<b>Very low GRADE</b>	<p>The evidence is very uncertain for the effect of nurse-to-patient ratio X compared with nurse-to-patient ratio Y on <b>morbidity</b> in adult ICU patients.</p> <p><i>Source: Amaravadi, 2000; Dimick, 2001; Pronovost, 2001; Blot, 2011</i></p>
<b>No GRADE</b>	<p>No evidence was found for the effect of nurse-to-patient ratio X compared with nurse-to-patient ratio Y on <b>ICU readmission</b> in adult ICU patients.</p>
<b>No GRADE</b>	<p>No evidence was found for the effect of nurse-to-patient ratio X compared with nurse-to-patient ratio Y on <b>patient satisfaction</b> in adult ICU patients.</p>

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijk en voor acties	Overige opmerkingen
<p>De formatie verpleegkundigen is minimaal 3,5 fte per operationeel bed. Minimaal 90% van deze 3,5 fte per bed bestaat uit gespecialiseerde IC-verpleegkundigen. Maximaal 10% van deze 3,5 fte per bed mag bestaan uit anders opgeleide verpleegkundigen (zoals MC-verpleegkundigen, CCU-verpleegkundigen of verpleegkundigen met een BAZ-certificaat). Evalueer een aanpassing in formatie per operationeel bed volgens de PDSA-cyclus op</p>	<1 jaar	<p>Uit de data van de NICE, uit de enquête die de werkgroep heeft gedaan onder ongeveer een kwart van de intensive care afdelingen in Nederland, en uit visitatiegegevens blijkt dat de formatie verpleegkundigen op dit moment ook al 3,5 – 4,2 fte per IC bed is, conform eerdere aanbeveling. De concept</p>	Geen nieuwe randvoorwaarden	Geen	Geen		

<p>patiënt en medewerker niveau.</p> <p>Naast patiëntgebonden taken zijn de volgende taken meegenomen in de minimale formatie:</p> <ul style="list-style-type: none"> <li>• Klinisch onderwijs;</li> <li>• Bij- en nascholing;</li> <li>• Zorgkwaliteitsbeleid</li> </ul> <p>De minimaal beoogde formatie per operationeel bed kan stijgen van 3,5 naar 4,2 fte wanneer er aanvullende taken zijn. Deze stijging in formatie kan ook gerealiseerd worden door de inzet van andere gespecialiseerde verpleegkundigen.</p>		<p>leidraad handhaaft deze aanbeveling.</p> <p>Al met al is de werkgroep van mening dat de personele kosten met de nieuwe formatie gelijk zullen blijven of hooguit in een enkel geval iets toe zullen nemen.</p>					
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<p>Voor de volgende aanvullende taken is extra formatie nodig:</p> <ul style="list-style-type: none"> <li>• Reanimatieteam;</li> <li>• IC-practitioners;</li> <li>• Regiefuncties;</li> <li>• Nazorg aan patiënten en hun familie;</li> <li>• Interdisciplinair en verpleegkundig wetenschappelijk onderzoek;</li> <li>• MICU-transport;</li> <li>• Regio- en/ of ziekenhuisactiviteiten;</li> <li>• Informatie technologie.</li> </ul>							
<p>De IC-verpleegkundige:bed ratio's zijn 1:1,5 voor de dagdienst, 1:1,75 voor de avonddienst en 1:2 voor de nachtdienst.</p> <ul style="list-style-type: none"> <li>• Ga hierbij uit van het aantal operationele</li> </ul>	<p>&lt; 1 jaar</p>	<p>Geen extra kosten, dit is idem aan voorgaande leidraad</p>	<p>Geen nieuwe randvoorwaarden</p>	<p>Geen</p>	<p>Geen</p>		

<p>bedden per verpleegkundige;</p> <ul style="list-style-type: none"> <li>• Ongeacht de grootte van de IC zijn in elke dienst tenminste 2 IC-verpleegkundigen exclusief beschikbaar voor de IC.</li> </ul> <p>Overweeg om de IC-verpleegkundige:bed ratio aan te passen naar een andere span of control die beter aansluit bij de populatie.</p> <p>De ratio kan met maximaal 0,5 worden aangepast, wat resulteert in een variatie van 1:1 tot maximaal 1:2,5. Bij een verhoging van de ratio dient de vermindering van IC-verpleegkundigen te worden gecompenseerd door verpleegkundigen met</p>							
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<p>een andere specialisatie die aansluit bij de zorgbehoefte van de populatie.</p> <p>Indien de ratio wordt verhoogd, dient aangetoond te worden dat dit verantwoord is voor zowel patiënten als personeel.</p> <p>Dit vereist een grondige onderbouwing en evaluatie volgens de PDSA-cyclus. Neem hierbij minimaal de volgende factoren mee:</p> <ul style="list-style-type: none"> <li>• Patiënt gerelateerde factoren en uitkomsten: ziekte-ernst, zorgzwaarte, mortaliteit, patiënttevredenheid, etc.;</li> </ul> <p>Medewerker gerelateerde factoren: werkplezier, werkdruk, verzuim, functiedifferentiatie, etc.</p>							
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## Evidence tables

Study reference	Study characteristics	Patient characteristics	Intervention (I)	Comparison / control (C)	Follow-up	Outcome measures and effect size	Comments
Amaravadi, 2000	<p>Type of study: retrospective cohort</p> <p>Setting and country: Non-federal acute care hospitals (n=35) in Maryland, USA</p> <p>Funding and conflicts of interest: NR</p>	<p><u>Inclusion criteria:</u> All adult patients discharged from Maryland hospitals from 1994 to 1998 with a primary procedure code for esophageal resection</p> <p><u>Exclusion criteria:</u> NR</p> <p><u>N total at baseline:</u> I: 225 (in 9 hospitals) C: 128 (in 23 hospitals)</p> <p><u>Important prognostic factors:</u> Age, mean (SD): I: 60 (12) C: 63 (12)</p> <p>Sex: I: 79% M C: 70% M</p>	Night-time nurse to patient ratio (NNPR) > 1:2 (nurse cared for one or two patients), obtained from ICU survey data	NNPR < 1:2 (nurse cared for three or more patients)	<p><u>Length of follow-up:</u> Until discharge (patient data was obtained from discharge data)</p> <p><u>Incomplete outcome data:</u> Unit survey data (used to determine the NNPR) was available for 32 of the 35 centres; 353 of 366 patients (96%)</p>	<p><u>Mortality</u> Unadjusted hospital mortality rate I: 5.6% C: 15%</p> <p>Multivariate analysis OR = 0.7 (95% CI 0.3 to 2.0)</p> <p><u>Length of (ICU) stay</u> Median hospital LOS I: 9 days (IQR 1.8 to 13) C: 15 days (IQR 11 to 27)</p> <p><u>Morbidity</u> Postoperative complications, %I/C, OR (95% CI) Pneumonia: 8/16, OR = 2.4 (1.2 to 4.7) Reintubation: 12/25, OR = 2.5 (1.4 to 4.5) Aspiration: 22/25, OR = 1.2 (0.7 to 2.0) Septicemia: 1.8/6.2, OR = 3.7 (1.1 to 12.5) Postoperative infection: 4/5.5, OR = 1.4 (0.5 to 3.8)</p>	Authors' conclusion: "Decreased nurse staffing (nurse to patient ratio less than 1 to 2) is associated with postoperative complications, increased LOS and increased health care cost."

		Groups comparable at baseline? “There was no significant difference between the two groups except for a greater incidence of peripheral vascular disease in patients with a NNPR < 1:2”				Myocardial infarction: 0.9/0.8, OR = 0.9 (0.08 to 9.7) Cardiac arrest: 0/0.8, OR = 1.2 (0.6 to 2.2) Surgical complications: 8/17 OR = 1.9 (0.9 to 3.8) Acute renal failure: 2.7/5.5, OR = 2.1 (0.7 to 6.4)  <u>Readmission to ICU</u> NR  <u>Patient satisfaction</u> NR	
Dimick, 2001	Type of study: retrospective cohort  Setting and country: Acute-care hospitals (n=33) in Maryland, USA  Funding and conflicts of interest:	<u>Inclusion criteria:</u> Adults undergoing hepatic resection between 1994 and 1998  <u>Exclusion criteria:</u> NR  <u>N total at baseline:</u> Intervention: 316 (at 8 hospitals) Control: 240 (at 25 hospitals)  <u>Important prognostic factors:</u> Age, mean (SD): I: 56 (15)	More nurses NPR = 1 : 1 or 1 : 2 (High), at night)	Fewer nurses NPR = 1 : 3 or 1 : 4 (Low) , at night	<u>Length of follow-up:</u> Until discharge (patient data was obtained from discharge data)  <u>Incomplete outcome data:</u> ICU survey data were available for 33 of 35 centers performing hepatic resection, providing information pertinent to the care of 556 (98%) of 569 patients.	<u>Mortality</u> I: 2.5% C: .7.1%  Unadjusted OR = 0.34 (95% CI 0.15 to 0.49) Adjusted OR = 0.49 (95% CI 0.18 to 1.29)  <u>Length of (ICU) stay</u> Median (IQR) I: 7 days (6 to 10) C: 8 days (6 to 12)  <u>Morbidity</u> Pneumonia I/C, OR (95% CI): 2.8/4.2, 1.4 (0.6 to 3.5) Reintubation: 1.9/10.8, 5.7 (2.4 to 13.7)	Authors’ conclusion: “Fewer nurses at night is associated with increased risk for specific pulmonary complications and with increased resource use in patients undergoing hepatectomy.”

		<p>C: 57 (16)</p> <p>Sex: I: 51% M C: 55% M</p> <p>Groups comparable at baseline? “Compared with patients in hospitals with more ICU nurses, patients in hospitals with fewer ICU nurses had a higher percentage of urgent or emergent surgery, were more often nonwhite, more often had a hepatic lobectomy, and had fewer myocardial infarctions as comorbid history. Each of these factors was considered in the adjusted analyses.”</p>				<p>Pulmonary failure: 1.6/5.8, 3.6 (1.3 to 10.1) Aspiration: 12.0/7.5,</p> <p><u>Readmission to ICU</u> NR</p> <p><u>Patient satisfaction</u> NR</p>	
Pronovost, 2001	<p>Type of study: retrospective cohort</p> <p>Setting and country: All non-federal acute care hospitals in Maryland</p>	<p><u>Inclusion criteria:</u> We obtained information on all patients 30 years of age or older who were discharged from a Maryland hospital between January 1994 and December 1996 with a principal</p>	<p>Hospitals with more ICU nurses (in which each nurse cared for one or two patients), during the day.</p> <p>We considered nurse-to-patient ratios of 1:1 or 1:2 as “more ICU nurses”</p>	<p>Hospitals with fewer ICU nurses (in which each nurse cared for three or four patients), during the day</p> <p>We considered nurse-to-patient ratios of 1:3 or 1:4 as “fewer ICU nurses.”</p>	<p><u>Length of follow-up:</u> Until discharge (patient data was obtained from discharge data)</p> <p><u>Incomplete outcome data:</u> Patient and ICU nurse staffing data were available for 38 of the 46 hospitals in this study.</p>	<p><u>Mortality</u> Inpatient mortality rate (95% CI) I: 7% (6.0%–8.1%) C: 8% (6.0%–11.2%) OR: 0.82 (0.57–1.18)</p> <p><u>Length of (ICU) stay</u></p>	<p>Authors’ conclusion: “Having fewer ICU nurses per patient is associated with increased risk for respiratory-related complications after abdominal aortic surgery.”</p>

	<p>Funding and conflicts of interest: NR</p>	<p>procedure code for abdominal aortic surgery (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] code 3844 for resection of abdominal aorta with replacement and ICD-9-CM code 3925 for aortoiliac-femoral bypass).</p> <p><u>Exclusion criteria:</u> We excluded 9 patients who were younger than 30 years of age, all of whom had had an injury to a blood vessel (ICD-9-CM code 902).</p> <p><u>N total at baseline:</u> I: 2,128 C: 478</p> <p><u>Important prognostic factors:</u> Age (SD) in years: I: 68 (10) C: 68 (10)</p> <p>Sex: I: 69% M C: 66% M</p>	<p>obtained from ICU survey data</p>	<p>obtained from ICU survey data</p>		<p>Hospital length of stay, median (range), d I: 8 (0–171) C: 8 (0–130)</p> <p>ICU length of stay, median (range), d I: 2 (0–118) C: 3 (0–112)</p> <p><u>Morbidity</u> Adjusted for patient characteristics and hospital and surgeon volume.</p> <p>Any complication % I/C: 34% / 47% RR (95% CI), crude; adjusted 1.4 (1.2–1.5); 1.7 (1.3–2.4) Any medical complication % I/C: 28% / 43% RR (95% CI), crude; adjusted 1.5 (1.4–1.7); 2.1 (1.5–2.9) Pulmonary insufficiency after procedure % I/C: 9% / 24% RR (95% CI), crude; adjusted 2.6 (2.1–3.2); 4.5 (2.9–6.9) Reintubation % I/C: 13% / 21% RR (95% CI), crude; adjusted 1.5 (1.3–1.8); 1.6 (1.1–2.5) Cardiac complications after procedure % I/C: 10% / 15% RR (95% CI), crude; adjusted 1.4 (1.1–1.7); 1.3 (0.8–1.8)</p>	
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		<p>Groups comparable at baseline?  “Demographic characteristics and severity of illness did not differ between patients in either nurse staffing model. Mild diabetes mellitus was the only comorbid disease that occurred significantly more often in patients in ICUs with fewer nurses”</p>				<p>Acute renal failure % I/C: 4% / 6%  RR (95% CI), crude; adjusted 1.3 (0.8–1.9); 1.6 (0.9–2.7)  Septicemia % I/C: 3% / 4%  RR (95% CI), crude; adjusted 1.4 (0.8–2.1); 1.9 (0.9–3.9)  Acute myocardial infarction % I/C: 3% / 4%  RR (95% CI), crude; adjusted 1.5 (0.8–2.4); 1.5 (0.9–2.2)  Cardiac arrest % I/C: 1% / 2%  RR (95% CI), crude; adjusted 1.4 (0.6–3.0); 1.7 (0.7–4.7)  Any surgical complication % I/C: 11% / 10%  RR (95% CI), crude; adjusted 0.9 (0.6–1.4); 0.7 (0.4–1.5)  Surgical complications after procedure % I/C: 9% / 8%  RR (95% CI), crude; adjusted 0.9 (0.6–1.2); 1.0 (0.6–1.4)  Surgical E codes % I/C: 0% / 1%  RR (95% CI), crude; adjusted 2.2 (0.4–10.5); N/A (insufficient data)  Reoperation for bleeding % I/C: 3% / 2%  RR (95% CI), crude; adjusted 0.8 (0.4–1.6); 1.2 (0.4–3.5)</p> <p><u>Readmission to ICU</u>  NR</p> <p><u>Patient satisfaction</u></p>	
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						NR	
Blot, 2011	<p>Type of study: Prospective observational study</p> <p>Setting and country: 27 ICUs in 9 European countries: Belgium, France, Germany, Greece, Italy, Ireland, Portugal, Spain, and Turkey.</p> <p>Funding and conflicts of interest: Dr Blot was supported by a grant from the European Society of Intensive Care Medicine and iMDsoft Patient Safety Research Award 2008. The study was supported, in</p>	<p><u>Inclusion criteria:</u> All patients who were admitted to the ICU for treatment of pneumonia or received invasive mechanical ventilation for more than 48 hours, irrespective of the admission diagnosis, were included in the initial cohort.</p> <p><u>Exclusion criteria:</u> Because the focus of the study reported here was prevention of VAP, data on patients with a clinical diagnosis of community-acquired pneumonia, non-ventilator-associated hospital-acquired pneumonia, or very early VAP (due to aspiration and developing within 48 hours after intubation), were excluded from the analysis. Data on patients from 6 ICUs that did not provide data on nurse staffing</p>	<p>Patient to nurse ratio <math>\leq</math> 2:1</p> <p>Routine staffing levels for all available ICU beds were considered, irrespective of bed occupancy. Routine staffing level is defined as the patient to nurse ratio that is standard in a particular ICU. As such, unit-based standard nurse staffing levels were used irrespective of acute shortages of staff and number of patients present. Daily bed occupancy levels were not taken into account because this cohort consisted solely of patients who received mechanical ventilation. Hence, actual day-to-day patient to nurse ratios were not available for the analysis. For units with variable staffing levels (eg, 1 to 1 during day shifts and 2 to 1 during night shifts), the highest patient to nurse ratio in a 24-hour period was considered.</p>	<p>Patient to nurse ratio &gt; 2:1</p>	<p><u>Length of follow-up:</u> NR</p> <p><u>Loss-to-follow-up &amp; incomplete data:</u> NR</p>	<p><u>Mortality</u> NR</p> <p><u>Length of (ICU) stay</u> ICU stay, median (25th-75th percentile), d I: 12 (6-22) C: 11 (6-20)</p> <p>Hospital stay, median (25th-75th percentile), d I: 22 (12-42) C: 17 (9-31)</p> <p><u>Morbidity</u> ventilator-associated pneumonia (VAP): N (%) I: 262 (24.6) C: 131 (22.1)</p> <p><u>Readmission to ICU</u> NR</p> <p><u>Patient satisfaction</u> NR</p>	<p>Authors' conclusion: "In this cohort of patients treated with mechanical ventilation, a patient to nurse ratio of 1 to 1 appeared to be associated with a lower risk for VAP. After adjustment for confounding covariates, however, the difference was no longer significant. Although higher staffing levels may be beneficial for other outcomes, the effect of trauma, general disease severity, and duration of mechanical ventilation are more important risk factors for VAP. Our data indicate that efforts to reduce the number of days at risk should be a priority in the prevention of VAP. Thus, our results underscore the value of a proactive extubation policy with a "sedation vacation" as recommended in current guidelines. Further research is necessary to evaluate the relationship between higher staffing levels (patient to nurse ratio &lt;2 to 1) and</p>

	<p>part, by Generalitat de Catalunya grant SGR 05/920, by CIBER Enfermedades Respiratorias (CIBERES), and by Carlos III Health Institute grants PI05/2410 and AI/07/90031.</p>	<p>levels were also excluded from the analysis.</p> <p><u>N total at baseline:</u> I: 1,066 C: 592</p> <p><u>Important prognostic factors:</u> Age median (IQR): I: 59 (41-71) C: 69 (57-77)</p> <p>Sex: I: 64% M C: 61% M</p> <p>Groups comparable at baseline? Important differences in patients' characteristics are considered, adjusted for in analyses.</p>					<p>compliance rates with distinct evidence-based strategies to prevent VAP. In our study, the actual patient to nurse ratio should be taken into account (actual number of patients per nurse each day)."</p>
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### Risk of bias

Author, year	Selection of participants	Exposure	Outcome of interest	Confounding-assessment	Confounding-analysis	Assessment of outcome	Follow up	Co-interventions	Overall Risk of bias
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	Was selection of exposed and non-exposed cohorts drawn from the same population?	Can we be confident in the assessment of exposure?	Can we be confident that the outcome of interest was not present at start of study?	Can we be confident in the assessment of confounding factors?	Did the study match exposed and unexposed for all variables that are associated with the outcome of interest or did the statistical analysis adjust for these confounding variables?	Can we be confident in the assessment of outcome?	Was the follow up of cohorts adequate? In particular, was outcome data complete or imputed?	Were co-interventions similar between groups?	
	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Low, Some concerns, High
<b>Amaravadi, 2000</b>	<i>Probably yes</i> Reason: Exposed and unexposed drawn for same administrative database of patients	<i>Probably no</i> Reason: Exposure data obtained via a survey that was reviewed independently by five intensive care physicians to ensure content validity.	<i>Probably yes</i> Reason: Outcomes mortality, LOS, ICU readmission cannot be present beforehand; not sure about complications	<i>Probably yes /unclear</i> Reason: Information obtained from patient hospital discharge data	<i>Probably yes</i> Reason: Models adjusted for age, sex, nature of admission, type of operation, comorbid disease, hospital volume and surgeon volume.	<i>Probably yes</i> Reason: Outcome data obtained from patient discharge data	<i>Probably no</i> Reason: Follow-up was adequate for all outcomes but no information on missing data	<i>Probably no/unclear</i> Reason: For the outcome hospital mortality: no information on care patients received outside of the ICU	<b>High (all outcomes)</b>

		Exposure data on hospital level, not individual patients.							
<b>Dimick, 2001</b>	<i>Probably yes</i> Reason: Exposed and unexposed drawn for same administrative database of patients	<i>Probably no</i> Reason: Exposure information obtained from ICU survey. Exposure data on hospital level, not individual patients.	<i>Probably yes</i> Reason: Outcomes mortality, LOS, ICU readmission cannot be present beforehand; not sure about complications	<i>Probably yes /unclear</i> Reason: Information obtained from patient hospital discharge data	<i>Probably yes</i> Reason: Adjustments in models were made for age, sex, nature of admission, type of operation, comorbid conditions, and hospital and surgeon volume.	<i>Probably yes</i> Reason: Outcome data obtained from patient discharge data	<i>Probably no</i> Reason: Follow-up was adequate for all outcomes but no information on missing data	<i>Probably no/unclear</i> Reason: For the outcome hospital mortality: no information on care patients received outside of the ICU	<b>High (all outcomes)</b>
<b>Pronovost, 2001</b>	<i>Probably yes</i> Reason: Exposed and unexposed drawn for same administrative database of patients	<i>Probably no</i> Reason: Exposure information obtained from ICU survey. Exposure data on hospital level, not individual patients.	<i>Probably no</i> Reason: Outcomes mortality, LOS, ICU readmission cannot be present beforehand. For outcome complications: "the discharge	<i>Probably yes /unclear</i> Reason: Information obtained from patient hospital discharge data	<i>Probably yes</i> Reason: Covariates: number of hospital beds, volume of aortic surgery performed by hospital and surgeon, age, sex, race (white/nonwhite),	<i>Probably yes</i> Reason: Outcome data obtained from patient discharge data	<i>Probably no</i> Reason: Follow-up was adequate for all outcomes but no information on missing data	<i>Probably no/unclear</i> Reason: For the outcome hospital mortality: no information on care patients received outside of the ICU	<b>High (all outcomes)</b>

			diagnosis codes we used do not distinguish between complications and comorbid conditions, the medical diagnoses listed here are for acute problems and are therefore more likely to represent complications than comorbid conditions”		comorbidity (each disease separately), severity of illness, nature of admission.  Reported RRs adjusted for patient characteristics and hospital and surgeon volume.				
<b>Blot, 2011</b>	<i>Probably yes</i>  Reason: Cohort of consecutive patients; exposed and unexposed from same database	<i>Probably no</i>  Reason: Exposure was based routine staffing level; unit-based standard nurse staffing levels were used irrespective of acute shortages of staff and	<i>Probably yes</i>  Reason: For the outcome VAP selection criteria were used to exclude patients that already had a similar/related diagnosis	<i>Probably yes</i>  Reason: Information obtained from prospectively recorded patient data. Data recorded by investigators on study sites on paper forms; sent to central study	<i>Probably yes</i>  Reason: Variables considered were age, SAPS II, underlying diseases, admission diagnosis, and patient to nurse ratio.	<i>Unclear</i>  Reason: Outcome VAP, criteria defined but may still be subjective, recorded by investigators on site, no information on whether they were blind to	<i>Probably no</i>  Reason: Follow-up was adequate for all outcomes but no information on missing data	<i>Unclear</i>  Reason: No information	<b>High (all outcomes)</b>

		number of patients present.		site and put into electric database, checked for inconsistencies		exposure (nurse staffing level)			
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**Table of excluded studies**

Reference	Reason for exclusion
<p>Bray K, Wren I, Baldwin A, St Ledger U, Gibson V, Goodman S, Walsh D. Standards for nurse staffing in critical care units determined by: The British Association of Critical Care Nurses, The Critical Care Networks National Nurse Leads, Royal College of Nursing Critical Care and In-flight Forum. <i>Nurs Crit Care</i>. 2010 May-Jun;15(3):109-11. doi: 10.1111/j.1478-5153.2010.00392.x. PMID: 20500648.</p>	<p>Review without systematic literature search</p>
<p>Chamberlain D, Pollock W, Fulbrook P; ACCCN Workforce Standards Development Group. ACCCN Workforce Standards for Intensive Care Nursing: Systematic and evidence review, development, and appraisal. <i>Aust Crit Care</i>. 2018 Sep;31(5):292-302. doi: 10.1016/j.aucc.2017.08.007. Epub 2017 Dec 12. PMID: 29246795.</p>	<p>Results of the literature analysis are not systematically presented</p>
<p>Dall'Ora C, Saville C, Rubbo B, Turner L, Jones J, Griffiths P. Nurse staffing levels and patient outcomes: A systematic review of longitudinal studies. <i>Int J Nurs Stud</i>. 2022 Oct;134:104311. doi: 10.1016/j.ijnurstu.2022.104311. Epub 2022 Jun 16. PMID: 35780608.</p>	<p>Systematic review not restricted to ICU settings, no relevant individual studies</p>
<p>Dodek PM, Norena M, Wong H, Keenan S, Martin C. Assessing the Influence of Intensive Care Unit Organizational Factors on Outcomes in Canada: Is There Residual Confounding? <i>J Intensive Care Med</i>. 2015 Oct;30(7):413-9. doi: 10.1177/0885066614521973. Epub 2014 Feb 7. PMID: 24509494.</p>	<p>Wrong comparison (does not describe nurse-to-patient ratio or workload)</p>
<p>Durbin CG Jr. Team model: advocating for the optimal method of care delivery in the intensive care unit. <i>Crit Care Med</i>. 2006 Mar;34(3 Suppl):S12-7. doi: 10.1097/01.CCM.0000199985.72497.D1. PMID: 16477198.</p>	<p>Non-exhaustive, selective literature search</p>
<p>Falk AC. Nurse staffing levels in critical care: The impact of patient characteristics. <i>Nurs Crit Care</i>. 2023 Mar;28(2):281-287. doi: 10.1111/nicc.12826. Epub 2022 Jul 27. PMID: 35896444.</p>	<p>Wrong comparison (two units with a different NPR)</p>
<p>Gershengorn HB, Garland A. Who Should Be at the Bedside 24/7: Doctors, Families, Nurses? <i>Semin Respir Crit Care Med</i>. 2016 Feb;37(1):107-18. doi: 10.1055/s-0035-1570350. Epub 2016 Jan 28. PMID: 26820278.</p>	<p>Review without systematic literature search</p>

Halm M. The Influence of Appropriate Staffing and Healthy Work Environments on Patient and Nurse Outcomes. <i>Am J Crit Care</i> . 2019 Mar;28(2):152-156. doi: 10.4037/ajcc2019938. PMID: 30824521.	No systematic literature search conducted, not restricted to ICU settings
Heenan S. Examining potential relationships between nurse staffing and clinical incidents in ICUs. <i>Aust Crit Care</i> . 2018;31(2):136-7.	Wrong publication type (abstract)
Kane RL, Shamliyan TA, Mueller C, Duval S, Wilt TJ. The association of registered nurse staffing levels and patient outcomes: systematic review and meta-analysis. <i>Med Care</i> . 2007 Dec;45(12):1195-204. doi: 10.1097/MLR.0b013e3181468ca3. PMID: 18007170.	Systematic review not restricted to ICU settings, no risk of bias assessment; relevant individual studies already included
McGahan M, Kucharski G, Coyer F; Winner ACCCN Best Nursing Review Paper 2011 sponsored by Elsevier. Nurse staffing levels and the incidence of mortality and morbidity in the adult intensive care unit: a literature review. <i>Aust Crit Care</i> . 2012 May;25(2):64-77. doi: 10.1016/j.aucc.2012.03.003. Epub 2012 Apr 18. PMID: 22515951.	No meta-analysis, relevant individual studies already included
Minnick AF, Mion LC. Nurse labor data: the collection and interpretation of nurse-to-patient ratios. <i>J Nurs Adm</i> . 2009 Sep;39(9):377-81. doi: 10.1097/NNA.0b013e3181b3b656. Erratum in: <i>J Nurs Adm</i> . 2009 Nov;39(11):464. PMID: 19745633; PMCID: PMC2879153.	Not restricted to ICU, wrong study aim: to compare the degree of completeness and the agreement between two approaches (nurse survey and nurse to patient ratio staffing plans) to obtain patient-to-nurse ratios
Numata Y, Schulzer M, van der Wal R, Globerman J, Semeniuk P, Balka E, Fitzgerald JM. Nurse staffing levels and hospital mortality in critical care settings: literature review and meta-analysis. <i>J Adv Nurs</i> . 2006 Aug;55(4):435-48. doi: 10.1111/j.1365-2648.2006.03941.x. PMID: 16866839.	Systematic review: Relevant individual studies included separately in current analysis
Olley R, Edwards I, Avery M, Cooper H. Systematic review of the evidence related to mandated nurse staffing ratios in acute hospitals. <i>Aust Health Rev</i> . 2019 Jul;43(3):288-293. doi: 10.1071/AH16252. PMID: 29661270.	Wrong analysis (qualitative); wrong outcome
Penoyer DA. Nurse staffing and patient outcomes in critical care: a concise review. <i>Crit Care Med</i> . 2010 Jul;38(7):1521-8; quiz 1529. doi: 10.1097/CCM.0b013e3181e47888. PMID: 20473146.	No meta-analysis, relevant individual studies already included
Pitkääho T, Partanen P, Miettinen MH, Vehviläinen-Julkunen K. The relationship between nurse staffing	Wrong setting (acute care instead of ICU)

and length of stay in acute-care: a one-year time-series data. J Nurs Manag. 2016 Jul;24(5):571-9. doi: 10.1111/jonm.12359. Epub 2016 Feb 1. PMID: 26833964.	
Rae PJJ, Pearce S, Greaves PJ, Dall'Ora C, Griffiths P, Endacott R. Outcomes sensitive to critical care nurse staffing levels: A systematic review. Intensive Crit Care Nurs. 2021 Dec;67:103110. doi: 10.1016/j.iccn.2021.103110. Epub 2021 Jul 9. PMID: 34247936.	Systematic review, no relevant outcome data reported; relevant individual studies already included
Shuldham C, Parkin C, Firouzi A, Roughton M, Lau-Walker M. The relationship between nurse staffing and patient outcomes: a case study. Int J Nurs Stud. 2009 Jul;46(7):986-92. doi: 10.1016/j.ijnurstu.2008.06.004. PMID: 18675419.	Wrong population (also included pediatric ICU's)
Shekelle PG. Nurse-patient ratios as a patient safety strategy: a systematic review. Ann Intern Med. 2013 Mar 5;158(5 Pt 2):404-9. doi: 10.7326/0003-4819-158-5-201303051-00007. PMID: 23460097.	Systematic review, only pooled OR reported, no information on individual studies; relevant individual studies already included
Tarnow-Mordi WO, Hau C, Warden A, Shearer AJ. Hospital mortality in relation to staff workload: a 4-year study in an adult intensive-care unit. Lancet. 2000 Jul 15;356(9225):185-9. doi: 10.1016/s0140-6736(00)02478-8. PMID: 10963195.	Wrong comparison (occupancy/nursing requirement per shift, no nurse-to-patient-ratio)

## Literature search strategy

### Zoekverantwoording

#### Algemene informatie

Cluster/richtlijn: NVIC – herziening leidraad organisatie van de intensive care	
Uitgangsvraag/modules: Wat is de benodigde formatie intensivisten, verpleegkundigen op de IC	
Database(s): Embase.com, Ovid/Medline, Cinahl	Datum: 25-10-2023
Periode: vanaf 2000	Talen: geen restrictie

### Zoekopbrengst

	EMBASE	OVID/MEDLINE	CINAHL	Ontdubbeld
SR	103	70	85	128
RCT	297	190	545	844
Observationele studies	715	593	382	995

Totaal	1115	853	1012	<b>*2021</b>
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*\*in Rayyan*

**Zoekstrategie**

**Embase.com**

No.	Query	Results
#1	'intensive care'/de OR 'intensive care unit'/exp OR 'artificial feeding'/exp OR 'artificial ventilation'/exp OR 'early goal-directed therapy'/exp OR 'sepsis'/exp OR 'acute respiratory failure'/exp OR 'respiratory tract intubation'/exp OR (((intensive OR critical OR medium) NEAR/2 care):ti,ab,kw) OR 'critically ill':ti,ab,kw OR 'acutely ill':ti,ab,kw OR weaning:ti,kw OR (((mechanical* OR artificial) NEAR/2 ventilat*):ti,ab,kw)	1164410
#2	(((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) NEAR/3 staffing):ti,ab,kw) OR 'workforce optimiz*':ti,ab,kw	4618
#3	((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) NEAR/4 ratio*):ti,ab,kw	7291
#4	'personnel management'/exp OR 'intensivist model*':ti,ab,kw	101164
#5	#2 OR #3 OR #4	109681
#6	#1 AND #5	4792
#7	#6 AND [2000-2023]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp) NOT (('adolescent'/exp OR 'child'/exp OR adolescent*:ti,ab,kw OR child*:ti,ab,kw OR schoolchild*:ti,ab,kw OR infant*:ti,ab,kw OR girl*:ti,ab,kw OR boy*:ti,ab,kw OR teen:ti,ab,kw OR teens:ti,ab,kw OR teenager*:ti,ab,kw OR youth*:ti,ab,kw OR pediatr*:ti,ab,kw OR paediatr*:ti,ab,kw OR puber*:ti,ab,kw) NOT ('adult'/exp OR 'aged'/exp OR 'middle aged'/exp OR adult*:ti,ab,kw OR man:ti,ab,kw OR men:ti,ab,kw OR woman:ti,ab,kw OR women:ti,ab,kw))	2355
#8	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR	969137

	synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasyntes*:ti,ab OR 'meta syntes*':ti,ab	
#9	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3891996
#10	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	7880253
#11	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*':ti,ab,kw OR cross?ectional*:ti,ab,kw OR multigent*:ti,ab,kw OR 'multi-cent*':ti,ab,kw OR consecutive*:ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*:ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*:ti,ab,kw OR 'odds ratio*':ab OR 'relative odds':ab OR 'risk ratio*':ab OR 'relative risk*':ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (((or' OR 'rr') NEAR/6 ci):ab)))	14491257

#12	#7 AND #8 SR	103
#13	#7 AND #9 NOT #12 Clinical trials	297
#14	#7 AND (#10 OR #11) NOT #12 NOT #13 Observatoneel	715
#15	#12 OR #13 OR #14	1115
#16	'intensivist physician-to-patient ratios and mortality in the intensive care unit'	1
#17	'patient mortality is associated with staff resources and workload in the icu: a multicenter observational study'	1
#18	'physician staffing patterns' AND pronovost	1
#19	'the effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units'	1
#20	#16 OR #17 OR #18 OR #19	4
#21	#15 AND #20 sleutelartikelen gevonden	4

### Ovid/Medline

#	Searches	Results
1	Critical Care/ or Critical Illness/ or Early Goal-Directed Therapy/ or exp Intensive Care Units/ or exp Sepsis/ or exp Respiratory Distress Syndrome/ or exp Respiration, Artificial/ or exp Intubation, Intratracheal/ or Ventilator Weaning/ or weaning.ti,ab,kf. or ((intensive or critical) adj2 care).ti,ab,kf. or critically ill.ti,ab,kf. or acutely ill.ti,ab,kf. or (mechanical*or artificial adj2 ventilat*).ti,ab,kf. or intubat*.ti,ab,kf.	628796
2	"Personnel Staffing and Scheduling"/ or intensivist model*.ti,ab,kf. or ((intensivist* or physician* or nurs* or staff* or specialist* or workforce or workload) adj4 ratio*).ti,ab,kf. or ((optim* or intensivist* or physician* or nurse* or specialist* or workforce or requirement* or necessit* or demand* or obligation* or personnel) adj3 staffing).ti,ab,kf. or 'workforce optimiz*'.ti,ab,kf.	24838
3	1 and 2	2337
4	limit 3 to yr="2000 -Current"	1917
5	4 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/) not ((Adolescent/ or Child/ or Infant/ or adolescen*.ti,ab,kf. or child*.ti,ab,kf. or schoolchild*.ti,ab,kf. or infant*.ti,ab,kf. or girl*.ti,ab,kf. or boy*.ti,ab,kf. or teen.ti,ab,kf. or teens.ti,ab,kf. or teenager*.ti,ab,kf. or youth*.ti,ab,kf. or pediater*.ti,ab,kf. or paediatr*.ti,ab,kf. or puber*.ti,ab,kf.) not (Adult/ or adult*.ti,ab,kf. or man.ti,ab,kf. or men.ti,ab,kf. or woman.ti,ab,kf. or women.ti,ab,kf.))	1499
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or	701576

	data-base*).ti,ab,kf. or (("data extraction" or "data source*") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*)).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*)).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	
7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2646742
8	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4561054
9	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multigent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or	5538148

	('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or (("OR" or "RR") adj6 CI).ab.)	
10	5 and 6 <b>SR</b>	70
11	(5 and 7) not 10 <b>Clinical trials</b>	190
12	(5 and (8 or 9)) not 10 not 11 <b>OBS</b>	593
13	10 or 11 or 12	853

## Cinahl

#	Query	Results
S1	(MH "Intensive Care Units+") OR (MH "Critical Care Nursing+") OR (MH "Critical Care+") OR TI ("critical care" OR "intensive care) OR AB ("critical care" OR "intensive care)	117,581
S2	(MH "Personnel Staffing and Scheduling+") OR TI (((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) N3 staffing) OR "workforce optimiz*" OR ((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) N4 ratio*) OR "intensivist model*") OR AB (((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) N3 staffing) OR "workforce optimiz*" OR ((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) N4 ratio*) OR "intensivist model*")	39,468
S3	S1 AND S2	2,133
S4	S3 NOT ((MH ("Adolescence" OR "Child+") OR TI (adolescen* OR child* OR schoolchild* OR infant* OR girl* OR boy* OR teen OR teens OR teenager* OR youth* OR pediater* OR paediatr* OR puber*)) OR AB (adolescen* OR child* OR schoolchild* OR infant* OR girl* OR boy* OR teen OR teens OR teenager* OR youth* OR pediater* OR paediatr* OR puber*)) NOT (MH ("Adult+") OR TI (adult* OR man OR men OR woman OR women) OR AB (adult* OR man OR men OR woman OR women)))	1,872
S5	(MH "Meta Analysis") or TX (meta-analy* or metanaly* or metaanaly* or meta analy*) or TX (systematic* N5 review*) or (evidence* N5 review*) or (methodol* N5 review*) or (quantitativ* N5 review*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (systematic* N5 survey*) or (evidence* N5 survey*) or (methodol* N5 survey*) or (quantitativ* N5 survey*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (pool* N2	319,039

	data) or (combined N2 data) or (combining N2 data) or (pool* N2 trials) or (combined N2 trials) or (combining N2 trials) or (pool* N2 studies) or (combined N2 studies) or (combining N2 studies) or (pool* N2 results) or (combined N2 results) or (combining N2 results)	
S6	(MH "Clinical Trials+") OR (PT (Clinical trial)) OR (MH "Random Assignment") OR (MH "Quantitative Studies") OR (TX ((clini* N1 trial*) OR (singl* N1 blind*) OR (singl* N1 mask*) OR (doubl* N1 blind*) OR (doubl* N1 mask*) OR (tripl* N1 blind*) OR (tripl* N1 mask*) OR (random* N1 allocat*) OR placebo* OR ((waitlist* OR (wait* and list*)) and (control* OR group)) OR "treatment as usual" OR tau OR (control* N3 (trial* OR study OR studies OR group*)) OR randomized OR randomised))	1,985,979
S7	(MH "Case Control Studies+") OR (MH "Case Studies") OR (MH "Cross Sectional Studies") OR (MH "Prospective Studies+") OR (MH "Retrospective Panel Studies") OR (MH "Correlational Studies") OR TI "case control" OR TI "case referent" OR AB "case referent*" OR TI "case stud*" OR AB "case stud*" OR TI "case series" OR AB "case series" OR TI cohort* OR AB cohort* OR TI "cross sectional" OR AB "cross sectional" OR TI "follow up" OR AB "follow up" OR TI longitudinal OR AB longitudinal OR TI retrospective* OR AB retrospective* OR TI prospective* OR AB prospective* OR TI observational OR AB observational OR TI "Controlled before and after" OR AB "Controlled before and after" OR TI "Interrupted time series" OR AB "Interrupted time series" OR TI Correlational OR AB Correlational	1,570,792
S8	S4 AND S5 <b>SR</b>	85
S9	S4 AND S6 NOT S8 <b>Clinical trials</b>	545
S10	S4 AND S7 NOT S8 NOT S9 <b>OBS</b>	382
S1	S8 OR S9 OR S10	1012

## Bijlage - Module 3.2 Formatie intensivisten

### Method

A systematic review of the literature was performed to answer the following question: What is the effect of intensivist-to-patient ratio X versus intensivist-to-patient ratio Y in the ICU?

<b>P (Population):</b>	adult ICU patients (>17 years)
<b>I (Intervention):</b>	intensivist-to-patient ratio X
<b>C (Control):</b>	intensivist-to-patient ratio Y
<b>O (Outcome):</b>	mortality (ICU, hospital), length of (ICU, hospital) stay, morbidity, ICU readmission, patient satisfaction

### Relevant outcome measures

The guideline development group considered mortality as a critical outcome measure for decision making; and length of stay, morbidity, ICU readmission, patient satisfaction as an important outcome measure for decision making.

A priori, the working group did not define the outcome measures listed above but used the definitions used in the studies.

The working group defined the following values as minimal clinically (patient) important difference:

- Mortality (ICU, hospital): 3% difference (absolute)
- Length of stay (ICU, hospital): ICU 1 day, hospital 3 days
- Morbidity: RR <0.8 or >1.25
- ICU readmission: RR <0.8 or >1.25
- Patient satisfaction: 10% difference

### *Search and select*

The databases Medline (via OVID), Embase (via Embase.com) and Cinahl were searched with relevant search terms until 25 October 2023. The search was combined with the search for the module about the nurse-to-patient ratio. The detailed search strategy is depicted under the tab Methods. The systematic literature search resulted in 2,021 hits. Studies were selected based on the following criteria: Systematic review, RCT or observational study comparing the effect of different intensivist-to-patient ratios on adults patients (>17 years) in the ICU, reporting at least one of the outcomes specified in the PICO, published after 2000. Initially, 12 studies were selected based on title and abstract screening. After reading the full text, 6 studies were excluded (see the table with reasons for exclusion under the tab Methods), and 6 studies were included. However, these results were not graded, due to the explorative nature of the analysis. An overview of these results without GRADE assessment is given in tables.

### Results

Six studies were included in the description of the literature. Data were summarized in Table 1. Due to the explorative nature of the analysis, the results were not graded.

**Table 1. Results of the non-comparative observational studies**

First author, year	Study design, Population Setting Country	Definition variable 'intensivist-patient ratio'	Analysis, confounders	Results
Dara, 2005	Retrospective cohort study, tertiary care medical center; all critically ill patients admitted to a medical ICU between December 8, 2001, and July 14, 2003; 2,492 patients.	<p>Intensivist-to-bed ratio, divided into four periods:</p> <ul style="list-style-type: none"> <li>• The period between December 8, 2001, and March 31, 2002, was labeled period 1 (intensivist-to-bed ratio, 1:15).</li> <li>• The period between April 1, 2002, and August 6, 2002, was labeled period 2 (intensivist-to-bed ratio, 1:7.5).</li> <li>• Period 3 (intensivist-to-bed ratio, 1: 9.5) was from August 7, 2002, to December 17, 2002.</li> <li>• Period 4 (intensivist-to-bed ratio, 1:12) was from December 18, 2002, to July 14, 2003.</li> </ul>	To determine if the intensivist-to-bed ratio is an independent variable associated with ICU or hospital mortality after controlling for other factors that impact on patient outcome, logistic regression analyses were performed with intensivist-to-bed ratio, APACHE III-predicted mortality, admission source, and intensity of treatment as independent variables.	<p><u>Hospital mortality</u>            Period 1: 57/349            Period 2: 104/491            Period 3: 125/573            Period 4: 196/1,079</p> <p><u>ICU mortality</u>            Period 1: 37/349            Period 2: 68/491            Period 3: 76/573            Period 4: 117/1,079</p> <p><u>Mean weighted ICU LOS</u>            Period 1: 12.27            Period 2: 9.46            Period 3: 9.66            Period 4: 9.22</p> <p><u>Mean weighted hospital LOS</u>            Period 1: 19.04            Period 2: 17.17            Period 3: 16.92            Period 4: 17.26</p> <p>The ICU period with one intensivist for 15 beds (period 1) had a longer adjusted ICU LOS ratio than ICU periods with one intensivist for 7.5 beds (<math>p &lt; 0.0001</math>), 9.5 beds (<math>p = 0.0003</math>), and 12</p>

				beds ( $p < 0.0001$ ). Although the ICU period with an intensivist-to-bed ratio of 1:7.5 had the shortest ICU LOS ratio, the difference was not statistically significant compared to the periods with intensivist-to-ICU bed ratios of 1:9.5 ( $p = 0.20$ ) or 1:12 ( $p = 0.51$ ). The observed hospital mortality, observed ICU mortality, and SMRs did not differ significantly across the four periods. Multiple logistic regression analysis did not show the intensivist-to-bed ratio to be independently associated with ICU or hospital mortality.
Neuraz, 2015	Multicenter longitudinal study using routinely collected hospital data, January to December 2013; 8 ICU's from 4 university hospitals in Lyon, France; 5,718 inpatient stays.	<p>Patient-to-physician (P/P) ratios by shift. The following four categories for P/P were defined as follows:</p> <ul style="list-style-type: none"> <li>• less than or equal to 8:1</li> <li>• greater than 8:1 to less than or equal to 10:1</li> <li>• greater than 10:1 to less than or equal to 14:1</li> <li>• greater than 14:1 (10:1 meaning 10 patients for one physician). Medical residents were included in the count of physicians. We calculated the resident-to-physician ratio (R/P) as the number of residents divided by the number of physicians.</li> </ul>	<p>To control for potential confounding variables, patients' characteristics were a priori selected as clinically important covariates. The proportion of surgical cases versus medical cases was used to adjust on the type of patient case-mix admitted to ICU.</p> <p>The final multivariate model included the following variables: P/N, P/P (patients/physician) and residents-to-physicians ratios, patient turnover, number of LSP, proportion of men, proportion of surgical cases, SAPSII, and number of comorbidities.</p>	<p><u>Mortality:</u> The fully adjusted model, taking into account both staffing and workload levels, showed an increased risk of mortality, with the highest values for P/P and P/N. The ICU risk of death increased by a factor of 2.0 (1.3–3.2) when the number of patients was above 14 per physician. The presence of medical residents did not influence inpatient mortality (<math>p = 0.6</math>).</p>

Ding, 2022	<p>Retrospective study. A total of 1267 ICUs from 30 provinces in mainland China were included. Data were collected using the National Clinical Improvement System Data that report ICU information.</p> <p>A total of 1267 hospitals and 109,1878 ICU patients from 30 provinces were included.</p>	Physician-to-bed ratio (calculated by the total number of ICU physicians divided by the number of beds in the ICU), patient-to-physician ratio (calculated by the total number of ICU patients divided by the number of ICU physicians).	Poisson regression analysis was used to identify the impact of factors on the incidence rate and mortality of VAP.	<p><u>VAP incidence rate</u> ICU VAP incidence rate was higher in hospitals with high physician-to-bed ratio (<math>\beta = 0.586</math> (0.331,0.84), <math>p &lt; 0.0001</math>) and patients-to-physician ratio (<math>\beta = 0.007</math> (0.006,0.007), <math>p &lt; 0.0001</math>).</p> <p><u>VAP mortality</u> Physician-to-bed ratio and patients-to-physician ratio were not significantly associated with VAP mortality.</p>
Gershengorn, 2017	<p>Retrospective cohort study using data on admissions to adult general critical care units in the United Kingdom participating in the Intensive Care National Audit and Research Centre (ICNARC) Case Mix Programme (CMP), linked with data from 2 staffing surveys.</p> <p>The cohort included participating ICUs from January 1, 2010, through December 31, 2013; 49,686 adults in 94 ICUs.</p>	Patient-intensivist-ratio (PIR): For the primary analysis, we calculated the PIR for a given patient as the total number of patients cared for by the intensivist for all or any portion of daytime hours, averaged over the patient's ICU stay. For example, if 10 patients were in the ICU at 8:00 AM, of whom 2 were discharged prior to 3:59 PM and 3 new patients were admitted during the daytime (8:00 AM-3:59 PM), the PIR would be 13 (the initial 10 plus the 3 admitted) for that day. All patients, including readmissions, were included for this calculation. This	We used multivariable, mixed-effect logistic regression to assess the association of patient-level PIR and mortality. All listed patient, ICU, and hospital variables were included as covariates with clustering within ICUs, except ICU bed number owing to collinearity with PIR.	<p><u>Ultimate hospital mortality</u> After multivariable adjustment, the PIR for each patient was significantly associated with ultimate hospital mortality (<math>P = .003</math>). This relationship was U-shaped with the lowest mortality at a nadir PIR of 7.5 and significantly higher mortality when the PIR was lower or higher than this value.</p> <p><u>Ultimate ICU mortality</u> nadir PIR of 7.8; <math>P &lt; .001</math></p> <p><u>Original ICU mortality</u> nadir PIR of 7.8; <math>P &lt; .001</math></p> <p><u>Original hospital mortality (from original acute hospital housing original ICU)</u> nadir PIR of 7.6; <math>P = .006</math></p>

		definition aimed to reflect the average overall patient workload for the intensivist, during daytime hours, over the duration of stay for a given patient.		
Gershengorn, 2022	Retrospective study of adult admissions to ICUs (August 2016–June 2018) in Australia and New Zealand, using two cohorts: “narrow”, based on previously used criteria including restriction to ICUs with a single daytime intensivist (27,380 complete cases in 67 ICUs); and “broad”, refined by individual ICU daytime staffing information (91,206 complete cases in 73 ICUs).	Patient-to-intensivist ratio (PIR): daytime average PIR, calculated as the number of all patients (including the index patient and any patients excluded due to cohort restrictions) in the ICU during daytime hours divided by the number of daytime intensivists. For the narrow cohort, daytime hours were defined as 8 a.m.–4 p.m. For the broad cohort, each ICU’s daytime hours were assigned as the interval during which at least one intensivist was continuously present onsite (up to 24 h for ICUs with continuous 24 h onsite coverage). Daily values were averaged over each patient’s ICU stay to determine their exposure.	Multilevel multivariable logistic regression models were used to assess the association of PIR with mortality. In each, PIR was modeled using restricted cubic splines to allow for non-linear associations. The broad cohort model included non-PIR physician and non-physician staffing covariables	<p><u>Mortality:</u></p> <p><i>Narrow cohort</i> Median average PIR (the median value of PIR averaged over all days) was 10.1 (IQR 7–14, full range of 0–53.5). Hospital mortality was 6.1%.</p> <p>There was no association of average PIR with hospital mortality in this cohort using mixed effects logistic regression modeling (PIR 1st spline term odds ratio [95% CI]: 1 [0.94, 1.06], Wald testing of all spline terms <math>p=0.61</math>).</p> <p><i>Broad cohort</i> Median average PIR was 7.8 (IQR 5.8–10.2, full range 0–56. Hospital mortality was 8.5%.</p> <p>Model 3 differed significantly from Models 1 and 2 (likelihood ratio Model 1 nested in Model 2, <math>p=0.28</math>; Model 2 in Model 3, <math>p=0.001</math>; Model 1 in Model 3, <math>p=0.004</math>). However, we found no association between average PIR and hospital mortality in any of the models (Wald testing for association of average PIR with mortality—Model 1, <math>p=0.91</math>; Model 2, <math>p=0.58</math>; Model 3, <math>p=0.4</math>). Given the null association, we did not assess whether PIR coefficients changed significantly from Models 1 to 3. There was a</p>

				significant interaction between the 23 staffing covariables and average PIR ( $p < 0.001$ ); however, no association was found between average PIR and hospital mortality in any staffing subgroup where models converged. Similarly, no association was found between average PIR and mortality across patient and ICU subgroups. Finally, no association was found in any of the sensitivity analyses.
Kahn, 2023	<p>Retrospective cohort study of intensivist-to-patient ratios in 29 ICUs in 10 hospitals in the United States from 2018 to 2020.</p> <p>Data were obtained from an ongoing EHR-based registry of ICU patients; The final analysis included 51,656 patients, 210,698 patient days, and 248 intensivist physicians.</p>	The primary exposure variable was the daily intensivist caseload expressed as a count. This variable was created at the level of the patient day and reflected the total number of patients seen by that intensivist (including the index patient) on that day, prior to all patient exclusions.	<p>A multivariable proportional hazards model with time varying covariates was fitted to estimate the relationship between the daily intensivist-to-patient ratio and ICU mortality at 28 days.</p> <p>To control for potential confounding, we defined several additional variables at the level of either the patient or the patient day. Variables defined at the patient level included age, gender, ICU admission source (emergency department, operating room, procedure unit, intermediate care unit, ward, or other), and comorbidities derived from ICD-10 diagnosis codes in the manner of Elixhauser. Variables defined at the level of the patient day included severity of illness (using the highest SOFA score on that day), an indicator for whether or not the patient received mechanical ventilation on that day, a count of new admissions on that day, and an indicator for whether a physician-in-training, a physician assistant, or a nurse practitioner was involved in the patient's care on that day, determined from meta-data in the clinical notes.</p>	<p><u>ICU mortality (28 days):</u></p> <p>There was no association between the intensivist-to-patient ratio and mortality (hazard ratio for each additional patient: 0.987, 95% confidence interval: 0.968–1.007, <math>p = 0.2</math>).</p> <p>This relationship persisted when we defined the ratio as caseload over the sample-wide average (hazard ratio: 0.907, 95% confidence interval: 0.763–1.077, <math>p = 0.26</math>) and cumulative days with a caseload over the sample-wide average (hazard ratio: 0.991, 95% confidence interval: 0.966–1.018, <math>p = 0.52</math>). The relationship was not modified by the presence of physicians-in-training, nurse practitioners, and physician assistants (<math>p</math> value for interaction term: 0.14).</p>

### Level of evidence of the literature

The level of evidence regarding the outcome measures mortality (ICU, hospital), length of (ICU, hospital) stay, morbidity, ICU readmission, patient satisfaction could not be graded due to the explorative nature of the studies.

### **Conclusions**

<b>No GRADE</b>	No evidence was found regarding the effect of intensivist-to-patient ratio on mortality (ICU, hospital), length of (ICU, hospital) stay, morbidity, ICU readmission, patient satisfaction in critically ill patients in the ICU.  <i>Source: -</i>
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### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoorde lijken voor acties <sup>3</sup>	Overige opmerkingen
<p>De formatie intensivisten is minimaal 0,45 fte per operationeel IC bed (gemiddeld per jaar). Het minimale aantal fte intensivisten bedraagt 4,5. Bij een IC met meer locaties is voor elke locatie deze minimale formatie nodig, dus voor een IC met twee locaties is de minimale formatie 9,0 fte. Taken die zijn meegenomen in de minimale formatie zijn:</p> <ul style="list-style-type: none"> <li>• Klinisch onderwijs;</li> <li>• Kwaliteitsbeleid;</li> <li>• IC-consulten;</li> </ul>	<1 jaar	<p>Uit de data van de NICE, de enquête die de werkgroep heeft gedaan onder ongeveer een kwart van de intensive care afdelingen in Nederland, en uit visitatiegegevens blijkt dat de formatie intensivisten op dit moment ook al rond de 0,5 fte per IC bed is.</p> <p>De werkgroep heeft er ook voor gekozen om de aanbeveling ten aanzien van arts-assistenten en PA's niet te vertalen naar een aantal fte per bed, maar uit te drukken in span of control. Dat betekent dat een arts-assistent en PA overdag een span of control heeft van 6 patiënten, in de avonddienst 9 en in de nachtdienst 12 patiënten. In de praktijk werkt dit uit tot een formatie van 0,6-1,0</p>	-	ziekenhuizen	-	Raad van bestuur	-

<ul style="list-style-type: none"> <li>• Spoed Interventie Team;</li> <li>• Peri-operatief MDO voor risico hoog patiënten.</li> </ul> <p>Met één of meerdere van de volgende aanvullende taken kan de minimaal benodigde formatie stijgen van 0,45 naar 0,55 fte per operationeel IC bed of van 4,5 fte naar 5,0 fte minimaal. Deze taken kunnen zijn (niet exclusief):</p> <ul style="list-style-type: none"> <li>• Reanimatieteam;</li> <li>• MICU en spoed transport;</li> <li>• Nazorg(poli);</li> <li>• (Interdisciplinaire) wetenschap;</li> <li>• Opleiding;</li> <li>• Regio- en/ of ziekenhuisactiviteiten;</li> <li>• Informatietechnologie &amp; PDMS-onderhoud;</li> <li>• Management taken.</li> </ul>		<p>fte per bed. Dat komt min of meer overeen met de huidige richtlijn, behalve voor de hele kleine intensive care afdelingen.</p> <p>Al met al is de werkgroep van mening dat de personele kosten met de nieuwe formatie gelijk zullen blijven of hooguit in een enkel geval iets toe zullen nemen.</p>					
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<p>De minimale formatie IC-voorwachten is 0,6 fte per operationeel bed (gemiddeld per jaar). Indien er geen of te weinig IC-voorwachten zijn, dan dient de formatie ruimte die hierdoor ontstaat, ten goede te komen aan de formatie intensivisten.</p>							
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### Table of excluded studies

Reference	Reason for exclusion
Durbin CG Jr. Team model: advocating for the optimal method of care delivery in the intensive care unit. Crit Care Med. 2006 Mar;34(3 Suppl):S12-7. doi: 10.1097/01.CCM.0000199985.72497.D1. PMID: 16477198.	Nonexhaustive, selective literature search
Gershengorn HB, Garland A. Who Should Be at the Bedside 24/7: Doctors, Families, Nurses? Semin Respir Crit Care Med. 2016 Feb;37(1):107-18. doi: 10.1055/s-0035-1570350. Epub 2016 Jan 28. PMID: 26820278.	No systematic literature search conducted
Halm M. The Influence of Appropriate Staffing and Healthy Work Environments on Patient and Nurse Outcomes. Am J Crit Care. 2019 Mar;28(2):152-156. doi: 10.4037/ajcc2019938. PMID: 30824521.	No systematic literature search conducted, not restricted to ICU settings
Kahn JM, Brake H, Steinberg KP. Intensivist physician staffing and the process of care in academic medical centres. Qual Saf Health Care. 2007 Oct;16(5):329-33. doi: 10.1136/qshc.2007.022376. PMID: 17913772; PMCID: PMC2464974.	Wrong comparison (high vs low intensity, no ratios)
Pronovost PJ, Angus DC, Dorman T, Robinson KA, Dremsizov TT, Young TL. Physician staffing patterns and clinical outcomes in critically ill patients: a systematic review. JAMA. 2002 Nov 6;288(17):2151-62. doi: 10.1001/jama.288.17.2151. PMID: 12413375.	Wrong comparison (no intensivist ratios)
Verburg IWM, Holman R, Dongelmans D, de Jonge E, de Keizer NF. Is patient length of stay associated with intensive care unit characteristics? J Crit Care. 2018 Feb;43:114-121. doi: 10.1016/j.jcrc.2017.08.014. Epub 2017 Aug 10. PMID: 28865340.	Wrong comparison (no intensivist-to-patient ratio)

### Literature search strategy

#### Zoekverantwoording

#### Algemene informatie

Cluster/richtlijn: NVIC – herziening leidraad organisatie van de intensive care	
Uitgangsvraag/modules: Wat is de benodigde formatie intensivisten, verpleegkundigen op de IC	
Database(s): Embase.com, Ovid/Medline, Cinahl	Datum: 25-10-2023
Periode: vanaf 2000	Talen: geen restrictie

#### Zoekopbrengst

	EMBASE	OVID/MEDLINE	CINAHL	Ontdubbeld
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SR	103	70	85	128
RCT	297	190	545	844
Observationele studies	715	593	382	995
<b>Totaal</b>	<b>1115</b>	<b>853</b>	<b>1012</b>	<b>*2021</b>

*\*in Rayyan*

### Zoekstrategie

#### Embase.com

No.	Query	Results
#1	'intensive care'/de OR 'intensive care unit'/exp OR 'artificial feeding'/exp OR 'artificial ventilation'/exp OR 'early goal-directed therapy'/exp OR 'sepsis'/exp OR 'acute respiratory failure'/exp OR 'respiratory tract intubation'/exp OR (((intensive OR critical OR medium) NEAR/2 care):ti,ab,kw) OR 'critically ill':ti,ab,kw OR 'acutely ill':ti,ab,kw OR weaning:ti,kw OR (((mechanical* OR artificial) NEAR/2 ventilat*):ti,ab,kw)	1164410
#2	(((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) NEAR/3 staffing):ti,ab,kw) OR 'workforce optimiz*':ti,ab,kw	4618
#3	((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) NEAR/4 ratio*):ti,ab,kw	7291
#4	'personnel management'/exp OR 'intensivist model*':ti,ab,kw	101164
#5	#2 OR #3 OR #4	109681
#6	#1 AND #5	4792
#7	#6 AND [2000-2023]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp) NOT (('adolescent'/exp OR 'child'/exp OR adolescent*:ti,ab,kw OR child*:ti,ab,kw OR schoolchild*:ti,ab,kw OR infant*:ti,ab,kw OR girl*:ti,ab,kw OR boy*:ti,ab,kw OR teen:ti,ab,kw OR teens:ti,ab,kw OR teenager*:ti,ab,kw OR youth*:ti,ab,kw OR pediatr*:ti,ab,kw OR paediatr*:ti,ab,kw OR puber*:ti,ab,kw) NOT ('adult'/exp OR 'aged'/exp OR 'middle aged'/exp OR adult*:ti,ab,kw OR man:ti,ab,kw OR men:ti,ab,kw OR woman:ti,ab,kw OR women:ti,ab,kw))	2355
#8	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND	969137

	'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab) OR metasyntes*:ti,ab OR 'meta syntes*':ti,ab	
#9	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3891996
#10	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	7880253
#11	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*':ti,ab,kw OR cross?ectional*:ti,ab,kw OR multicent*:ti,ab,kw OR 'multi-	14491257

	cent*':ti,ab,kw OR consecutive*':ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*':ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*':ti,ab,kw OR 'odds ratio*':ab OR 'relative odds':ab OR 'risk ratio*':ab OR 'relative risk*':ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (((('or' OR 'rr') NEAR/6 ci):ab)))	
#12	#7 AND #8 <b>SR</b>	103
#13	#7 AND #9 NOT #12 <b>Clinical trials</b>	297
#14	#7 AND (#10 OR #11) NOT #12 NOT #13 <b>Observationeel</b>	715
#15	#12 OR #13 OR #14	1115
#16	'intensivist physician-to-patient ratios and mortality in the intensive care unit'	1
#17	'patient mortality is associated with staff resources and workload in the icu: a multicenter observational study'	1
#18	'physician staffing patterns' AND pronovost	1
#19	'the effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units'	1
#20	#16 OR #17 OR #18 OR #19	4
#21	#15 AND #20 <b>sleutelartikelen gevonden</b>	4

## Ovid/Medline

#	Searches	Results
1	Critical Care/ or Critical Illness/ or Early Goal-Directed Therapy/ or exp Intensive Care Units/ or exp Sepsis/ or exp Respiratory Distress Syndrome/ or exp Respiration, Artificial/ or exp Intubation, Intratracheal/ or Ventilator Weaning/ or weaning.ti,ab,kf. or (((intensive or critical) adj2 care).ti,ab,kf. or critically ill.ti,ab,kf. or acutely ill.ti,ab,kf. or (mechanical*or artificial adj2 ventilat*).ti,ab,kf. or intubat*.ti,ab,kf.	628796
2	"Personnel Staffing and Scheduling"/ or intensivist model*.ti,ab,kf. or (((intensivist* or physician* or nurs* or staff* or specialist* or workforce or workload) adj4 ratio*).ti,ab,kf. or ((optim* or intensivist* or physician* or nurse* or specialist* or workforce or requirement* or necessit* or demand* or obligation* or personnel) adj3 staffing).ti,ab,kf. or 'workforce optimiz*'.ti,ab,kf.	24838
3	1 and 2	2337
4	limit 3 to yr="2000 -Current"	1917
5	4 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/) not ((Adolescent/ or Child/ or Infant/ or adolescen*.ti,ab,kf. or child*.ti,ab,kf. or schoolchild*.ti,ab,kf. or infant*.ti,ab,kf. or girl*.ti,ab,kf. or boy*.ti,ab,kf. or teen.ti,ab,kf. or teens.ti,ab,kf. or teenager*.ti,ab,kf. or youth*.ti,ab,kf. or pediater*.ti,ab,kf. or paediatr*.ti,ab,kf. or puber*.ti,ab,kf.) not (Adult/ or adult*.ti,ab,kf. or man.ti,ab,kf. or men.ti,ab,kf. or woman.ti,ab,kf. or women.ti,ab,kf.))	1499
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or	701576

	prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or data-base*).ti,ab,kf. or (("data extraction" or "data source") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	
7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2646742
8	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4561054
9	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or	5538148

	observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multicent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or ('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or ("OR" or "RR") adj6 CI).ab.))	
10	5 and 6 <b>SR</b>	70
11	(5 and 7) not 10 <b>Clinical trials</b>	190
12	(5 and (8 or 9)) not 10 not 11 <b>OBS</b>	593
13	10 or 11 or 12	853

## Cinahl

#	Query	Results
S1	(MH "Intensive Care Units+") OR (MH "Critical Care Nursing+") OR (MH "Critical Care+") OR TI ("critical care" OR "intensive care) OR AB ("critical care" OR "intensive care)	117,581
S2	(MH "Personnel Staffing and Scheduling+") OR TI (((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) N3 staffing) OR "workforce optimiz*" OR ((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) N4 ratio*) OR "intensivist model*") OR AB (((optim* OR intensivist* OR physician* OR nurse* OR specialist* OR workforce OR requirement* OR necessit* OR demand* OR obligation* OR personnel) N3 staffing) OR "workforce optimiz*" OR ((intensivist* OR physician* OR nurs* OR staff* OR specialist* OR workforce OR workload) N4 ratio*) OR "intensivist model*")	39,468
S3	S1 AND S2	2,133
S4	S3 NOT ((MH ("Adolescence" OR "Child+") OR TI (adolescen* OR child* OR schoolchild* OR infant* OR girl* OR boy* OR teen OR teens OR teenager* OR youth* OR pediater* OR paediatr* OR puber*) OR AB (adolescen* OR child* OR schoolchild* OR infant* OR girl* OR boy* OR teen OR teens OR teenager* OR youth* OR pediater* OR paediatr* OR puber*)) NOT (MH ("Adult+") OR TI (adult* OR man OR men OR woman OR women) OR AB (adult* OR man OR men OR woman OR women)))	1,872
S5	(MH "Meta Analysis") or TX (meta-analy* or metanaly* or metaanaly* or meta analy*) or TX (systematic* N5 review*) or (evidence* N5 review*) or (methodol* N5 review*) or (quantitativ* N5 review*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*)	319,039

	or (quantitativ* N5 overview*) or TX (systematic* N5 survey*) or (evidence* N5 survey*) or (methodol* N5 survey*) or (quantitativ* N5 survey*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (pool* N2 data) or (combined N2 data) or (combining N2 data) or (pool* N2 trials) or (combined N2 trials) or (combining N2 trials) or (pool* N2 studies) or (combined N2 studies) or (combining N2 studies) or (pool* N2 results) or (combined N2 results) or (combining N2 results)	
S6	(MH "Clinical Trials+") OR (PT (Clinical trial)) OR (MH "Random Assignment") OR (MH "Quantitative Studies") OR (TX ((clini* N1 trial*) OR (singl* N1 blind*) OR (singl* N1 mask*) OR (doubl* N1 blind*) OR (doubl* N1 mask*) OR (tripl* N1 blind*) OR (tripl* N1 mask*) OR (random* N1 allocat*) OR placebo* OR ((waitlist* OR (wait* and list*)) and (control* OR group)) OR "treatment as usual" OR tau OR (control* N3 (trial* OR study OR studies OR group*)) OR randomized OR randomised))	1,985,979
S7	(MH "Case Control Studies+") OR (MH "Case Studies") OR (MH "Cross Sectional Studies") OR (MH "Prospective Studies+") OR (MH "Retrospective Panel Studies") OR (MH "Correlational Studies") OR TI "case control" OR TI "case referent" OR AB "case referent*" OR TI "case stud*" OR AB "case stud*" OR TI "case series" OR AB "case series" OR TI cohort* OR AB cohort* OR TI "cross sectional" OR AB "cross sectional" OR TI "follow up" OR AB "follow up" OR TI longitudinal OR AB longitudinal OR TI retrospective* OR AB retrospective* OR TI prospective* OR AB prospective* OR TI observational OR AB observational OR TI "Controlled before and after" OR AB "Controlled before and after" OR TI "Interrupted time series" OR AB "Interrupted time series" OR TI Correlational OR AB Correlational	1,570,792
S8	S4 AND S5 <b>SR</b>	85
S9	S4 AND S6 NOT S8 <b>Clinical trials</b>	545
S10	S4 AND S7 NOT S8 NOT S9 <b>OBS</b>	382
S1	S8 OR S9 OR S10	1012

## **Bijlage - Module 3.3 Aanrijtijd intensivist**

### **Onderbouwing**

#### Methode

De overwegingen en aanbevelingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, op basis van de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

Uit de literatuuranalyse in de kwaliteitsstandaard uit 2016 bleek dat bij een voldoende intensivistenbezetting binnen kantooruren, aanwezigheid van een intensivist in de nacht geen eenduidig effect had op de opnameduur en mortaliteit. Een voordeel van nachtelijke aanwezigheid van een intensivist werd gezien in de snelheid waarmee besluitvorming en beleidsbepaling plaats vond, een nadeel in de toename van kosten en overbelasting van intensivisten.

Sinds de publicatie van de vorige richtlijn is een aantal artikelen verschenen die de aanwezigheid van intensivisten 24/7 tegen het licht houden.

#### Resultaten

In een in 2016 gepubliceerde voor/na interventie trial werd het effect onderzocht van 24/7 aanwezigheid van intensivisten op het aantal urineweginfecties, centrale lijn infecties en VAP's (ventilator geassocieerde pneumonieën). Er werd geen verschil gevonden in het voorkomen van de genoemde infecties of IC-opnameduur (Geva, 2017).

In 2019 werd op een medisch-chirurgische IC en cardiale IC van een academisch ziekenhuis met in totaal 42 bedden, een retrospectieve, single centrum studie verricht naar het effect van de nachtelijke aanwezigheid van intensivisten. Het betreft hier wederom een voor/na interventie trial. In totaal werden in 2 jaar tijd meer dan 5000 patiënten opgenomen: 2100 voor invoering van 24/7 aanwezigheid van intensivisten en 2900 na invoering van 24/7 aanwezigheid van intensivisten. Er werd geen verschil gezien in mortaliteit, opnameduur (zowel intensive care als ziekenhuis) en beademingsduur (Ramakrishnan, 2019).

Een grote meta-analyse uit 2018 welke het tijdstip van IC-opname relateerde aan de mortaliteit vond dat opnames op doordeweekse avonden en nachten niet gepaard gingen met een hogere mortaliteit in vergelijking met opname binnen kantooruren. Opnames op weekenddagen gingen gepaard met een hogere mortaliteit. Dit laatste was minder uitgesproken als er sprake was van 24/7 aanwezigheid van intensivisten in het weekend (Galloway, 2018).

In 2017 werd een survey interview verricht met 13 nachtdienst draaiende IC-verpleegkundige op een academisch medische IC. Ze rapporteerden allen een door hen ervaren betere en snellere besluitvorming, efficiëntie en communicatie met de nachtelijke aanwezigheid van een intensivist (Stanton, 2017).

Een tweetal studies hebben zich specifiek gericht op post-cardiochirurgie patiënten. Post cardiochirurgie patiënten hebben een postoperatief beloop dat mogelijk vaker gekenmerkt

wordt door hemodynamische instabiliteit in de nachtelijke uren. Onderzoekers suggereren dat juist deze groep daarom baat heeft bij 24/7 aanwezigheid van een intensivist (Benoit, 2017).

In 2018 vond een single center voor/na studie plaats welke 1509 post cardiochirurgie patiënten met 24/7 intensivisten vergeleek met nachtelijk niet in huis intensivisten en vond een lagere incidentie van majeure complicaties, kortere ventilatie duur en minder heropnames (Lane-Fall, 2017).

Daarentegen vond een andere studie uit 2018 met 43 cardiochirurgische IC's geen relatie tussen mortaliteit of betere zorg ervaren door IC-verpleegkundige en de aanwezigheid van intensivisten in de nacht (Galloway, 2018; Stanton, 2017).

In de zoektocht naar een zo optimaal mogelijke bezetting van de IC door artsen gedurende de avond-/nachten is in 2020 onderzoek gedaan naar de aanwezigheid van een "nocturnist". Dat is een dokter die extra vaardigheden heeft in luchtwegmanagement en inbrengen van centraal veneuze katheters, maar geen intensivist betreft. Deze dokter heeft dienst naast de op afstand aanwezige intensivist gedurende de nacht. Dit is grotendeels vergelijkbaar met de Nederlandse situatie waarin een arts-assistent op IC beschikbaar is. Uit deze single center voor/na studie blijkt de aanwezigheid van deze "nocturnist" de mortaliteit en opname duur op de IC te verminderen (Tanios, 2020).

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
<p>Zorg ervoor dat de aanrijtijd van een intensivist, die niet in het ziekenhuis is buiten kantooruren, maximaal 30 minuten is. De aanrijtijd is gedefinieerd als de tijd die verstrijkt tussen de oproep om naar het ziekenhuis te komen en het daadwerkelijk aanwezig zijn bij de patiënt. Voor ziekenhuis locaties zonder een IC-afdeling kunnen naar lokaal inzicht en oordeel andere afspraken gemaakt worden, zolang de opvang voor de vitaal bedreigde patiënt maar goed geregeld is.</p> <p>Bepaal op lokaal niveau of een kortere aanrijdtijd dan 30 minuten nodig wordt geacht, rekening houdend met het type IC,</p>	<1 jaar	minimaal	Indien de intensivist in huis moet blijven als gevolg van het niet meer kunnen voldoen aan de aanrijtijd ten gevolge van aanpassing in het zorgbeleidsplan van de aanrijtijd op basis van deze kwaliteitsstandaard, dienen deze uren te worden aangemerkt als zijnde een aanwezigheidsdienst.	Organisatorisch op het niveau van het ziekenhuis Professionals Benodigde uitbreiding formatie vakgroep intensive care incl loonkosten	Informereren ziekenhuis bestuurders Informereren beroepsgroep Eventueel aanpassen individuele contracten intensivisten die vallen onder de AMS. Eventueel aanpassen samenwerkingsovereenkomst vakgroep intensive care en raad van bestuur	Ziekenhuisbestuurders, medisch en bedrijfskundig manager van de desbetreffende afdeling, beroepsvereniging	

personele bezetting en het type patiënten liggend op de IC.							
Zorg dat er altijd binnen 5 minuten tenminste een FCCS/ICF of gelijkwaardig geschoolde IC-voorwacht, SEH-arts KNMG, anesthesioloog of intensivist aanwezig kan zijn bij de patiënt.	<1 jaar	geen	geen	Geen	geen	geen	

## Bijlage - Module 4.1 MDO en perioperatieve MDO

### Onderbouwing

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, gebaseerd op een interpretatie van de werkgroep van de internationale literatuur. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, op basis van de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet systematisch literatuuronderzoek.

#### Resultaten

##### *1. Hoe dient het MDO te worden vormgegeven?*

Intensive Care geneeskunde is gezien de ernst en meervoudige aard van de problematiek een multidisciplinair vak bij uitstek. Afstemming van multidisciplinaire zorg vereist een dagelijks multidisciplinair overleg. Hoe deze besprekingen vorm te geven is onderhevig aan meerdere factoren die voor een belangrijk deel afhankelijk zijn van de lokale context. Literatuur omtrent multidisciplinair overleg of interdisciplinair overleg is niet eenduidig te interpreteren vanwege meerdere factoren. De beschreven situatie is vaak niet vergelijkbaar met de Nederlandse situatie en studies onderzoeken vaak meerdere facetten van samenwerken tegelijkertijd. Ook is het nogal eens onduidelijk omschreven hoe interdisciplinair werken is vormgegeven en hoe de kwaliteit hiervan is geborgd. Enkele studies laten positieve associaties zien op mortaliteit of IC-ligduur, maar de forse heterogeniteit in methodologie (frequentie, deelnemers en bedside/niet bedside) maakt een eenduidige interpretatie voor de Nederlandse situatie onmogelijk (Kim, 2010; Reader, 2009; Watanabe, 2023). Desalniettemin kan het multidisciplinair werken positieve effecten hebben op andere uitkomsten, zoals sneller inzetten van revalidatie en dus sneller herstel, passender medicijn gebruik en kosteneffectieve inzet van diagnostiek en/of behandelingen (Donovan, 2018; Young, 1998). Er zijn wel aanwijzingen dat in de Nederlandse situatie de aanwezigheid van een ziekenhuisapotheker en arts-microbioloog tijdens het MDO een positieve bijdrage oplevert (Janssen, 2023; Klopotoska, 2010; Leape, 1999). Er is geen literatuur over de betrokkenheid van poortspecialismen bij het MDO. Daarbij kan een dagelijks MDO ook een positieve uitwerking hebben op de algemene samenwerking en werkplezier (Reader, 2009). Dit geldt met name voor de samenwerking tussen IC-artsen en IC-verpleegkundigen, maar ook voor de samenwerking met (para)medici buiten de IC-afdeling.

Voor een effectieve multidisciplinaire samenwerking zijn enkele voorwaarden vereist, zoals medisch leiderschap en organisatiestructuren die functioneel overleg faciliteren (Ervin, 2018; Ten Have, 2013). Hierin zijn geen algemene aanbevelingen te doen, omdat dit per ziekenhuis en samenstelling van vakgroepen kan verschillen. De werkgroep acht het belangrijk dat de kwaliteit en effectiviteit van patiëntenbesprekingen op regelmatige basis geëvalueerd wordt en zo nodig wordt verbeterd.

##### *2. Hoe dient het perioperatieve MDO voor electieve patiënten te worden vormgegeven?*

Ook de perioperatieve zorg kan profiteren van het multidisciplinair samenwerken. Hier is literatuur te vinden die ook specifiek de Nederlandse praktijk bestudeert (van der Vlies, 2020; Vernooij, 2021; Verwijmeren, 2020; Wegdam, 2023). Voor de invulling van het perioperatieve MDO wordt naar de Leidraad Perioperatieve Zorg (2024) van de Nederlandse Vereniging van Anesthesiologie verwezen.

Aanvullend op deze leidraad geldt dat een intensivist voor hoog-risicopatiënten een toegevoegde waarde kan hebben, door de specifieke kennis van de intensivist op brede

vlakken van de geneeskunde en ervaring met ernstige complicaties van operatieve behandelingen. In dat kader is het wenselijk dat een intensivist participeert in preoperatieve besprekingen. De verantwoordelijkheid of een patiënt in een hoog-risico bespreking in aanwezigheid van een intensivist besproken moet worden, ligt primair bij de anesthesioloog en/of de operateur.

Als in de preoperatieve beoordeling voor een patiënt een postoperatieve IC-opname wordt gepland, dient hierbij een intensivist betrokken te zijn. Bij patiënten die protocollair worden opgenomen op de IC, kan dat middels betrokkenheid bij vaststelling van het protocol binnen lokale afspraken.

Een bespreking op het perioperatieve MDO van hoog-risico patiënten biedt ook de kans om een goede inschatting te krijgen van de pre-existente functionele status. Daarmee biedt het een ingang voor het bespreken van behandelbeperkingen (eventueel pas bij complicaties) met patiënten op een planbaar moment. In een perioperatief MDO dient dit dan ook ter sprake te komen, opdat de regiebehandelaar dit met de patiënt kan bespreken. Het regelmatig georganiseerde perioperatieve MDO is primair bedoeld voor electieve operaties, voor acute operaties verdient een *ad hoc* bespreking aanbeveling en is noodzakelijk voor patiënten die postoperatief op IC opgenomen worden.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie : < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
<p><b>Algemeen MDO ten behoeve van de IC-patiënt</b> Organiseer een geformaliseerd, dagelijks MDO met actieve participatie van intensivisten, IC-voorwachten, IC-verpleegkundigen en andere relevante medisch specialisten en zorgprofessionals.</p> <p>Bij fysieke afwezigheid van medebehandelaars bij het MDO dient een andere vorm van contact te worden geborgd.</p> <p>De invulling van het MDO heeft als uitgangspunt dat iedere patiënt de aandacht</p>	<1 jaar	Geen	Geen	Geen	Geen	Geen	Geen

<p>krijgt die voor de patiënt op die dag noodzakelijk is. Dit kan betekenen dat niet alle IC-patiënten dagelijks worden besproken.</p> <p>Documenteer de inhoudelijke punten van de bespreking in het patiëntendossier.</p> <p>In het weekend kan het MDO indien nodig <i>ad hoc</i> georganiseerd worden, zolang aan het uitgangspunt voldaan wordt dat iedere patiënt de aandacht krijgt die voor de patiënt op die dag noodzakelijk is.</p> <p>Betrek dagelijks een arts-microbioloog bij het MDO.</p> <p>Betrek op regelmatige basis een ziekenhuisapotheker bij het MDO, waarbij dit tenminste twee keer per week is én dat de input geborgd blijft op dagen waarbij de</p>							
--	--	--	--	--	--	--	--

<p>ziekenhuisapotheker niet aanwezig is bij het MDO.</p> <p>Betrek medebehandelaars in het MDO als dat noodzakelijk wordt geacht door de intensivist of door de betreffende medebehandelaar.</p> <p>Geef de communicatie dusdanig vorm, dat iedereen inbreng kan geven.</p> <p>Overweeg een toegankelijke locatie te kiezen die voor iedereen gemakkelijk bereikbaar is, of maak gebruik van digitale mogelijkheden om deelname te vergemakkelijken</p> <p>Evalueer het MDO 3-jaarlijks met de belanghebbenden.</p>							
<p><b>Peri-operatief MDO</b> Een intensivist dient beschikbaar te zijn voor het geplande perioperatief MDO voor electieve hoog-risico</p>	1-3 jaar	Geen	Vakgroepen moeten meedoen	Geen	Opzetten perioperatieve MDO	Vakgroepen Anesthesiologie, Intensive Care en operateurs	Geen

<p>patiënten. Bij het geplande perioperatieve MDO zijn dan tenminste een anesthesioloog en de snijvend specialist aanwezig.</p> <p>De anesthesioloog is primair verantwoordelijk voor de inschatting of bij een bepaalde patiënt een bespreking op het perioperatieve MDO nodig is.</p> <p>Als preoperatief voor een patiënt een postoperatieve IC-opname wordt gepland (zowel acuut als electief), dient hierbij een intensivist betrokken te zijn. Bij patiënten die protocollair worden opgenomen op de IC, kan dat middels betrokkenheid van een intensivist bij vaststelling van het protocol binnen lokale afspraken.</p> <p>Bespreek tijdens het perioperatieve MDO tenminste:</p>							
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<ul style="list-style-type: none"> <li>• of de voorgestelde behandeling de beste optie is;</li> <li>• of er een preoperatieve optimalisatie mogelijk is en in wat voor tijdsbestek dit kan gebeuren;</li> <li>• wat de functionele Ausgangssituatie is, zo mogelijk uitgedrukt in een <i>clinical frailty score</i>;</li> <li>• wat de beste chirurgische en anesthesiologische techniek is;</li> <li>• wat de beste postoperatieve locatie is;</li> <li>• of er behandelbeperkingen preoperatief of postoperatief dienen te worden ingesteld.</li> </ul> <p>Documenteer de inhoudelijke punten van de</p>							
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bespreking in het patiëntendossier.  Evalueer het peri-operatieve MDO 3-jaarlijks met de belanghebbenden.							
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## **Bijlage - Module 4.2 Communicatie**

### **Onderbouwing**

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie : < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
<p>Zorg er bij een dienst-overdracht voor:</p> <ul style="list-style-type: none"> <li>• Dat uitsluitend belangrijke informatie wordt overgedragen;</li> <li>• Dat er een mogelijkheid is om vragen te stellen;</li> <li>• Dat er voldoende tijd is om een effectieve overdracht af te ronden;</li> <li>• Dat eventuele schriftelijke hulpmiddelen zo min mogelijk informatie dienen te bevatten, om dubbele administratie en</li> </ul>	1-3 jaar	Geen	Er is lokaal een verbetering nodig	Geen	Geen	Beroepsvereniging	

<p>onbedoelde verspreiding van patiëntinformatie te minimaliseren.</p> <p>Voor het optimaliseren van de overdracht, overweeg:</p> <ul style="list-style-type: none"> <li>• Een overdrachtsstructuur te implementeren;</li> <li>• Een locatie te kiezen die de overdracht faciliteert, waarbij het bij de artsen waarschijnlijk een niet-<i>bedside</i> ruimte is, maar bij de verpleegkundigen juist <i>bedside</i>;</li> <li>• Interrupties te minimaliseren;</li> <li>• De aanwezigheid bij de overdracht te beperken;</li> </ul> <p>Scholing en training te geven over een</p>						
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overdracht, mede om de team-cultuur ten aanzien van de overdracht te verbeteren.							
<p>Zorg voor een dagelijkse visite waarbij:</p> <ul style="list-style-type: none"> <li>• Tenminste een IC-voorwacht en een IC-verpleegkundige actief participeren;</li> <li>• Dagelijkse behandeldoelen bij het afronden van de visite gezamenlijk worden geformuleerd en schriftelijk vastgelegd;</li> <li>• Overwogen wordt om gebruik te maken van een checklist;</li> <li>• Overwogen wordt om familie- of patiëntparticipatie toe te staan tijdens de visite, waarbij</li> </ul>	1-3 jaar	Geen	Er is lokaal een verbetering nodig	Geen	Geen	Beroepsvereniging	

bewaakt moet worden dat dit niet tot afleiding of een inadequate visite leidt.							
Train periodiek afdelingsbreed communicatie en <i>non-technical skills</i> .	>3 jaar	Toename van kosten		Beschikbare tijd, trainers en locatie.	Opleiden van trainers, tijd beschikbaar stellen	Ziekenhuisbestuurders	

## Bijlage - Module 4.3 Overplaatsing rondom IC-opname en IC-ontslag

### Onderbouwing

#### Methode

A systematic review of the literature was performed to answer the following questions:

1. Which possibilities exist to ensure that a transfer of an ICU patient to a general ward takes place with the fewest possible risks?

P: patients	Adult, critically ill patients being discharged from the ICU to a general ward
I: intervention	Structured handover (such as, but not limited to, electronic aids, face-to-face contact, transfer nurse, nurse consultation)
C: control	Unstructured handover or no intervention
O: outcome measure	Mortality, morbidity, readmission, resource use, medication errors, patient satisfaction, medical staff satisfaction

2. Which possibilities exist to ensure that a transfer of a patient from operating room (OR) to ICU takes place with the fewest possible risks?

P: patients	Adult, critically ill patients being discharged from the OR to ICU
I: intervention	Structured handover (such as, but not limited to, electronic aids, face-to-face contact, transfer nurse, nurse consultation)
C: control	Unstructured handover or no intervention
O: outcome measure	Mortality, morbidity, readmission, resource use, medication errors, patient satisfaction, medical staff satisfaction

#### Relevant outcome measures

The guideline development group considered morbidity, readmission, resource use, medication errors as a critical outcome measure for decision making; and mortality, patient satisfaction and medical staff satisfaction as an important outcome measure for decision making.

A priori, the working group did not define the outcome measures listed above but used the definitions that were used in the studies.

The working group defined the following differences as a minimal clinically (patient) important differences:

- Mortality:  $RR \leq 0.9$  and  $RR \geq 1$ .
- Morbidity:  $RR < 0.9$  and  $RR > 1.1$
- Readmission:  $RR < 0.9$  and  $RR > 1.1$
- Resource use:  $RR < 0.9$  and  $RR > 1.1$
- Medication errors:  $RR < 0.9$  and  $RR > 1.1$
- Patient satisfaction: 10% (10 points on a 100 points scale, 1 point on a 10 points scale)
- Medical staff satisfaction: 10% (10 points on a 100 points scale, 1 point on a 10 points scale)

#### Search and select (Methods)

The databases Medline (via OVID) and Embase (via Embase.com) were searched with relevant search terms until 24 October 2023. The detailed search strategy is depicted under the tab Methods. The systematic literature search resulted in 828 hits. Studies were selected based on the following criteria: systematic review (meta-analysis), RCTs or observational studies comparing structured handover with unstructured handover in adult, critically ill patients being transferred from ICU to a general ward or from operating room (OR) to ICU. In total, 66 studies were initially selected based on title and abstract screening. After reading the full text, 64 studies were excluded (see the table with reasons for exclusion under the tab Methods), and two studies were included.

## Results

A total of two studies were included in the analysis of the literature. One study included patients being transferred from ICU to a general ward, and one study included patients being transferred from OR to ICU. Important study characteristics and results are summarized in the evidence tables. The assessment of the risk of bias is summarized in the risk of bias tables.

### **Summary of literature**

#### Description of studies

##### 1. ICU to general ward

**Stelfox (2016)** performed a quasi-experimental study with an interrupted time series analysis to evaluate whether readmission to ICU and mortality among patients discharged alive from ICU changed after implementation of a critical care transition program. Adult patients discharged alive from eight medical-surgical ICUs in eight hospitals in two cities in Alberta, Canada, from January 1 2002 to January 1 2012 were eligible for inclusion. No exclusion criteria were reported in the study. In total, 32,234 patients were eligible. The patients in the intervention group (n=12,940) were discharged with the use of a critical care program, and the patients in the control group (n=19,294) were discharged without the use of a critical care program. The duration of the follow-up was at least 14 days. The study reported the following relevant outcome measures: mortality within 14 days, and ICU readmission within 72 hours.

##### 2. Operating room (OR) to ICU

**Qian (2023)** performed a randomized controlled trial to design a postoperative structured handover protocol for SICU and evaluate its impact on the quality of the transition. Patients aged  $\geq 18$  years and  $\leq 75$  years who were transferred to the SICU after surgery and clinicians participating in handover were eligible for trial participation. Exclusion criteria were absent members at any time during the handover, handover of two patients at the same time, interruption of handover: existing distraction of handover members' attention. In total, 101 patients were eligible and were randomized into two groups. The intervention group (n=51) carried out structured protocol with postoperative handover checklist, and the control group (n=50) carried out unstructured handover, without interference with the content and order of their handover. The duration of the follow-up was at least 28 days. The study reported the following relevant outcome measures: ICU mortality, 28-day mortality, readmissions to ICU,

satisfaction total score, observer's evaluation (overall quality), surgeon's evaluation (overall quality), and nurses' evaluation (overall quality).

## Results

### Comparison 1: ICU to general ward

#### **Mortality (important)**

Stelfox (2016) reported the outcome measure mortality within 14 days. In total, 3.4% of the patients (95% CI 2.8 to 4.0) whose discharge was carried out with the use of a critical care transition program died, compared with 4.2% of the patients (95% CI 3.5 to 4.9) whose discharge was carried out without the use of a critical care transition program. The RR was 0.81 (95% CI 0.72 to 0.91), in favor of the patients who were discharged with the use of a critical care transition program. This difference is considered clinically relevant.

#### **Morbidity (critical)**

None of the studies reported the outcome measure morbidity.

#### **Readmission (critical)**

Stelfox (2016) reported the outcome measure ICU readmission within 72 hours. In total, 3.6% of the patients (95% CI 2.7 to 4.5) whose discharge was carried out with the use of a critical care transition program were readmitted to the ICU within 72 hours, compared with 3.6% of the patients (95% CI 2.7 to 4.5) whose discharge was carried out without the use of a critical care transition program. The RR was 1 (95% CI 0.89 to 1.12), which means there was no difference between the two groups.

#### **Resource use (critical)**

None of the studies reported the outcome measure resource use.

#### **Medication errors (critical)**

None of the studies reported the outcome measure medication errors.

#### **Patient satisfaction (important)**

None of the studies reported the outcome measure patient satisfaction.

#### **Medical staff satisfaction (important)**

None of the studies reported the outcome measure medical staff satisfaction.

### Comparison 2: operating room (OR) to ICU

#### **Mortality (important)**

Qian (2023) reported the outcome measure ICU mortality. In total, 2 of the 51 patients (3.9%) whose discharge was carried out with a structured handover protocol died, compared to 4 of the 50 patients (8%) whose discharge was carried out with unstructured handover. The risk ratio (RR) was 0.49 (95% CI 0.09 to 2.56), and the risk difference (RD) was -0.04 (95%

CI -0.13 to 0.05), in favor of the patients who received structured handover. This difference is considered clinically relevant.

Qian (2023) reported the outcome measure 28-day mortality. In total, 4 of the 51 patients (7.8%) whose discharge was carried out with a structured handover protocol died, compared with 4 of the 50 patients (8%) whose discharge was carried out with unstructured handover. The RR was 0.98 (95% CI 0.26 to 3.71), and the RD was -0.00 (95% CI -0.11 to 0.10), in favor of the patients who received structured handover. This difference is not considered clinically relevant.

#### **Morbidity (critical)**

None of the studies reported the outcome measure morbidity.

#### **Readmission (critical)**

Qian (2023) reported the outcome measure ICU readmission. In total, 3 of the 51 patients (5.9%) whose discharge was carried out with a structured handover protocol were readmitted to the ICU, compared with 4 of the 50 patients (8%) whose discharge was carried out with unstructured handover. The RR was 0.74 (95% CI 0.17 to 3.12), and the RD was -0.02 (95% CI -0.12 to 0.08), in favor of the patients who received structured handover. This difference is considered clinically relevant.

#### **Resource use (critical)**

None of the studies reported the outcome measure resource use.

#### **Medication errors (critical)**

None of the studies reported the outcome measure medication errors.

#### **Patient satisfaction (important)**

Qian (2023) reported the outcome measure satisfaction total score (0-100). The patients whose discharge was carried out with a structured handover protocol (n=51) reported a mean satisfaction score of 81.24 (SD ± 6.95), compared with a mean satisfaction score of 76.44 (SD ± 7.32) reported by the patients who received unstructured handover (n=50). The mean difference was -4.80 (95% CI -7.58 to -2.02), in favor of the patients who received structured handover. This difference is not considered clinically relevant.

#### **Medical staff satisfaction (important)**

##### *Surgeon's evaluation*

Qian (2023) reported the outcome measure surgeon's evaluation (overall quality) (0-10). A mean surgeons' evaluation score of 7.47 (SD ± 1.01) was reported for the group of patients whose discharge was carried out with a structured handover protocol (n=51), compared with a mean surgeons' evaluation score of 7.28 (SD ± 1.01) for the patients who received unstructured handover (n=50). The mean difference was -0.19 (95% CI -0.58 to 0.20), in favor of the patients who received structured handover. This difference is not considered clinically relevant.

### *Nurses' evaluation*

Qian (2023) reported the outcome measure nurses' evaluation (overall quality) (0-10). A mean ICU nurses' evaluation score of 8.27 (SD  $\pm$  0.77) was reported for the group of patients whose discharge was carried out with a structured handover protocol (n=51), compared with a mean ICU nurses' evaluation score of 8.04 (SD  $\pm$  0.78) for the patients who received unstructured handover (n=50). The mean difference was -0.23 (95% CI -0.53 to 0.07), in favor of the patients who received structured handover. This difference is not considered clinically relevant.

### Level of evidence of the literature

#### 1. ICU to general ward

##### **Mortality**

The level of evidence regarding the outcome measure mortality was based on a quasi-experimental study and therefore starts high. The level of evidence was downgraded by two levels because of study limitations (risk of bias, -1), and because the confidence interval exceeds the lower level for clinical relevance (imprecision, -1). The level of evidence is therefore graded as low.

##### **Readmission**

The level of evidence regarding the outcome measure readmission was based on a quasi-experimental study and therefore starts high. The level of evidence was downgraded by three levels because of study limitations (risk of bias, -1), and because the confidence interval exceeds the upper and lower level for clinical relevance (imprecision, -2). The level of evidence is therefore graded as very low.

##### **Morbidity, Resource use, Medication errors, Patient satisfaction, Medical staff satisfaction**

The level of evidence could not be graded since the outcome measure was not reported in the study.

#### 2. OR to ICU

##### **Mortality**

The level of evidence regarding the outcome measure mortality was based on a RCT and therefore starts high. The level of evidence was downgraded by two levels because the confidence interval exceeds both the upper and the lower level for clinical relevance (imprecision, -3). The level of evidence is therefore graded as very low.

##### **Readmission**

The level of evidence regarding the outcome measure readmission was based on a RCT and therefore starts high. The level of evidence was downgraded by two levels because the confidence interval exceeds both the upper and the lower level for clinical relevance (imprecision, -3). The level of evidence is therefore graded as very low.

### Patient satisfaction

The level of evidence regarding the outcome measure patient satisfaction was based on a RCT and therefore starts high. The level of evidence was downgraded by two levels because of the small number of patients included in the study (imprecision, -2). The level of evidence is therefore graded as low.

### Medical staff satisfaction

The level of evidence regarding the outcome measure medical staff satisfaction was based on a RCT and therefore starts high. The level of evidence was downgraded by two levels because of the small number of patients included in the study (imprecision, -2). The level of evidence is therefore graded as low.

### Morbidity, Resource use, Medication errors

The level of evidence could not be graded since the outcome measure was not reported in the study.

### Conclusions

1. ICU to general ward

#### Mortality

<b>Low GRADE</b>	Structured handover may reduce mortality when compared with unstructured handover in adult, critically ill patients who are transferred from OR to ICU.  <i>Source: Stelfox, 2016</i>
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#### Readmission

<b>Very low GRADE</b>	The evidence is very uncertain about the effect of structured handover on readmission when compared with unstructured handover in adult, critically ill patients who are transferred from ICU to general ward.  <i>Source: Stelfox, 2016</i>
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#### Morbidity, Resource use, Medication errors, Patient satisfaction, Medical staff satisfaction

<b>No GRADE</b>	No evidence was found regarding the effect of structured handover on morbidity, resource use, medication errors when compared with unstructured handover in critically ill patients who are transferred from ICU to general ward.  <i>Source: -</i>
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2. OR to ICU

#### Mortality

<b>Very low GRADE</b>	The evidence is very uncertain about the effect of structured handover on mortality when compared with unstructured handover in adult, critically ill patients who are transferred from OR to ICU.
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	<i>Source: Qian, 2023</i>
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### Readmission

<b>Very low GRADE</b>	<p>The evidence is very uncertain about the effect of structured handover on readmission when compared with unstructured handover in adult, critically ill patients who are transferred from OR to ICU.</p> <p><i>Source: Qian, 2023</i></p>
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### Patient satisfaction

<b>Low GRADE</b>	<p>Structured handover may result in little to no difference in patient satisfaction when compared with unstructured handover in adult, critically ill patients who are transferred from OR to ICU.</p> <p><i>Source: Qian, 2023</i></p>
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### Medical staff satisfaction

<b>Low GRADE</b>	<p>Structured handover may result in little to no difference in medical staff satisfaction when compared with unstructured handover in adult, critically ill patients who are transferred from OR to ICU.</p> <p><i>Source: Qian, 2023</i></p>
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### Morbidity, Resource use, Medication errors

<b>No GRADE</b>	<p>No evidence was found regarding the effect of structured handover on morbidity, resource use, medication errors when compared with unstructured handover in critically ill patients who are transferred from OR to ICU.</p> <p><i>Source: -</i></p>
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### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
<p>Zorg voor een gestructureerde overdracht van patiënten die naar de afdeling worden ontslagen.</p> <p>Houd er rekening mee dat:</p> <ul style="list-style-type: none"> <li>• De overdracht ruimte moet bieden om direct vragen te kunnen stellen;</li> <li>• Belangrijke informatie ook in het patiëntdossier moet zijn terug te vinden;</li> <li>• De overdracht hoofdzakelijk relevante informatie moet</li> </ul>	1 tot 3 jaar	Geen		Geen	Informereren en trainen van zorgpersoneel	Beroepsvereniging	

<p>bevatten en dus niet overcompleet moet zijn.</p> <p>Evalueer 3-jaarlijks met de ontvangende verpleegafdelingen over mogelijke knelpunten van overplaatsingen. Wanneer knelpunten zich voordoen, dient de mogelijkheid van ondersteuning door de IC op een verpleegafdeling overwogen te worden.</p>							
<p>Draag tenminste de volgende items over bij ontslag van een IC-patiënt naar de afdeling:</p> <ul style="list-style-type: none"> <li>• relevante voorgeschiedenis;</li> <li>• reden van ziekenhuis- en IC-opname;</li> </ul>	1 tot 3 jaar	Geen		Geen	Informereren en trainen van zorgpersoneel	Beroepsvereniging	

<ul style="list-style-type: none"> <li>• actuele problematiek en behandeling;</li> <li>• medicatie, waarin specifiek gestopte thuismedicatie, antistolling en antibiotica;</li> <li>• belangrijke items die nog met patient en/of familie besproken moeten worden.</li> </ul> <p>Draag voor postoperatieve IC-patiënten óók eventuele postoperatieve adviezen over.</p> <p>Bovenstaande informatie is ook belangrijk bij de overdracht tijdens een IC-opname, al kan het spoedeisende karakter soms verhinderen dat de informatie compleet is.</p>							
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Zorg dat de patiënt en/of familie op de hoogte is van de behandeldoelen en potentiële risico's bij ontslag van de IC naar de afdeling.	1 tot 3 jaar	Geen		Geen	Geen	Beroepsvereniging	
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## Evidence table for intervention studies

Study reference	Study characteristics	Patient characteristics <sup>2</sup>	Intervention (I)	Comparison / control (C) <sup>3</sup>	Follow-up	Outcome measures and effect size <sup>4</sup>	Comments
Qian, 2023	<p><u>Type of study:</u> Randomized controlled trial.</p> <p><u>Setting and country:</u> ICU of the First Affiliated Hospital of SYSU, a comprehensive teaching hospital in China.</p> <p><u>Funding:</u> Funded by Guangdong Medical Science and Technology Research.</p>	<p><u>Inclusion criteria:</u> Patients aged <math>\geq 18</math> years and <math>\leq 75</math> years who were transferred to the SICU after surgery and clinicians participating in handover met the inclusion criteria.</p> <p><u>Exclusion criteria:</u> Absent members and any time during the handover, handover of two patients at the same time, interruption of handover: existing distraction of handover members' attention.</p> <p><u>N, total at baseline:</u></p>	<p>Intervention: The intervention group carried out structured protocol with postoperative handover checklist.</p>	<p>Control: The control group carried out unstructured handover, without interfered with the content and order of their handover.</p>	<p><u>Length of follow-up:</u> Not reported, at least 28 days (outcome measure 28-day mortality)</p> <p><u>Loss-to-follow-up:</u> Intervention: N=4 (7.3%) Reasons (describe): -Handover member absent (n=2) -Patients were transferred simultaneously (n=2)</p> <p>Control: N=7 (12.3%) Reasons (describe): -Handover member absent (n=3) -Patients were transferred</p>	<p>Mean <math>\pm</math> SD</p> <p><b>Information omissions:</b> Intervention: <math>0.67 \pm 0.62</math> Control: <math>1.44 \pm 0.97</math></p> <p><b>Handover duration (min):</b> Intervention: <math>5.86 \pm 1.91</math> Control: <math>5.98 \pm 1.67</math></p> <p><b>ICU mortality:</b> Intervention: 2 (3.9%) Control: 4 (8%)</p> <p><b>28-day mortality:</b> Intervention: 4 (7.8%) Control: 4 (8%)</p>	

	<p><u>Conflicts of interest:</u> The authors declare that they have no conflict of interest. The funding source did not participate in this study.</p>	<p>Intervention: 51 Control: 50</p> <p><u>Important prognostic factors:</u> Age <math>\pm</math> SD: Intervention: 50.71 <math>\pm</math> 12.71 Control: 53.32 <math>\pm</math> 11.91</p> <p>Sex (male/female): Intervention: 37/14 Control: 33/17</p> <p>Time of admission (daytime/off-hours): Intervention: 12/39 Control: 16/34</p> <p>Medical staff, n: Intervention: 26 Control: 24</p> <p>Handover member (anesthesiologist/ surgeon/ ICU providers): Intervention: 10/9/7 Control: 8/9/7</p>			<p>simultaneously (n=2) -Handover interruption (n=2)</p> <p><u>Incomplete outcome data:</u> Not reported.</p>	<p><b>Length of stay in ICU (hours):</b> Intervention: 59.94 <math>\pm</math> 72.14 Control: 94.52 <math>\pm</math> 116.90</p> <p><b>Readmission to ICU:</b> Intervention: 3 (5.9%) Control: 4 (8%)</p> <p><b>Satisfaction total score (0-100):</b> Intervention: 81.24 <math>\pm</math> 6.95 Control: 76.44 <math>\pm</math> 7.32</p> <p><b>Observer's evaluation, overall quality (0-10):</b> Intervention: 8.16 <math>\pm</math> 0.95 Control: 7.12 <math>\pm</math> 1.15</p> <p><b>Surgeons' evaluation, overall quality (0-10):</b> Intervention: 7.47 <math>\pm</math> 1.01 Control: 7.28 <math>\pm</math> 1.01</p>	
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		Groups were comparable at baseline.				<b>ICU nurses' evaluation, overall quality (0-10):</b> Intervention: 8.27 ± 0.77 Control: 8.04 ± 0.78	
Stelfox, 2016	<p><b>Type of study:</b> Quasi-experimental design and interrupted time series analysis.</p> <p><b>Setting and country:</b> Eight hospitals in two cities in Alberta, Canada.</p> <p><b>Funding:</b> Funded by an establishment grant from Alberta Innovates – Health Solutions. HTS is supported by a Population</p>	<p><b>Inclusion criteria:</b> Adult patients discharged alive from eight medical-surgical ICUs in eight hospitals in two cities in Alberta, Canada, from January 1 2002 to January 1 2012 were eligible for inclusion.</p> <p><b>Exclusion criteria:</b> Not reported.</p> <p><b>N total at baseline:</b> Intervention: 12940 -Pre-implementation: 4872 -Post-implementation: 8068 Control: 19294</p>	<p><b>Intervention:</b> Patients discharged with use of a critical care transition program from January 1, 2002 to January 1, 2012 (2 years prior to implementation).</p> <p>Implementation of a critical care transition program: an independent multidisciplinary ICU team that provided standardized support services for all patients discharged from ICU to a hospital ward.</p>	<p><b>Control:</b> Patients discharged without use of a critical care transition program from January 1, 2002 to January 1, 2012 (2 years prior to implementation).</p> <p>No critical care transition program.</p>	<p><b>Length of follow-up:</b> Patients were followed for a minimum of two consecutive evaluations (24h) and signed off when deemed stable. Outcome measures were mortality at 14 and 28 days, so follow-up was at least 28 days.</p> <p><b>Loss-to-follow-up:</b> Not reported.</p> <p><b>Incomplete outcome data:</b> Not reported.</p>	<p><b>ICU readmission within 72h, % (95% CI)</b> Beginning of study Intervention: 3.7 (2.6 to 4.8) Control: 4.2 (3.1 to 5.2)</p> <p>End of study Intervention: 3.6 (2.7 to 4.5) Control: 3.6 (2.7 to 4.5)</p> <p><b>Mortality within 14 days, % (95% CI)</b> Beginning of study Intervention: 4.8 (4.0 to 5.6) Control: 3.6 (2.8 to 4.4)</p> <p>End of study</p>	

	<p>Health Investigator Award, DJN is supported by a Clinician Fellowship Award, SBM is supported by a Canada Research Chair in Critical Care Nephrology and Clinical Investigator Award.</p> <p><u>Conflicts of interest:</u> Funding sources had no role in the design, conduct, or reporting of this study and they are unaware of any conflicts of interest.</p>	<p>-Pre-implementation: 7560</p> <p>-Post-implementation: 11734</p> <p><u>Important prognostic factors</u><sup>2</sup>:</p> <p>Age median (IQR):  I pre: 58 (42.72)  I post: 58 (44.70)  C pre: 61 (46.73)  C post: 59 (46.72)</p> <p>Sex, % F:  I pre: 2069 (42%)  I post: 3367 (42%)  C pre: 3192 (42%)  C post: 4992 (43%)</p> <p>Reason for ICU admission (medical/surgical):  I pre: 3136/1662  I post: 5238/2807  C pre: 2782/2001  C post: 7260/4474</p> <p>Day of week for discharge (weekday/weekend):</p>				<p>Intervention: 3.4 (2.8 to 4.0)  Control: 4.2 (3.5 to 4.9)</p>	
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		<p>I pre: 3545/1327  I post: 6060/2008  C pre: 5620/1940  C post: 8871/2863</p> <p>Time of day for discharge (day-time/night-time):  I pre: 3045/1827  I post: 5131/2937  C pre: 5760/1854  C post: 8529/3205</p> <p>Groups comparable at baseline?</p>					
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**Risk of bias table for intervention studies (RCT)**

Study reference (first author, publication year)	Was the allocation sequence adequately generated?	Was the allocation adequately concealed?	Blinding: Was knowledge of the allocated interventions adequately prevented?  Were patients blinded?  Were healthcare providers blinded?  Were data collectors blinded?  Were outcome assessors blinded?  Were data analysts blinded?	Was loss to follow- up (missing outcome data) infrequent?	Are reports of the study free of selective outcome reporting?	Was the study apparently free of other problems that could put it at a risk of bias?	Overall risk of bias If applicable/necessary, per outcome measure
	Definitely yes Probably yes Probably no Definitely no	Definitely yes Probably yes Probably no Definitely no	Definitely yes Probably yes Probably no Definitely no	Definitely yes Probably yes Probably no Definitely no	Definitely yes Probably yes Probably no Definitely no	Definitely yes Probably yes Probably no Definitely no	<b>LOW</b> <b>Some concerns</b> <b>HIGH</b>

Qian, 2023	<p><b>Definitely yes</b></p> <p>Reason: Randomization determined by a computerized random-number generator.</p>	<p><b>Probably yes</b></p> <p>Reason: One single ICU was randomly selected from two SICUs of this hospital, and a total of 10 beds were included and randomized in a 1:1 ratio into control and intervention groups. Each bed was randomly assigned to a fixed resident.</p>	<p><b>Definitely no</b></p> <p>Reason: Health care providers were not blinded. No information about blinding of patients, outcome assessors and data analysts.</p>	<p><b>Probably no</b></p> <p>Reason: Loss-to-follow-up was 7.3% in the intervention group and 12.3% in the control group.</p>	<p><b>Definitely yes</b></p> <p>Reason: All relevant outcomes were reported.</p>	<p><b>Probably yes</b></p> <p>Reason: small sample size.</p>	<p><b>LOW (mortality)</b> <b>Some concerns</b> (other outcomes)</p>
Stelfox, 2016	<p><b>Definitely no</b></p> <p>Reason: no randomization, a critical care transition program was implemented in 3 hospitals and not implemented in 5 other hospitals. The five hospitals were used as control.</p>	<p><b>Definitely no</b></p> <p>Reason: no randomization, a critical care transition program was implemented in 3 hospitals and not implemented in 5 other hospitals. The five hospitals were used as control. Therefore, no allocation was necessary.</p>	<p><b>Definitely no</b></p> <p>Reason: no one involved with the study was blinded, due to no randomization.</p>	<p>No information</p> <p>Reason: loss-to-follow-up data were not reported in the study.</p>	<p><b>Definitely yes</b></p> <p>Reason: All relevant outcomes were reported.</p>	<p><b>Probably no</b></p> <p>Reason: it is possible that other activities may have occurred during the study that could have affected the readmission of patients to ICU and mortality, and allocation of resources and processes for ICU discharge may vary</p>	<p><b>HIGH (all outcomes)</b></p>

						across healthcare jurisdictions.	
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## Table of excluded studies

Reference	Reason for exclusion
Abraham J, Burton S, Gordon HS. Moving patients from emergency department to medical intensive care unit: Tracing barriers and root contributors. <i>Int J Med Inform.</i> 2020 Jan;133:104012. doi: 10.1016/j.ijmedinf.2019.104012. Epub 2019 Oct 18. PMID: 31726385.	Wrong study design: non-comparing observational study
Abraham J, Meng A, Tripathy S, Avidan MS, Kannampallil T. Systematic review and meta-analysis of interventions for operating room to intensive care unit handoffs. <i>BMJ Qual Saf.</i> 2021 Jun;30(6):513-524. doi: 10.1136/bmjqs-2020-012474. Epub 2021 Feb 9. PMID: 33563791.	Wrong population: part of studies about children. Wrong outcome measures: technical errors, information omissions, information sharing score, time to analgesia dosing
Abraham J, Kannampallil TG, Almoosa KF, Patel B, Patel VL. Comparative evaluation of the content and structure of communication using two handoff tools: implications for patient safety. <i>J Crit Care.</i> 2014 Apr;29(2):311.e1-7. doi: 10.1016/j.jcrc.2013.11.014. Epub 2013 Nov 23. PMID: 24360818.	Wrong comparison: two handoff tools
Appelbaum RD, McCullough MA, Barnett RS, Talbott AL, Neff LP, Hildreth AN, Miller PR 3rd, Nunn AM. Improving the Culture of Safety: A Prospective Handoff Initiative from the Operating Room to the Trauma Intensive Care Unit. <i>Am Surg.</i> 2022 Jul;88(7):1584-1587. doi: 10.1177/00031348221091938. Epub 2022 Apr 25. PMID: 35469445.	Wrong study design: pre-post
Barry ME, Hochman BR, Lane-Fall MB, Zappile D, Holena DN, Smith BP, Kaplan LJ, Huffenberger A, Reilly PM, Pascual JL. Leveraging Telemedicine Infrastructure to Monitor Quality of Operating Room to Intensive Care Unit Handoffs. <i>Acad Med.</i> 2017 Jul;92(7):1035-1042. doi: 10.1097/ACM.0000000000001590. PMID: 28198723; PMCID: PMC5912952.	Wrong intervention: handoffs on weekdays vs nights and weekends
Bell CM, Rahimi-Darabad P, Orner AI. Discontinuity of chronic medications in patients discharged from the intensive care unit. <i>J Gen Intern Med.</i> 2006 Sep;21(9):937-41. doi: 10.1111/j.1525-1497.2006.00499.x. PMID: 16918738; PMCID: PMC1831608.	Wrong study design: non-comparing observational study
Bosma BE, Meuwese E, Tan SS, van Bommel J, Melief PH, Hunfeld NG, van den Bemt PM. The effect of the TIM program (Transfer ICU Medication reconciliation) on medication transfer errors in two Dutch intensive care units: design of a prospective 8-month observational study with a before and after period. <i>BMC Health Serv Res.</i> 2017 Feb 10;17(1):124. doi: 10.1186/s12913-017-2065-y. PMID: 28183302; PMCID: PMC5301448.	Results not reported
Bourne RS, Jennings JK, Panagioti M, Hodkinson A, Sutton A, Ashcroft DM. Medication-related interventions to improve medication safety and patient outcomes on transition from adult intensive care settings: a systematic review and meta-analysis. <i>BMJ Qual Saf.</i> 2022 Aug;31(8):609-622. doi: 10.1136/bmjqs-2021-013760. Epub 2022 Jan 18. PMID: 35042765; PMCID: PMC9304084.	Wrong study design: pre-post
Brown KN, Leigh JP, Kamran H, Bagshaw SM, Fowler RA, Dodek PM, Turgeon AF, Forster AJ, Lamontagne F, Soo A, Stelfox HT. Transfers from intensive care unit to hospital ward: a multicentre textual analysis of physician progress notes. <i>Crit Care.</i> 2018 Jan 28;22(1):19. doi: 10.1186/s13054-018-1941-0. PMID: 29374498; PMCID: PMC5787341.	Wrong study design: non-comparing observational study
Chatterjee S, Shake JG, Arora RC, Engelman DT, Firstenberg MS, Geller CM, Hirose H, Lonchyna VA, Lytle FT, Milewski RKC, Moosdorf RGH, Rabin J, Sanjanwala R, Galati M, Whitman GJ; Society of Thoracic Surgeons Workforce on Critical Care. Handoffs From the Operating Room to the Intensive Care Unit After Cardiothoracic Surgery: From The Society of Thoracic Surgeons Workforce on Critical Care. <i>Ann Thorac Surg.</i> 2019	Wrong population: part of studies about children, wrong outcome measures: provider satisfaction, technical errors, information omissions, quality of handover

Feb;107(2):619-630. doi: 10.1016/j.athoracsur.2018.11.010. Epub 2018 Nov 27. PMID: 30500341.	
Conn Busch J, Wu J, Anglade E, Peifer HG, Lane-Fall MB. So Many Ways to Be Wrong: Completeness and Accuracy in a Prospective Study of OR-to-ICU Handoff Standardization. <i>Jt Comm J Qual Patient Saf.</i> 2023 Aug;49(8):365-372. doi: 10.1016/j.jcjq.2023.05.001. Epub 2023 May 13. PMID: 37316396.	Wrong study design: pre post, wrong population: age not specified, wrong outcome measures: handoff information accuracy
Coon EA, Kramer NM, Fabris RR, Burkholder DB, Klaas JP, Graff-Radford J, Moore SA, Wijdicks EFM, Britton JW, Jones LK Jr. Structured handoff checklists improve clinical measures in patients discharged from the neurointensive care unit. <i>Neurol Clin Pract.</i> 2015 Feb;5(1):42-49. doi: 10.1212/CPJ.0000000000000094. PMID: 29443183; PMCID: PMC5764427.	Wrong study design: pre-post
Correia PC, Gomes de Macedo P, Santos JFG, Moreira Júnior JR, de Oliveira C, Malbouisson LMS. Impact of customised ICU handover protocol on the quality of ICU discharge reports. <i>BMJ Open Qual.</i> 2022 Aug;11(3):e001647. doi: 10.1136/bmj-oq-2021-001647. PMID: 35977742; PMCID: PMC9389091.	Wrong study design: pre-post
Cuzco C, Torres-Castro R, Torralba Y, Manzanares I, Muñoz-Rey P, Romero-García M, Martínez-Momblan MA, Martínez-Estalella G, Delgado-Hito P, Castro P. Nursing Interventions for Patient Empowerment during Intensive Care Unit Discharge: A Systematic Review. <i>Int J Environ Res Public Health.</i> 2021 Oct 21;18(21):11049. doi: 10.3390/ijerph182111049. PMID: 34769569; PMCID: PMC8582948.	Wrong intervention: different types of interventions for patient empowerment (pre-discharge, post-ICU), no discharge interventions).
Dabliz R, Poon SK, Fairbrother G, Ritchie A, Soo G, Burke R, Kol M, Ho R, Thai L, Laurens J, Ledesma S, Abu Sardaneh A, Leung T, Hincapie AL, Penm J. Medication safety improvements during care transitions in an Australian intensive care unit following implementation of an electronic medication management system. <i>Int J Med Inform.</i> 2021 Jan;145:104325. doi: 10.1016/j.ijmedinf.2020.104325. Epub 2020 Nov 4. PMID: 33221648.	Wrong study design: pre-post
de Grood C, Leigh JP, Bagshaw SM, Dodek PM, Fowler RA, Forster AJ, Boyd JM, Stelfox HT. Patient, family and provider experiences with transfers from intensive care unit to hospital ward: a multicentre qualitative study. <i>CMAJ.</i> 2018 Jun 4;190(22):E669-E676. doi: 10.1503/cmaj.170588. PMID: 29866892; PMCID: PMC5988518.	Wrong study design: non-comparing observational study
Dixon JL, Stagg HW, Wehbe-Janek H, Jo C, Culp WC Jr, Shake JG. A standard handoff improves cardiac surgical patient transfer: operating room to intensive care unit. <i>J Healthc Qual.</i> 2015 Jan-Feb;37(1):22-32. doi: 10.1097/01.JHQ.0000460123.91061.b3. PMID: 26042374.	Wrong study design: pre-post, wrong outcome measures: duration of handoff
Dusse F, Pütz J, Böhmer A, Schieren M, Joppich R, Wappler F. Completeness of the operating room to intensive care unit handover: a matter of time? <i>BMC Anesthesiol.</i> 2021 Feb 5;21(1):38. doi: 10.1186/s12871-021-01247-3. PMID: 33546588; PMCID: PMC7863365.	Wrong study design: non-comparing observational study
Gardiner TM, Marshall AP, Gillespie BM. Clinical handover of the critically ill postoperative patient: an integrative review. <i>Aust Crit Care.</i> 2015 Nov;28(4):226-34. doi: 10.1016/j.aucc.2015.02.001. Epub 2015 Mar 19. PMID: 25797689.	Wrong study design: integrative review
Giles C, Novakovic M, Hopman W, Barreto EF, Beaubien-Souligny W, Birks P, Neyra JA, Wald R, Silver SA. The Quality of Discharge Summaries After Acute Kidney Injury. <i>Can J Kidney Health Dis.</i> 2023 Sep 28;10:20543581231199018. doi: 10.1177/20543581231199018. PMID: 37781153; PMCID: PMC10540581.	Wrong study design: non-comparing chart review
Goulding L, Parke H, Maharaj R, Loveridge R, McLoone A, Hadfield S, Helme E, Hopkins P, Sandall J. Improving critical care discharge summaries: a collaborative quality improvement project using	Wrong study design: scoping review

PDSA. BMJ Qual Improv Rep. 2015 Apr 30;4(1):u203938.w3268. doi: 10.1136/bmjquality.u203938.w3268. PMID: 26734368; PMCID: PMC4645923.	
Hervé MEW, Zucatti PB, Lima MADDs. Transition of care at discharge from the Intensive Care Unit: a scoping review. Rev Lat Am Enfermagem. 2020;28:e3325. doi: 10.1590/1518-8345.4008.3325. Epub 2020 Jul 15. PMID: 32696919; PMCID: PMC7365613.	Wrong study design: scoping review
Heselmans A, van Krieken J, Cootjans S, Nagels K, Filliers D, Dillen K, De Broe S, Ramaekers D. Medication review by a clinical pharmacist at the transfer point from ICU to ward: a randomized controlled trial. J Clin Pharm Ther. 2015 Oct;40(5):578-583. doi: 10.1111/jcpt.12314. Epub 2015 Aug 12. PMID: 29188903.	Wrong population: 15 years and older, wrong outcome measures: number of implemented recommendations
Ho JK. Improving clinical handover: Development of a web-based intensive care unit consultation system with structured reply generation. BMJ Qual Improv Rep. 2016 Apr 29;5(1):u210292.w4180. doi: 10.1136/bmjquality.u210292.w4180. PMID: 27158498; PMCID: PMC4856893.	Wrong study design: non-comparing observational study
Ilan R, LeBaron CD, Christianson MK, Heyland DK, Day A, Cohen MD. Handover patterns: an observational study of critical care physicians. BMC Health Serv Res. 2012 Jan 10;12:11. doi: 10.1186/1472-6963-12-11. PMID: 22233877; PMCID: PMC3280171.	Wrong study design: non-comparing observational study
Keller N, Bosse G, Memmert B, Treskatsch S, Spies C. Improving quality of care in less than 1 min: a prospective intervention study on postoperative handovers to the ICU/PACU. BMJ Open Qual. 2020 Jun;9(2):e000668. doi: 10.1136/bmjopen-2019-000668. PMID: 32565419; PMCID: PMC7311016.	Wrong study design: pre-post
Kleinpell RM. Randomized trial of an intensive care unit-based early discharge planning intervention for critically ill elderly patients. Am J Crit Care. 2004 Jul;13(4):335-45. PMID: 15293587.	Wrong population: discharge from hospital
Kovacic NL, Gagnon DJ, Riker RR, Wen S, Fraser GL. An Analysis of Psychoactive Medications Initiated in the ICU but Continued Beyond Discharge: A Pilot Study of Stewardship. J Pharm Pract. 2020 Dec;33(6):760-767. doi: 10.1177/0897190019830518. Epub 2019 Feb 27. PMID: 30813837; PMCID: PMC6711824.	Wrong study design: non-comparing observational study
Krimminger D, Sona C, Thomas-Horton E, Schallom M. A Multidisciplinary QI Initiative to Improve OR-ICU Handovers. Am J Nurs. 2018 Feb;118(2):48-59. doi: 10.1097/01.NAJ.0000530248.45711.60. PMID: 29369877.	Wrong study design: pre-post
Lane-Fall MB, Christakos A, Russell GC, Hose BZ, Dauer ED, Greulich PE, Hong Mershon B, Potestio CP, Pukenas EW, Kimberly JR, Stephens-Shields AJ, Trotta RL, Beidas RS, Bass EJ. Handoffs and transitions in critical care-understanding scalability: study protocol for a multicenter stepped wedge type 2 hybrid effectiveness-implementation trial. Implement Sci. 2021 Jun 15;16(1):63. doi: 10.1186/s13012-021-01131-1. PMID: 34130725; PMCID: PMC8204062.	Wrong study design: Study protocol for implementation trial
Lane-Fall MB, Pascual JL, Peifer HG, Di Taranti LJ, Collard ML, Jablonski J, Gutsche JT, Halpern SD, Barg FK, Fleisher LA; HATRICC study team (Kimberly Allen, BSN, RN; Mark Barry, MD; Sruthi Buddai, BA; Tyler Chavez, BA; Mahrukh Choudhary, BA; Della George; Megan Linehan, DO; Enrique Torres Hernandez; Jerome Watts, BA. A Partially Structured Postoperative Handoff Protocol Improves Communication in 2 Mixed Surgical Intensive Care Units: Findings From the Handoffs and Transitions in Critical Care (HATRICC) Prospective Cohort Study. Ann Surg. 2020 Mar;271(3):484-493. doi: 10.1097/SLA.0000000000003137. PMID: 30499797.	Wrong study design: pre-post
Li P, Stelfox HT, Ghali WA. A prospective observational study of physician handoff for intensive-care-unit-to-ward patient	Wrong study design: non-comparing observational study

transfers. Am J Med. 2011 Sep;124(9):860-7. doi: 10.1016/j.amjmed.2011.04.027. PMID: 21854894.	
Lin F, Chaboyer W, Wallis M. A literature review of organisational, individual and teamwork factors contributing to the ICU discharge process. Aust Crit Care. 2009 Feb;22(1):29-43. doi: 10.1016/j.aucc.2008.11.001. Epub 2009 Jan 10. PMID: 19138531.	Wrong study design: literature review
Meuwese, E. and Bosma, B. E. and Hunfeld, N. G. M. and Quax, R. A. M. and Hemesath, K. C. F. and Van Wijngaarden, C. and Aref, Z. and Hassan, R. and Van Den Bemt, P. M. L. A. Effect of medication reconciliation by a pharmacist on unintended medication discrepancies at admission to and discharge from the intensive care unit. Pharmaceutisch Weekblad. 2017; 152 (19) :25-28	Wrong study design: pre-post
McFetridge B, Gillespie M, Goode D, Melby V. An exploration of the handover process of critically ill patients between nursing staff from the emergency department and the intensive care unit. Nurs Crit Care. 2007 Nov-Dec;12(6):261-9. doi: 10.1111/j.1478-5153.2007.00244.x. PMID: 17983360.	Wrong study design: non-comparing observational study
Moon TS, Gonzales MX, Woods AP, Fox PE. Improving the quality of the operating room to intensive care unit handover at an urban teaching hospital through a bundled intervention. J Clin Anesth. 2016 Jun;31:5-12. doi: 10.1016/j.jclinane.2016.01.001. Epub 2016 Mar 16. PMID: 27185667.	Wrong study design: pre-post
Mukhopadhyay D, Wiggins-Dohlvik KC, MrDutt MM, Hamaker JS, Machen GL, Davis ML, Regner JL, Smith RW, Ciceri DP, Shake JG. Implementation of a standardized handoff protocol for post-operative admissions to the surgical intensive care unit. Am J Surg. 2018 Jan;215(1):28-36. doi: 10.1016/j.amjsurg.2017.08.005. Epub 2017 Aug 10. PMID: 28823594.	Wrong outcomes: presence of physician, critical details communicated including procedure and complications, handoff duration
Österlind J, Gerhardsson J, Myrberg T. Critical care transition programs on readmission or death: A systematic review and meta-analysis. Acta Anaesthesiol Scand. 2020 Aug;64(7):870-883. doi: 10.1111/aas.13591. Epub 2020 Apr 17. PMID: 32232833.	Wrong study design: pre-post
Paredes-Garza F, López-Mases P, Lázaro E, Marín-Maicas P. [Effect of on patient safety of bedside handoff performed in intensive care units. Systematic review]. An Sist Sanit Navar. 2022 Jun 29;45(2):e0996. Spanish. doi: 10.23938/ASSN.0996. PMID: 35786699; PMCID: PMC10123455.	Article in Spanish
Parent B, LaGrone LN, Albirair MT, Serina PT, Keller JM, Cuschieri J, Addison EJ, Choe L, Delossantos GB, Gaskill CE, Moon SD, MacDonald JT, Stolzberg MJ, Van Eaton EG, Zech JM, Kritek PA. Effect of Standardized Handoff Curriculum on Improved Clinician Preparedness in the Intensive Care Unit: A Stepped-Wedge Cluster Randomized Clinical Trial. JAMA Surg. 2018 May 1;153(5):464-470. doi: 10.1001/jamasurg.2017.5440. PMID: 29299602; PMCID: PMC5875375.	Wrong study design: pre-post
Perren A, Conte P, De Bitonti N, Limoni C, Merlani P. From the ICU to the ward: cross-checking of the physician's transfer report by intensive care nurses. Intensive Care Med. 2008 Nov;34(11):2054-61. doi: 10.1007/s00134-008-1138-0. Epub 2008 May 7. PMID: 18461306.	Wrong study design: non-comparing observational study
Petrovic MA, Aboumatar H, Baumgartner WA, Ulatowski JA, Moyer J, Chang TY, Camp MS, Kowalski J, Senger CM, Martinez EA. Pilot implementation of a perioperative protocol to guide operating room-to-intensive care unit patient handoffs. J Cardiothorac Vasc Anesth. 2012 Feb;26(1):11-6. doi: 10.1053/j.jvca.2011.07.009. Epub 2011 Sep 1. PMID: 21889365.	Wrong study design: pre-post
Plotnikoff KM, Krewulak KD, Hernández L, Spence K, Foster N, Longmore S, Straus SE, Niven DJ, Parsons Leigh J, Stelfox HT, Fiest KM. Patient discharge from intensive care: an updated scoping review to identify tools and practices to inform high-quality care. Crit Care. 2021 Dec 17;25(1):438. doi: 10.1186/s13054-021-03857-2. PMID: 34920729; PMCID: PMC8684123.	Wrong study design: scoping review

Prasad A, Cios TJ, Staub-Juergens W, Dziedzina C, Rao S, Singbartl K. Standardization improves postoperative patient handoff experience for junior clinicians. <i>Am J Manag Care</i> . 2020 Jun 1;26(6):e184-e190. doi: 10.37765/ajmc.2020.43494. PMID: 32549068.	Wrong study design: pre-post
Pronovost, P. and Hobson, D. B. and Earsing, K. and Lins, E. S. and Rinke, M. L. and Emery, K. and Berenholtz, S. M. and Lipsett, P. A. and Dorman, T. A practical tool to reduce medication errors during patient transfer from an intensive care unit. <i>Journal of Clinical Outcomes Management</i> . 2004; 11 (1) :26-33	No full text available
Pronovost P, Weast B, Schwarz M, Wyskiel RM, Prow D, Milanovich SN, Berenholtz S, Dorman T, Lipsett P. Medication reconciliation: a practical tool to reduce the risk of medication errors. <i>J Crit Care</i> . 2003 Dec;18(4):201-5. doi: 10.1016/j.jcrc.2003.10.001. PMID: 14691892.	Wrong study design: non-comparing observational study
Rehm C, Zoller R, Schenk A, Müller N, Strassberger-Nerschbach N, Zenker S, Schindler E. Evaluation of a Paper-Based Checklist versus an Electronic Handover Tool Based on the Situation Background Assessment Recommendation (SBAR) Concept in Patients after Surgery for Congenital Heart Disease. <i>J Clin Med</i> . 2021 Dec 7;10(24):5724. doi: 10.3390/jcm10245724. PMID: 34945021; PMCID: PMC8706564.	Wrong population: Pediatric ICU
Rice M, Lear A, Kane-Gill S, Seybert AL, Smithburger PL. Pharmacy Personnel's Involvement in Transitions of Care of Intensive Care Unit Patients: A Systematic Review. <i>J Pharm Pract</i> . 2021 Feb;34(1):117-126. doi: 10.1177/0897190020911524. Epub 2020 Apr 1. PMID: 32233830.	Wrong comparison: medication intervention performed by pharmacist vs. performed by physician
Rose MW, Newman S, Brown C. Postoperative Information Transfers: An Integrative Review. <i>J Perianesth Nurs</i> . 2019 Apr;34(2):403-424.e3. doi: 10.1016/j.jopan.2018.06.096. Epub 2018 Oct 16. PMID: 30340958.	Wrong study design: integrative review
Salzwedel C, Mai V, Punke MA, Kluge S, Reuter DA. The effect of a checklist on the quality of patient handover from the operating room to the intensive care unit: A randomized controlled trial. <i>J Crit Care</i> . 2016 Apr;32:170-4. doi: 10.1016/j.jcrc.2015.12.016. Epub 2015 Dec 29. PMID: 26818630.	Wrong outcome measures: items that should/must be handed over (quality of handover)
Segall N, Bonifacio AS, Schroeder RA, Barbeito A, Rogers D, Thornlow DK, Emery J, Kellum S, Wright MC, Mark JB; Durham VA Patient Safety Center of Inquiry. Can we make postoperative patient handovers safer? A systematic review of the literature. <i>Anesth Analg</i> . 2012 Jul;115(1):102-15. doi: 10.1213/ANE.0b013e318253af4b. Epub 2012 Apr 27. PMID: 22543067; PMCID: PMC6152818.	Wrong study design: part of studies non-comparing
Stelfox HT, Brundin-Mather R, Soo A, Whalen-Browne L, Kashyap D, Sauro KM, Bagshaw SM, Fiest KM, Taljaard M, Parsons Leigh J. A Multiple Baseline Trial of an Electronic ICU Discharge Summary Tool for Improving Quality of Care. <i>Crit Care Med</i> . 2022 Nov 1;50(11):1566-1576. doi: 10.1097/CCM.0000000000005638. Epub 2022 Aug 16. PMID: 35972243.	Wrong study design: pre-post
Stelfox HT, Lane D, Boyd JM, Taylor S, Perrier L, Straus S, Zygun D, Zuege DJ. A scoping review of patient discharge from intensive care: opportunities and tools to improve care. <i>Chest</i> . 2015 Feb;147(2):317-327. doi: 10.1378/chest.13-2965. PMID: 25210942.	Wrong study design: scoping review
Stelfox HT, Leigh JP, Dodek PM, Turgeon AF, Forster AJ, Lamontagne F, Fowler RA, Soo A, Bagshaw SM. A multi-center prospective cohort study of patient transfers from the intensive care unit to the hospital ward. <i>Intensive Care Med</i> . 2017 Oct;43(10):1485-1494. doi: 10.1007/s00134-017-4910-1. Epub 2017 Aug 29. PMID: 28852789.	Wrong study design: non-comparing observational study
Tortosa-Altred R, Reverté-Villarroya S, Martínez-Segura E, López-Pablo C, Berenguer-Poblet M. Emergency handover of critical	Wrong population: transfer between two critical emergency care wards, wrong

patients. A systematic review. Int Emerg Nurs. 2021 May;56:100997. doi: 10.1016/j.ienj.2021.100997. Epub 2021 Apr 19. PMID: 33887611.	study design: mostly non-comparing observational studies
Tully AP, Hammond DA, Li C, Jarrell AS, Krueger RM. Evaluation of Medication Errors at the Transition of Care From an ICU to Non-ICU Location. Crit Care Med. 2019 Apr;47(4):543-549. doi: 10.1097/CCM.0000000000003633. PMID: 30855330.	Wrong study design: non-comparing observational study
Turner CJ, Haas B, Lee C, Brar S, Detsky ME, Munshi L. Improving Communication Between Surgery and Critical Care Teams: Beyond the Handover. Am J Crit Care. 2018 Sep;27(5):392-397. doi: 10.4037/ajcc2018114. PMID: 30173172.	Wrong study design: pre-post
Van Der Walt, J. J. N. and Scholl, A. T. and Joubert, I. A. and Petrovic, M. A. Implementation of a postoperative handoff protocol. Southern African Journal of Anaesthesia and Analgesia. 2016; 22 (6) :33-37	Wrong study design: pre-post
van Sluisveld N, Bakhshi-Raiez F, de Keizer N, Holman R, Wester G, Wollersheim H, van der Hoeven JG, Zegers M. Variation in rates of ICU readmissions and post-ICU in-hospital mortality and their association with ICU discharge practices. BMC Health Serv Res. 2017 Apr 17;17(1):281. doi: 10.1186/s12913-017-2234-z. PMID: 28416016; PMCID: PMC5393034.	Wrong study design: non-comparing observational study
van Sluisveld N, Hesselink G, van der Hoeven JG, Westert G, Wollersheim H, Zegers M. Improving clinical handover between intensive care unit and general ward professionals at intensive care unit discharge. Intensive Care Med. 2015 Apr;41(4):589-604. doi: 10.1007/s00134-015-3666-8. Epub 2015 Feb 12. PMID: 25672275; PMCID: PMC4392116.	Wrong population: neonatal, pediatric and adult population
Verholen N, Vogt L, Klasen M, Schmidt M, Beckers S, Marx G, Sopka S. Do Digital Handover Checklists Influence the Clinical Outcome Parameters of Intensive Care Unit Patients? A Randomized Controlled Pilot Study. Front Med (Lausanne). 2021 Apr 20;8:661343. doi: 10.3389/fmed.2021.661343. PMID: 33959627; PMCID: PMC8093756.	Wrong intervention: use of two different checklists during shift-to-shift handovers
Wang Y, Zhang X, Hu X, Sun X, Wang Y, Huang K, Sun S, Lv X, Xie X. Evaluation of medication risk at the transition of care: a cross-sectional study of patients from the ICU to the non-ICU setting. BMJ Open. 2022 Apr 15;12(4):e049695. doi: 10.1136/bmjopen-2021-049695. PMID: 35428614; PMCID: PMC9013992.	Wrong study design: non-comparing observational study
Wibrandt I, Lippert A. Improving Patient Safety in Handover From Intensive Care Unit to General Ward: A Systematic Review. J Patient Saf. 2020 Sep;16(3):199-210. doi: 10.1097/PTS.0000000000000266. PMID: 28452913.	Wrong study design: pre-post
Zjadewicz K, Deemer KS, Coulthard J, Doig CJ, Boiteau PJ. Identifying What Is Known About Improving Operating Room to Intensive Care Handovers: A Scoping Review. Am J Med Qual. 2018 Sep/Oct;33(5):540-548. doi: 10.1177/1062860618754701. Epub 2018 Jan 27. PMID: 29374964.	Wrong study design: scoping review

## Literature search strategy

### Zoekverantwoording

#### Algemene informatie

Cluster/richtlijn: NVIC – Herziening leidraad organisatie van de intensive care	
Uitgangsvraag/modules: UV4 Hoe dient de overplaatsing van IC-patiënten die naar de afdeling worden ontslagen te worden vormgegeven	
Database(s): Embase.com, Ovid/Medline	Datum: 24-10-2023
Periode: vanaf 2000	Talen: geen restrictie
Literatuurspecialist: Ingeborg van Dusseldorp	Rayyan review: <a href="https://rayyan.ai/reviews/820151">https://rayyan.ai/reviews/820151</a>
BMI-zoekblokken: voor verschillende opdrachten wordt (deels) gebruik gemaakt van de zoekblokken van BMI-Online <a href="https://blocks.bmi-online.nl/">https://blocks.bmi-online.nl/</a> Bij gebruikmaking van een volledig zoekblok zal naar de betreffende link op de website worden verwezen.	

**Toelichting:**

Voor deze vraag is gezocht op de concepten:

Overplaatsing EN kritiek zieke patiënten EN verschillende afdelingen EN volwassenen

Vanwege de aantallen worden alleen de SRs en clinical trials aangeboden in Rayyan.

Vier van de vijf sleutelartikelen worden gevonden. Het artikel van Alali wordt niet gevonden omdat het een kinder IC betreft.

Alali H, Antar M, AlShehri A, AlHamouieh O, Al-Surimi K, Kazzaz Y. Improving physician handover documentation process for patient transfer from paediatric intensive care unit to general ward. *BMJ Open Qual.* 2020 Dec;9(4):e001020. doi: 10.1136/bmjoq-2020-001020. PMID: 33384337; PMCID: PMC7780523

Te gebruiken voor richtlijntekst:

In de databases Embase.com en Ovid/Medline is op 24-10-2023 systematisch gezocht vanaf 2000 naar systematische reviews en RCTs over de overplaatsing van patiënten van de IC naar (verpleeg)afdelingen en vice versa. De literatuurzoekactie leverde 828 unieke treffers op.

**Zoekopbrengst**

	EMBASE	OVID/MEDLINE	Ontdubbeld
SR	108	87	142
RCT	540	292	686
Observationele studies	1425	1240	
<b>Totaal</b>	<b>2073</b>	<b>1619</b>	<b>*828</b>

**\*in Rayyan****Zoekstrategie****Embase.com**

No.	Query	Results
#1	'clinical handover'/exp OR (((clinical OR patient* OR nurs* OR shift OR care OR protocol OR 'face to face' OR sheet* OR form* OR checklist*) NEAR/2 ('sign out' OR signout OR transfer* OR transition* OR signover* OR 'sign over*')):ti,ab,kw) OR handover*:ti,ab,kw OR handoff*:ti,ab,kw OR 'liaison nurse*':ti,ab,kw OR 'change agent*':ti,ab,kw OR (((sheet* OR form* OR checklist* OR protocol* OR instrument* OR strategy OR software OR planning OR tool*) NEAR/3 discharge):ti,ab,kw) OR 'bed manager*':ti,ab,kw OR 'critical care transfer':ti,ab,kw	83897
#2	'intensive care'/de OR 'intensive care unit'/exp OR 'artificial feeding'/exp OR 'artificial ventilation'/exp OR 'early goal-directed therapy'/exp OR 'sepsis'/exp OR 'acute respiratory failure'/exp OR 'respiratory tract intubation'/exp OR (((intensive OR critical OR medium) NEAR/2 care):ti,ab,kw) OR 'critically ill':ti,ab,kw OR 'acutely ill':ti,ab,kw OR weaning:ti,kw OR (((mechanical* OR artificial) NEAR/2 ventilat*):ti,ab,kw) OR 'icu patient*':ti,ab,kw OR 'icu discharge':ti,ab,kw	1167717
#3	#1 AND #2	13997
#4	'barriers and facilitators to improve safety and efficiency of the icu discharge process: a mixed methods study'	1
#5	'improving clinical handover between intensive care unit and general ward professionals at intensive care unit discharge'	1
#6	'improving physician handover documentation process for patient transfer from paediatric intensive care unit to general ward'	1
#7	'medication-related interventions to improve medication safety and patient outcomes on transition from adult intensive care settings: a systematic review and meta-analysis'	1

#8	'the effect of the tim program (transfer icu medication reconciliation) on medication transfer errors in two dutch intensive care units: design of a prospective 8-month observational study with a before and after period'	1
#9	#4 OR #5 OR #6 OR #7 OR #8 sleutelartikelen	5
#10	#3 AND #9	5
#11	'ward'/exp OR ward:ti,ab,kw OR (((operating OR emergency OR recovery OR nursing) NEAR/3 (room* OR theatre OR department* OR unit*)):ti,ab,kw)	731043
#12	#3 AND #11	8851
#13	#3 NOT #12	5146
#14	#12 AND [2000-2024]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp)	4258
#15	#14 NOT (('adolescent'/exp OR 'child'/exp OR adolescent*:ti,ab,kw OR child*:ti,ab,kw OR schoolchild*:ti,ab,kw OR infant*:ti,ab,kw OR girl*:ti,ab,kw OR boy*:ti,ab,kw OR teen:ti,ab,kw OR teens:ti,ab,kw OR teenager*:ti,ab,kw OR youth*:ti,ab,kw OR pediater*:ti,ab,kw OR paediatr*:ti,ab,kw OR puber*:ti,ab,kw) NOT ('adult'/exp OR 'aged'/exp OR 'middle aged'/exp OR adult*:ti,ab,kw OR man:ti,ab,kw OR men:ti,ab,kw OR woman:ti,ab,kw OR women:ti,ab,kw))	2838
#16	#9 AND #15	4
#17	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasyntes*:ti,ab OR 'meta syntes*':ti,ab	733409
#18	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3302394
#19	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	6767914
#20	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical	14514778

	study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*:ti,ab,kw OR cross?ectional*:ti,ab,kw OR multicent*:ti,ab,kw OR 'multi-cent*:ti,ab,kw OR consecutive*:ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*:ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*:ti,ab,kw OR 'odds ratio*:ab OR 'relative odds':ab OR 'risk ratio*:ab OR 'relative risk*:ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (('or' OR 'rr') NEAR/6 ci:ab)))	
#21	#15 AND #17 SR	108
#22	#15 AND #18 NOT #21 Clinical trials	540
#23	#15 AND (#19 OR #20) NOT #21 NOT #22 OBS	1425
#24	#21 OR #22 OR #23	2073

## Ovid/Medline

#	Searches	Results
1	exp Patient Handoff/ or exp Patient Transfer/ or ((clinical or patient* or nurs* or shift or care or protocol or face to face or sheet* or form* or checklist*) adj2 (sign out or signout or transfer* or transition* or signover* or sign over*)).ti,ab,kf. or handover*.ti,ab,kf. or handoff*.ti,ab,kf. or liaison nurse*.ti,ab,kf. or change agent*.ti,ab,kf. or ((sheet* or form* or checklist* or protocol* or instrument* or strategy or software or planning or tool*) adj3 discharge).ti,ab,kf. or bed manager*.ti,ab,kf. or critical care transfer.ti,ab,kf.	55831
2	Critical Care/ or Critical Illness/ or Early Goal-Directed Therapy/ or exp Intensive Care Units/ or exp Sepsis/ or exp Respiratory Distress Syndrome/ or exp Respiration, Artificial/ or exp Intubation, Intratracheal/ or Ventilator Weaning/ or weaning.ti,ab,kf. or ((intensive or critical) adj2 care).ti,ab,kf. or critically ill.ti,ab,kf. or acutely ill.ti,ab,kf. or (mechanical*or artificial adj2 ventilat*).ti,ab,kf. or intubat*.ti,ab,kf. or ICU discharge.ti,ab,kf.	629238
3	1 and 2	6886
4	exp Hospital Units/ or Anesthesia Department, Hospital/ or Cardiology Service, Hospital/ or Emergency Service, Hospital/ or Nursing Service, Hospital/ or "Obstetrics and Gynecology Department, Hospital"/ or Oncology Service, Hospital/ or Psychiatric Department, Hospital/ or Surgery Department, Hospital/ or Urology Department, Hospital/ or ward.ti,ab,kf. or ((operating or emergency or recovery or nursing) adj3 (room* or theatre or department* or unit*)).ti,ab,kf.	420750
5	3 and 4	3742
6	5 not ((Adolescent/ or Child/ or Infant/ or adolescen*.ti,ab,kf. or child*.ti,ab,kf. or schoolchild*.ti,ab,kf. or infant*.ti,ab,kf. or girl*.ti,ab,kf. or boy*.ti,ab,kf. or teen.ti,ab,kf. or teens.ti,ab,kf. or teenager*.ti,ab,kf. or youth*.ti,ab,kf. or pediatr*.ti,ab,kf. or paediatr*.ti,ab,kf. or puber*.ti,ab,kf.) not (Adult/ or adult*.ti,ab,kf. or man.ti,ab,kf. or men.ti,ab,kf. or woman.ti,ab,kf. or women.ti,ab,kf.))	3074
7	limit 6 to yr="2000 -Current"	2742
8	7 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/)	2625
9	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*)).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or (((literature adj3 review*) and (search* or database* or data-base*)).ti,ab,kf. or (("data extraction" or "data source*") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*)).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*)).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	702762

10	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2648681
11	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4565515
12	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multigent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or ('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or (('OR" or "RR") adj6 CI).ab.))	5542499
13	8 and 9 <b>SR</b>	87
14	(8 and 10) not 13 <b>Clinical trials</b>	292
15	(8 and (11 or 12)) not 13 not 14 <b>OBS</b>	1240

## Bijlage - Module 5.1 Minimale aantal bedden op de IC

### Search and select

A systematic review of the literature was performed to answer the following question: What is the effect of X ICU beds compared with Y ICU beds on the quality and safety of care of critically ill patients in the ICU?

<b>P</b> (Patients)	: adult ICU patients (>17 years)
<b>I</b> (Intervention)	: X ICU beds
<b>C</b> (Comparison)	: Y ICU beds
<b>O</b> (Outcomes)	: mortality (ICU, hospital), ICU readmission, adverse events, length of stay (ICU, hospital)

### Relevant outcome measures

The guideline development group considered mortality as a critical outcome measure for decision making; and ICU readmission, adverse events and length of stay as an important outcome measure for decision making.

A priori, the working group did not define the outcome measures listed above but used the definitions used in the studies.

The working group defined the following minimal clinically (patient) important differences:

- Mortality (ICU, hospital): 5%, RR <0.95 or >1.05
- ICU readmission: 25%, RR <0.8 or >1.25
- Adverse events: lethal >5%, acute or severe >25%
- Length of stay (ICU, hospital): 1 day

### Search and select (Methods)

The databases Medline (via OVID) and Embase (via Embase.com) were searched with relevant search terms until 26 October 2023. The detailed search strategy is depicted under the tab Methods. The systematic literature search was combined with the search for the module ICU bed occupancy rate and resulted in 1,585 hits. Studies were selected based on the following criteria: Systematic review, RCT or observational study comparing the effect of different numbers of ICU beds on the safety of critically ill patients (>17 years) in the ICU, reporting at least one of the outcomes specified in the PICO, published after 2000. Initially, 18 studies were selected for both modules based on title and abstract screening. After reading the full text, 18 studies were excluded (see the table with reasons for exclusion under the tab Methods), and no studies were included.

### Results

No studies were included from the systematic literature search.

### **Summary of literature**

#### Description of studies

No studies reporting the effect of X ICU beds compared with Y ICU beds on the quality and safety of care for critically ill patients in the ICU were found.

## Results

### **Mortality (ICU, hospital), ICU readmission, Adverse events, Length of stay (ICU, hospital)**

No studies were found that reported the effect of varying ICU bed numbers on the Mortality (ICU, hospital), ICU readmission, Adverse events, Length of stay (ICU, hospital) in/for critically ill patients in the ICU.

#### Level of evidence of the literature

The level of evidence regarding the outcome measure **mortality** could not be graded as no studies reporting the effect of X ICU beds compared with Y ICU beds on mortality in critically ill patients in the ICU were found.

The level of evidence regarding the outcome measure **ICU readmission** could not be graded as no studies reporting X ICU beds compared with Y ICU beds on ICU readmission in critically ill patients in the ICU were found.

The level of evidence regarding the outcome measure **adverse events** could not be graded as no studies reporting X ICU beds compared with Y ICU beds on adverse events in critically ill patients in the ICU were found.

The level of evidence regarding the outcome measure **length of stay** could not be graded as no studies reporting X ICU beds compared with Y ICU beds on length of stay in critically ill patients in the ICU were found.

## **Conclusions**

<b>No GRADE</b>	No evidence was found regarding the effect of varying ICU bed numbers on <b>mortality</b> in critically ill patients in the ICU.  <i>Source: -</i>
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<b>No GRADE</b>	No evidence was found regarding the effect of varying ICU bed numbers on <b>ICU readmission</b> in critically ill patients in the ICU.  <i>Source: -</i>
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<b>No GRADE</b>	No evidence was found regarding the effect of varying ICU bed numbers on <b>adverse events</b> in critically ill patients in the ICU.  <i>Source: -</i>
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<b>No GRADE</b>	No evidence was found regarding the effect of varying ICU bed numbers on <b>length of stay</b> in critically ill patients in the ICU.  <i>Source: -</i>
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### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
Elke IC bestaat uit minimaal vier operationele IC-bedden. Dit betreft bedden die zijn toegerust op het leveren van IC-zorg inclusief het bijbehorende personeel onder de voorwaarden zoals benoemd in deze leidraad. Als een IC bestaat uit meerdere locaties dan mag het aantal operationele	< 1 jaar	- Lokaal: mogelijk afname kosten	- borgen dat de acute zorg 24/7 geborgd blijft binnen het desbetreffende ziekenhuis van de IC-afdeling waar aanbeveling betrekking op heeft evenals borgen continuïteit acute zorgketen adherentiegebied	- onvoldoende draagvlak onder IC-afdelingen waar aanbeveling invloed op heeft - afname pandemische paraatheid NL	- het IC-netwerk van afdelingen waar de aanbeveling betrekking op heeft betrekken bij evt consequenties voor de regio	Medisch en bedrijfskundig manager IC-afdeling waar aanbeveling betrekking op heeft evenals RvB desbetreffende ziekenhuis. Borgen implementatie aanbeveling en continuïteit en kwaliteit van acute zorg	

bedden per locatie kleiner zijn dan vier.							
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## Table of excluded studies

Reference	Reason for exclusion
Bagshaw SM, Wang X, Zygun DA, Zuege D, Dodek P, Garland A, Scales DC, Berthiaume L, Faris P, Chen G, Opgenorth D, Stelfox HT. Association between strained capacity and mortality among patients admitted to intensive care: A path-analysis modeling strategy. <i>J Crit Care</i> . 2018 Feb;43:81-87. doi: 10.1016/j.jcrc.2017.08.032. Epub 2017 Aug 24. PMID: 28854400.	Wrong topic/comparison (included in module about ICU bed occupancy rate)
Blayne MC, Donaldson L, Smith P, Wallis C, Cole S, Lone NI; Scottish Intensive Care Society Audit Group. Intensive care unit occupancy and premature discharge rates: A cohort study assessing the reporting of quality indicators. <i>J Crit Care</i> . 2020 Feb;55:100-107. doi: 10.1016/j.jcrc.2019.09.018. Epub 2019 Oct 9. PMID: 31715526.	Wrong topic/comparison (included in module about ICU bed occupancy rate)
Botros AR, El Razik GM, Alanwer KM, Abd El Salam MM. The association between ICU occupancy rate and each of premature discharge, early readmission, and mortality rate. <i>J Cardiovasc Dis Res</i> . 2021;12(4):476. doi: 10.31838/jcdr.2021.12.04.53	Wrong topic/comparison (occupancy rate instead of the number of beds)
Esparza. Analysis of the intensive care unit bed occupancy and its relationship with the length of stay of admitted patients. <i>Intensive Care Medicine Experimental</i> . 2019	Wrong publication type (meeting abstract)
Gabler NB, Ratcliffe SJ, Wagner J, Asch DA, Rubenfeld GD, Angus DC, Halpern SD. Mortality among patients admitted to strained intensive care units. <i>Am J Respir Crit Care Med</i> . 2013 Oct 1;188(7):800-6. doi: 10.1164/rccm.201304-0622OC. PMID: 23992449; PMCID: PMC3826272.	Wrong topic/comparison (included in module about ICU bed occupancy rate)
Holmberg, M. and Steins, K. and Walther, S. M. Does high ICU occupancy have adverse effects on patient outcomes? an observational multicentre study of the relationship between occupancy, length-of-stay and mortality. <i>Intensive Care Medicine</i> . 2013; 39 :S464	Wrong publication type (conference paper)
Iwashyna TJ, Kramer AA, Kahn JM. Intensive care unit occupancy and patient outcomes. <i>Crit Care Med</i> . 2009 May;37(5):1545-57. doi: 10.1097/CCM.0b013e31819fe8f8. PMID: 19325466; PMCID: PMC2782597.	Wrong topic/comparison (Included in module about ICU bed occupancy rate)

Kim SH, Chan CW, Olivares M, Escobar GJ. Association Among ICU Congestion, ICU Admission Decision, and Patient Outcomes. Crit Care Med. 2016 Oct;44(10):1814-21. doi: 10.1097/CCM.0000000000001850. PMID: 27332046.	Wrong topic/comparison (occupancy rate instead of the number of beds)
Mathews KS, Durst MS, Vargas-Torres C, Olson AD, Mazumdar M, Richardson LD. Effect of Emergency Department and ICU Occupancy on Admission Decisions and Outcomes for Critically Ill Patients. Crit Care Med. 2018 May;46(5):720-727. doi: 10.1097/CCM.0000000000002993. PMID: 29384780; PMCID: PMC5899025.	Wrong topic/comparison (occupancy rate instead of the number of beds)
Nguyen YL, Wallace DJ, Yordanov Y, Trinquart L, Blomkvist J, Angus DC, Kahn JM, Ravaud P, Guidet B. The Volume-Outcome Relationship in Critical Care: A Systematic Review and Meta-analysis. Chest. 2015 Jul;148(1):79-92. doi: 10.1378/chest.14-2195. PMID: 25927593; PMCID: PMC4493880.	Wrong topic/comparison (case volume instead of number of ICU beds)
Robert R, Coudroy R, Ragot S, Lesieur O, Runge I, Souday V, Desachy A, Gouello JP, Hira M, Hamrouni M, Reignier J. Influence of ICU-bed availability on ICU admission decisions. Ann Intensive Care. 2015 Dec;5(1):55. doi: 10.1186/s13613-015-0099-z. Epub 2015 Dec 30. PMID: 26714805; PMCID: PMC4695477.	Wrong topic/comparison (occupancy rate instead of the number of beds)
Sasabuchi Y, Yasunaga H, Matsui H, Lefor AK, Horiguchi H, Fushimi K, Sanui M. The Volume-Outcome Relationship in Critically Ill Patients in Relation to the ICU-to-Hospital Bed Ratio. Crit Care Med. 2015 Jun;43(6):1239-45. doi: 10.1097/CCM.0000000000000943. PMID: 25756414.	Wrong topic/comparison (case volume instead of number of ICU beds)
Stelfox HT, Hemmelgarn BR, Bagshaw SM, Gao S, Doig CJ, Nijssen-Jordan C, Manns B. Intensive care unit bed availability and outcomes for hospitalized patients with sudden clinical deterioration. Arch Intern Med. 2012 Mar 26;172(6):467-74. doi: 10.1001/archinternmed.2011.2315. Epub 2012 Mar 12. PMID: 22412076.	Wrong topic/comparison (occupancy rate instead of the number of beds)
Town JA, Churpek MM, Yuen TC, Huber MT, Kress JP, Edelson DP. Relationship between ICU bed availability, ICU readmission, and cardiac arrest in the general wards. Crit Care Med. 2014 Sep;42(9):2037-41. doi: 10.1097/CCM.0000000000000401. PMID: 24776607; PMCID: PMC4134732.	Wrong topic/comparison (Included in module about ICU bed occupancy rate)

Varney J, Bean N, Mackay M. The self-regulating nature of occupancy in ICUs: stochastic homeostasis. Health Care Manag Sci. 2019 Dec;22(4):615-634. doi: 10.1007/s10729-018-9448-4. Epub 2018 May 3. PMID: 29725895.	Wrong topic/comparison (occupancy rate instead of the number of beds)
Wilcox, M. Elizabeth and Harrison, David A. and Patel, Akshay and Rowan, Kathryn M. Higher ICU Capacity Strain Is Associated With Increased Acute Mortality in Closed ICUs. Critical care medicine. 2020; 48 (5) :709-716	Wrong topic/comparison (included in module about ICU bed occupancy rate)
Wortel SA, de Keizer NF, Abu-Hanna A, Dongelmans DA, Bakhshi-Raiez F. Number of intensivists per bed is associated with efficiency of Dutch intensive care units. J Crit Care. 2021 Apr;62:223-229. doi: 10.1016/j.jcrc.2020.12.008. Epub 2020 Dec 19. PMID: 33434863.	Wrong topic/comparison (number of intensivists per bed)
Yergens DW, Ghali WA, Faris PD, Quan H, Jolley RJ, Doig CJ. Assessing the association between occupancy and outcome in critically ill hospitalized patients with sepsis. BMC Emerg Med. 2015 Oct 19;15:31. doi: 10.1186/s12873-015-0049-y. PMID: 26481448; PMCID: PMC4610044.	Wrong topic/comparison (occupancy rate instead of the number of beds)

### Literature search strategy

Database(s): Embase.com, Ovid/Medline	Datum: 26-10-2023
Periode: vanaf 2000	Talen: geen restrictie

### Zoekopbrengst

	EMBASE	OID/MEDLINE	Ontdubbeld
SR	48	24	58
RCT	429	128	496
Observationele studies	847	467	1031
<b>Totaal</b>	1324	619	<b>1585*</b>

*\*in Rayyan*

### Zoekstrategie

#### Embase.com

No.	Query	Results
#1	'intensive care'/de OR 'intensive care unit'/exp OR 'artificial feeding'/exp OR 'artificial ventilation'/exp OR 'early goal-directed therapy'/exp OR 'sepsis'/exp OR 'acute respiratory failure'/exp OR	1170582

	'respiratory tract intubation'/exp OR 'critically ill patient'/exp OR (((intensive OR critical OR medium) NEAR/2 care):ti,ab,kw) OR 'critically ill':ti,ab,kw OR 'acutely ill':ti,ab,kw OR weaning:ti,kw OR (((mechanical* OR artificial) NEAR/2 ventilat*):ti,ab,kw)	
#2	'hospital bed utilization'/exp OR 'hospital bed capacity'/exp OR (((ratio* OR reduc* OR capacit*) NEAR/3 (bed OR beds)):ti,ab,kw) OR 'occupanc* rate':ti,ab,kw OR 'bed use':ti,ab,kw OR 'bed utiliz*':ti,ab,kw OR 'bed occupanc*':ti,ab,kw	29752
#3	#1 AND #2	3386
#4	#3 AND [2000-2024]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp) NOT (('child'/exp OR child*:ti,ab,kw OR schoolchild*:ti,ab,kw OR infant*:ti,ab,kw OR girl*:ti,ab,kw OR boy*:ti,ab,kw OR teen:ti,ab,kw OR teens:ti,ab,kw OR teenager*:ti,ab,kw OR youth*:ti,ab,kw OR pediater*:ti,ab,kw OR paediatr*:ti,ab,kw OR puber*:ti,ab,kw) NOT ('adult'/exp OR 'aged'/exp OR 'middle aged'/exp OR adult*:ti,ab,kw OR man:ti,ab,kw OR men:ti,ab,kw OR woman:ti,ab,kw OR women:ti,ab,kw))	1677
#5	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasyntes*:ti,ab OR 'meta syntes*':ti,ab	971882
#6	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3899806
#7	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	7896434

#8	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*':ti,ab,kw OR cross?ectional*:ti,ab,kw OR multicient*:ti,ab,kw OR 'multi-cent*':ti,ab,kw OR consecutive*:ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*:ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*:ti,ab,kw OR 'odds ratio*':ab OR 'relative odds':ab OR 'risk ratio*':ab OR 'relative risk*':ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (((or' OR 'rr') NEAR/6 ci):ab)))	14520192
#9	#4 AND #5 <b>SR</b>	48
#10	#3 AND #6 NOT #9 <b>Clinical trials</b>	429
#11	(#7 OR #8) AND #4 NOT #9 NOT #10 <b>OBS</b>	847
#12	#9 OR #10 OR #11	1324
#13	'a mathematical model for simulating daily bed occupancy in an intensive care unit'	1
#14	'the relationship between labour cost per patient and the size of intensive care units: a multicentre prospective study'	1
#15	volume AND of AND activity AND occupancy AND rate AND in AND intensive AND care AND units. AND association AND with AND mortality	1
#16	'rationing critical care beds: a systematic review'	1
#17	'evaluation of icus and weight of quality control indicators: an exploratory study based on chinese icu quality data from 2015 to 2020'	1
#18	#13 OR #14 OR #15 OR #16 OR #17 <b>sleutelartikelen</b>	5
#19	#12 AND #18 <b>sleutelartikelen gevonden</b>	5

## Ovid/Medline

#	Searches	Results
1	Critical Care/ or Critical Illness/ or Early Goal-Directed Therapy/ or exp Intensive Care Units/ or exp Sepsis/ or exp Respiratory Distress Syndrome/ or exp Respiration, Artificial/ or exp Intubation, Intratracheal/ or Ventilator Weaning/ or weaning.ti,ab,kf. or ((intensive or critical) adj2 care).ti,ab,kf. or critically ill.ti,ab,kf. or acutely ill.ti,ab,kf. or (mechanical*or artificial adj2 ventilat*).ti,ab,kf. or intubat*.ti,ab,kf.	628749
2	exp bed occupancy/ or exp Hospital Bed Capacity/ or "bed occupanc*".ti,ab,kf. or "occupanc* rate".ti,ab,kf. or "bed use".ti,ab,kf. or "bed utiliz*".ti,ab,kf. or ((ratio* or reduc*) adj3 (bed or beds)).ti,ab,kf.	29658
3	1 and 2	2345
4	limit 3 to yr="2000 -Current"	1294
5	4 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/) not ((Adolescent/ or Child/ or Infant/ or adolescen*.ti,ab,kf. or child*.ti,ab,kf. or schoolchild*.ti,ab,kf. or infant*.ti,ab,kf. or girl*.ti,ab,kf. or boy*.ti,ab,kf. or teen.ti,ab,kf. or teens.ti,ab,kf. or teenager*.ti,ab,kf. or youth*.ti,ab,kf. or pediatr*.ti,ab,kf. or paediatr*.ti,ab,kf. or puber*.ti,ab,kf.) not (Adult/ or adult*.ti,ab,kf. or man.ti,ab,kf. or men.ti,ab,kf. or woman.ti,ab,kf. or women.ti,ab,kf.))	1072
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or data-base*).ti,ab,kf. or (("data extraction" or "data source*") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	701591
7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or	2646651

	doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	
8	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4560645
9	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multigent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or ('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or ("OR" or "RR") adj6 CI).ab.))	5537929
10	5 and 6 <b>SR</b>	24
11	(5 and 7) not 10 <b>Clinical trials</b>	128
12	(5 and (8 or 9)) not 10 not 11 <b>OBS</b>	467
13	10 or 11 or 12	619

## Bijlage - Module 5.2 Weigeringspercentage

### Onderbouwing

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, gebaseerd op een interpretatie van de werkgroep van de internationale literatuur. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, op basis van de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

#### Resultaten

Het weigeren van patiënten bij wie er een indicatie is vastgesteld voor opname op de intensive care lijkt te zijn geassocieerd met of toont een trend naar een hogere ziekenhuismortaliteit of verhoogde sterfte op dag 28, 60 of 90 na opname op de IC of moment van triage (Joynt, 2001; Sprung, 1999; Robert, 2012; Metcalfe, 1997; Iapichino, 2010; Sinuff, 2004).

Als er sprake is van een situatie waarin er geen opnamecapaciteit beschikbaar is op de IC terwijl er een patiënt is met een opname-indicatie lijken intensivisten onderling verschillende afwegingen te maken. Naast het weigeren van deze patiënt wordt door andere collega's gekozen voor maatregelen om capaciteit te creëren, bijv. door vroegtijdig ontslag van een andere IC-patiënt, overplaatsing naar een andere IC en/of uitstel van de opname tot een later moment (Oerlemans, 2016; Duke, 2009; Cardoso, 2011). Genomen maatregelen om op zo'n moment capaciteit te creëren en de patiënt niet te weigeren zijn geassocieerd met een verhoogd risico op IC- en ziekenhuismortaliteit en een langere ziekenhuisopnameduur (Duke, 2009; Cardoso, 2011).

De weigeringskans van patiënten met een opname-indicatie voor de IC staat in relatie tot het aantal beschikbare of operationele bedden op een IC en/of het bedbezettingspercentage (Sprung, 1999; Garrouste-Orgeas, 2005; De Bruin, 2009; Barado, 2012; Osinaïke, 2017; Louriz, 2012; Sinuff, 2004). De weigeringskans wordt daarnaast beïnvloed door het aantal IC-opnames per dag en patiëntfactoren zoals de ligduur, ziekte-ernst, leeftijd of opnamediagnose (Joynt, 2001; De Bruin, 2009; Barado, 2012; Louriz, 2012; Sinuff, 2004). Dit suggereert dat voor het doen van aanbevelingen bovenstaande factoren in ogenschouw moeten worden genomen en per IC verschillend zijn. Daarnaast hebben de aanbevelingen ook betrekking op patiënten, bij wie een IC-opname is geïndiceerd na een operatie.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijk en voor acties	Overige opmerkingen
<p>Neem maatregelen om het weigeren van een patiënt met een opname-indicatie voor de IC te voorkomen. Dit betreft ook patiënten bij wie een IC-opname is geïndiceerd na een operatie. Maak hierbij gebruik van oplossingsrichtingen, zoals aanwezig binnen de eigen organisatie of binnen het eigen IC-netwerk.</p> <p>Voor de te nemen maatregelen kan aan de volgende aspecten worden gedacht:</p> <ul style="list-style-type: none"> <li>Organisatiefactoren specifiek voor de eigen afdeling, zoals het bedbezettingspercentage, het aantal operationele en beschikbare bedden,</li> </ul>	< 1 jaar	Geen	Coördinatie en regie op de acute zorgketen binnen zowel de eigen organisatie als de regio van het IC-netwerk	Onvoldoende coördinatie op de integrale IC-capaciteit van het desbetreffende IC-netwerk, geen 24/7 beschikbaarheid MICU-transport. Gestelde kaders binnen de CAO.	Maken van afspraken en het vastleggen in het zorgbeleidsplan voor de intensive care (ZBP-IC) en het regionaal samenwerkingsplan van het eigen IC-netwerk.	Medisch en bestuurlijk manager van de intensive care afdeling, raad van bestuur van het desbetreffende ziekenhuis, IC-netwerk waar de desbetreffende afdeling toe behoort	Geen

<p>beschikbare zorgprofessionals, opvangmogelijkheden voor IC-patiënten buiten de IC, regiofunctie met betrekking tot (boven)regionale zorg, etc.;</p> <ul style="list-style-type: none"> <li>• Patiëntgebonden factoren specifiek voor de eigen afdeling, zoals de ligduur, ziekte-ernst, herkomst, opname-diagnoses, leeftijd, kwetsbaarheid/vitaliteit, etc.;</li> <li>• Het dynamisch inzetten van de IC-capaciteit tijdens de verschillende seizoenen, zoals de zomer en winter;</li> </ul> <p>De mogelijkheden om de IC-capaciteit van de verschillende IC's behorend tot een IC-netwerk integraal</p>							
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te benaderen en niet als losstaande afdelingen.							
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## Bijlage - Module 5.3 Minimale bedbezettingspercentage op de IC

### Method

A systematic review of the literature was performed to answer the following question:  
*What is the influence of bed occupancy percentage X on mortality, readmission, complications, patient satisfaction, absenteeism from work and employee satisfaction when compared with bed occupancy percentage Y in adult patients admitted to the ICU?*

P: Adult patients admitted to the ICU  
I: bed occupancy percentage X  
C: bed occupancy percentage Y  
O: mortality, readmission, complications, patient satisfaction, absenteeism from work, employee satisfaction

### Relevant outcome measures

The guideline development group considered mortality, readmission and complications as critical outcome measures for decision making; and patient satisfaction, absenteeism from work and employee satisfaction as an important outcome measure for decision making.

A priori, the working group did not define the outcome measures listed above but used the definitions used in the studies.

The working group defined the following minimal clinically (patient) important difference:

- Mortality:  $0.95 \leq OR \leq 1.05$
- Readmission:  $0.8 \leq OR \leq 1.25$
- Complications:  $0.8 \leq OR \leq 1.25$
- Patient satisfaction: 10% (e.g. 1 point on a 10-point scale)
- Absenteeism from work:  $0.8 \leq OR \leq 1.25$
- Employee satisfaction: 10% (e.g. 1 point on a 10-point scale)

### Search and select (Methods)

The databases Medline (via OVID) and Embase (via Embase.com) were searched for systematic reviews and randomized controlled trials (RCTs) with relevant search terms from 2000 until October 26<sup>th</sup>, 2023. On January 12<sup>th</sup>, 2024, the search was updated with observational studies. The detailed search strategy is depicted under the tab Methods. The systematic literature search was combined with the search for the module minimum number of ICU beds and resulted in 1,585 hits. Studies were selected based on the following criteria:

- Systematic review, RCT or observational study;
- comparing bed occupancy percentage X with bed occupancy percentage Y in adult patients admitted to the ICU;
- reporting at least one of the outcomes specified in the PICO;
- published after 2000.

Initially, 18 studies were selected for both modules based on title and abstract screening.

After reading the full text, 12 studies were excluded (see the table with reasons for exclusion under the tab Methods), and 6 studies were included.

### Results

Two studies were included in the analysis of the literature and four studies were described in a table without GRADE assessment. Important study characteristics and results are summarized in the evidence tables. The assessment of the risk of bias is summarized in the risk of bias tables.

#### Description of studies

Two studies are included in the analysis of the literature. Additionally, four studies are described in a table without GRADE assessment, as these are non-comparative studies which cannot be graded.

**Wilcox (2020)** performed a multicentre observational cohort study to determine whether patients admitted to an intensive care unit (ICU) during times of strain, when compared with its own norm (i.e. accommodating a greater number of patients, higher acuity of illness, or frequent turnover), is associated with a higher risk of death in ICUs with closed models of intensivist staffing. ICU capacity strain is defined as a time varying shortfall of resources (e.g. availability of beds, staff, and equipment) when compared with patient demand (e.g. number and complexity of patients). The patient cohort included 142,310 adult patients admitted between January 1, 2015, and December 31, 2016, to 214 adult general ICUs in 213 hospitals. Primary analysis included admissions during the weekday (Monday to Friday) on daytime (08:00 to 19:59). Secondary analysis included ICU admissions during the (1) weekday (all admissions for 24-hr period) and (2) daytime on the weekend. ICU capacity strain was defined in three ways: 1) bed census (i.e. the number of patients), 2) severity-weighted bed census (i.e. the sum of the ICNARC<sub>H-2015</sub> risk prediction model estimate of risk of acute hospital mortality for such patients), and (3) activity-weighted bed census (the sum of assigned weights for such patients (determined, a priori, new admissions = 2.0, patients present throughout period of interest = 1.0, patients discharged or identified as ready for discharge = 0.5). For each strain metric, patients were then categorized as having been admitted to ICU during periods of low, typical, and high ICU capacity strain for that ICU, defined by being admitted on that calendar day during daytime hours at least 10% below or above the median value for bed census and activity-weighted bed census (3) or 20% below or above the median value for severity-weighted bed census. The primary outcome was acute hospital mortality, and the secondary outcome was ICU mortality. All patients were followed up until ultimate discharge from acute hospital, whether discharged from acute hospital from the original hospital or from a subsequent acute hospital to which the patient was transferred. The median ICU size was 12 beds (interquartile range 8–16; range 3–65). A previous survey of ICUs participating in the audit identified a median of one fulltime equivalent intensivist for every nine patients (interquartile range, 7–11). The mean patient age was 62 years and 55% were men.

**Iwashyna (2009)** conducted a multicentre observational cohort study to examine the association of daily ICU occupancy with outcomes of patients admitted to the ICU on that day. Data from patients admitted to ICUs participating in the APACHE clinical information system was obtained for the period between January 2002 through June 2005. Included ICUs were diverse in size, geographic region and teaching status. A total of 200,499 patients from

108 ICUs in 46 hospitals were included in the study. The exposure of interest is the census of each ICU on the day of ICU admission. Census is defined as the total number of patients who spent at least 2 hours in each ICU on the calendar day on which a given patient was admitted. Primary outcomes were in-hospital mortality and discharge to another hospital. Secondary outcome was ICU length of stay. The mean age of the patient group was 61.5 years (SD 17.60). The mean daily census for the included intensive care units (n=108) was 12.8 (median 11, interquartile range 9-15).

Four additional studies (**Bagshaw, 2018; Blayney, 2020; Gabler, 2013; Town, 2014**) are included and described in a table without GRADE assessment, as these are non-comparative studies which cannot be graded. The results can be found in Table 4.

## **Results**

### **Mortality**

**Wilcox (2020)** reported acute hospital death and ICU mortality in relation to bed census, severity-weighted bed census, and activity-weighted bed census. Results for daytime hours on weekdays are reported in this section. Results are reported in Table 1 and written out below.

#### *Acute hospital mortality*

When calculated by bed census, the adjusted Odds Ratio (OR) for acute hospital mortality was 0.94 (95%CI 0.90 to 0.99) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.04 (95%CI 1.00 to 1.10) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

When calculated by severity-weighted bed census, the adjusted OR for acute hospital mortality was 0.99 (95%CI 0.95 to 1.04) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.05 (95%CI 1.01 to 1.10) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

When calculated by activity-weighted bed census, the adjusted OR for acute hospital mortality was 0.97 (95%CI 0.93 to 1.01) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.05 (95%CI 1.00 to 1.09) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

#### *ICU mortality*

When calculated by bed census, the adjusted OR for ICU mortality was 0.99 (95%CI 0.94 to 1.04) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.04 (95%CI 0.98 to 1.09) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

When calculated by severity-weighted bed census, the adjusted OR for ICU mortality was 1.04 (95%CI 0.99 to 1.10) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.02 (95%CI 0.97 to 1.07) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

When calculated by activity-weighted bed census, the adjusted OR for ICU mortality was 0.98 (95%CI 0.93 to 1.03) for admission during a period of low ICU capacity strain compared with typical ICU capacity strain. The OR was 1.01 (95%CI 0.96 to 1.07) for admission during a period of high ICU capacity strain compared with typical ICU capacity strain.

Strain metrics	Acute hospital mortality, OR (95% CI)	ICU mortality, OR (95% CI)
<i>Bed census – typical</i>	1	1
<i>Bed census – low</i>	0.94 (0.90 to 0.99)	0.99 ( 0.94 to 1.04)
<i>Bed census – higher</i>	1.04 (1.00 to 1.10)	1.04 (0.98 to 1.09)
<i>Severity-weighted bed census – typical</i>	1	1
<i>Severity-weighted bed census – low</i>	0.99 (0.95 to 1.04)	1.04 (0.99 to 1.10)
<i>Severity-weighted bed census – high</i>	1.05 (1.01 to 1.10)	1.02 (0.97 to 1.07)
<i>Activity-weighted bed census – typical</i>	1	1
<i>Activity-weighted bed census – low</i>	0.97 (0.93 to 1.01)	0.98 (0.93 to 1.03)
<i>Activity-weighted bed census – high</i>	1.05 (1.00 to 1.09)	1.01 (0.96 to 1.07)

**Table 1.** Logistic regression analyses for the relationship between ICU capacity strain on day of admission and risk-adjusted acute hospital and ICU mortality for weekdays during daytime hours. OR, Odds Ratio; CI, confidence interval.

**Iwashyna (2009)** reported in-hospital mortality after adjustment for differences in predicted inpatient mortality using APACHE IV. The results are reported in Table 2.

Census low to high (ratio to mean census)	Outcome strata	In-hospital death (n=108 ICUs, n=196,877 patients) OR (95% CI)
	Decile 1	1.01 (0.939 to 1.086)
	Decile 2	0.952 (0.886 to 1.023)
	Decile 3	0.972 (0.905 to 1.044)
	Decile 4	0.986 (0.917 to 1.059)
	Decile 5	0.934 (0.868 to 1.005)
	Decile 6	Reference
	Decile 7	0.985 (0.916 to 1.06)
	Decile 8	1.051 (0.977 to 1.13)
	Decile 9	0.995 (0.925 to 1.071)
Decile 10	0.983 (0.911 to 1.062)	

**Table 2.** Effect on in-hospital death of daily census for all patients. OR, Odds Ratio; CI, confidence interval.

### Readmission

**Iwashyna (2009)** reported readmission to the intensive care unit within 7 days of discharge. Results are depicted in Table 3.

Census low to high (ratio to mean census)	Outcome strata	Readmission to the intensive care unit within 7 days of discharge (n=108 ICUs, n=196,877 patients) OR (95% CI)
	Decile 1	1.001 (0.891 to 1.125)
	Decile 2	0.986 (0.88 to 1.105)
	Decile 3	1.02 (0.911 to 1.143)
	Decile 4	1.078 (0.963 to 1.206)
	Decile 5	0.944 (0.839 to 1.062)
	Decile 6	Reference
	Decile 7	1.007 (0.895 to 1.132)
	Decile 8	1.004 (0.896 to 1.126)
	Decile 9	1.034 (0.922 to 1.16)
Decile 10	1.002 (0.889 to 1.129)	

**Table 3.** Effect on readmission to the intensive care unit within 7 days of daily census for all patients

**Wilcox (2020)** did not report readmission.

### Complications

**Wilcox (2020) and Iwashyna (2009)** did not report complications.

### Patient satisfaction

**Wilcox (2020) and Iwashyna (2009)** did not report patient satisfaction.

### Absenteeism from work

**Wilcox (2020) and Iwashyna (2009)** did not report absenteeism from work.

### Employee satisfaction

**Wilcox (2020) and Iwashyna (2009)** did not report employee satisfaction.

Reference	Study design and methods	Study population	Findings
Bagshaw, 2018	<p>Multi-center population-based cohort study in 9 adult ICUs in Alberta, Canada.</p> <p>Primary exposure was ICU strain, defined as instantaneous bed availability (<math>\leq 1</math>, <math>\leq 2</math> or <math>\leq 3</math> beds available at the time of patient admission) and as instantaneous bed occupancy (<math>\geq 90\%</math>, <math>\geq 95\%</math> proportion of occupied beds at the time of patient admission).</p> <p>A path-analysis model was developed to estimate the magnitude and significance of hypothesized causal associations (direct, indirect and the total combined effect of both) between measures of strained capacity and outcomes (see Figure 1 in the article). A mixed-effects linear regression model was used, adjusting for co-variables (see section 2.4.1 in the article for more information).</p>	<p>All consecutive adults (age <math>\geq 15</math> yrs) admitted to any of the 9 ICUs were eligible for inclusion.</p> <p>There were 12,265 ICU admissions to all ICUs during the study period.</p> <p>Patient age, median (IQR): 59 years (46–70)</p> <p>Sex male: 58.3%</p> <p>Comorbidity, n (%): 10,485 (85.49)</p> <p>Admission APACHE II score, mean (SD): 20.2 (8.4)</p> <p>Surgery-related admissions: 26.7%</p> <p>ICU mortality: 14.7% (n = 1802).</p>	<p><u>Effect of strained ICU capacity on ICU mortality</u></p> <p>Direct effect</p> <p>Available beds <math>\leq 1</math>: OR 1.116 (95%CI 0.995, 1.252) Available beds <math>\leq 2</math>: OR 1.025 (95%CI 0.928, 1.133) Available beds <math>\leq 3</math>: OR 0.948 (95% CI 0.856, 1.051) Occupancy <math>\geq 90\%</math>: OR 1.042 (95% CI 0.936, 1.160) Occupancy <math>\geq 95\%</math>: OR 1.095 (95% CI 0.962, 1.247)</p> <p>Indirect effect</p> <p>Available beds <math>\leq 1</math>: OR 1.044 (95%CI 1.018, 1.070) Available beds <math>\leq 2</math>: OR 1.037 (95%CI 1.016, 1.059) Available beds <math>\leq 3</math>: OR 1.029 (95% CI 1.008, 1.052) Occupancy <math>\geq 90\%</math>: OR 1.047 (95% CI 1.024, 1.072) Occupancy <math>\geq 95\%</math>: OR 1.047 (95% CI 1.017, 1.077)</p> <p>Total (integrated) effect</p> <p>Available beds <math>\leq 1</math>: OR 1.165 (95%CI 1.036, 1.310) Available beds <math>\leq 2</math>: OR 1.063 (95%CI 0.960, 1.178) Available beds <math>\leq 3</math>: OR 0.976 (95% CI 0.879, 1.084) Occupancy <math>\geq 90\%</math>: OR 1.091 (95% CI 0.978, 1.218) Occupancy <math>\geq 95\%</math>: OR 1.146 (95% CI 1.004, 1.309)</p> <p><u>Effect of strained ICU capacity on hospital mortality</u></p> <p>Direct effect</p>

			<p>Available beds <math>\leq</math> 1: OR 1.05 (95% CI 0.955, 1.155)  Available beds <math>\leq</math> 2: OR 1.041 (95% CI 0.959, 1.13)  Available beds <math>\leq</math> 3: OR 0.961 (95% CI 0.883, 1.045)  Occupancy <math>\geq</math> 90%: OR 1.017 (95% CI 0.931, 1.11)  Occupancy <math>\geq</math>95%: OR 1.033 (95% CI 0.928, 1.15)</p> <p>Indirect effect</p> <p>Available beds <math>\leq</math> 1: OR 1.033 (95%CI 1.014, 1.053)  Available beds <math>\leq</math> 2: OR 1.028 (95%CI 1.012, 1.045)  Available beds <math>\leq</math> 3: OR 1.022 (95% CI 1.006, 1.039)  Occupancy <math>\geq</math> 90%: OR 1.036 (95% CI 1.018, 1.054)  Occupancy <math>\geq</math> 95%: OR 1.035 (95% CI 1.013, 1.058)</p> <p>Total (integrated) effect</p> <p>Available beds <math>\leq</math> 1: OR 1.085 (95%CI 0.985, 1.195)  Available beds <math>\leq</math> 2: OR 1.070 (95%CI 0.985, 1.163)  Available beds <math>\leq</math> 3: OR 0.982 (95% CI 0.901, 1.07)  Occupancy <math>\geq</math> 90%: OR 1.053 (95% CI 0.963, 1.152)  Occupancy <math>\geq</math> 95%: OR 1.069 (95% CI 0.958, 1.193)</p>
Blayney, 2020	<p>Retrospective cohort study</p> <p>The exposure variable was daily occupancy, calculated as the sum of the proportion of the day each patient spent on the unit (derived from</p>	<p>All patients admitted to every Scottish adult general ICU from 2006-2014.</p> <p>N total at baseline:  Total: 77,209 patients</p>	<p>Mortality</p> <p>14.7% of patients experiencing early discharge died before ultimate hospital discharge compared with 7.4% of those not experiencing early</p>

	<p>admission and discharge times), divided by the number of beds in that unit each day. For example, on a 4-bed unit, if three patients spent the entire day on the unit, a fourth patient was admitted at midday and there were no discharges, occupancy would be <math>3.5/4 = 0.875</math> (87.5%). Using this formula, it is possible that units may function at an occupancy exceeding 1. This is because some units in Scotland have spare physical (but not funded) beds to facilitate patient admission whilst another is prepared for discharge.</p> <p>Ultimate hospital mortality was reported for patients who experienced early discharge from ICU compared to those who did not, and for patients experiencing non clinical transfer (NCT) compared to patients who did not experience NCT. These were stratified by the occupancy level on the day of discharge (N70%, N80%, N90%), and by time of discharge (day-time vs night-time. Night-time was defined as after 22:00 and before 08:00, as per SICSAG definition. All readmissions to ICU were excluded from these analyses.</p>	<p>Important prognostic factors:</p> <p>Age, median (QR) Total group: 62 (47 – 72)</p> <p>Sex, n male (%) Total group: 43,943 (56.9%)</p>	<p>discharge. Similarly, 30.0% of patients experiencing NCT died compared with 7.5% of those not experiencing NCT.</p>
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<p>Gabler, 2013</p>	<p>Retrospective cohort study</p> <p>The primary exposures were three metrics of ICU capacity strain measured on the day of a patient's admission: (1) standardized census, (2) acuity, and (3) admissions.</p> <p>Primary and secondary outcomes were analyzed by hierarchical logistic regression in which ICU-year was modeled as a fixed effect to adjust for correlation of outcomes within ICUs and to prevent confounding by practice differences among ICUs or within ICUs over time.</p> <p>Before model building, used locally weighted scatterplot smoothing was used to determine whether variables required transformation or could be entered linearly. Log transformation was required for admitted patients' MPM0-III scores. Strain variables were entered as continuous variables and all three were included in each model. We explored two-way interactions between strain variables for each outcome.</p>	<p>Patients admitted to U.S. ICUs included in the Project IMPACT database. Eligible patients were admitted between April 1, 2001 and December 31, 2008 to U.S. ICUs included in IMPACT.</p> <p>Total at baseline: 264,401 patients admitted to 155 ICUs in 107 Hospitals</p> <p>Patients' mean age was 60 years (SD, 18), 54% were male, and 77% were white.</p>	<p>The primary outcome was in-hospital death, which included patients dying during their initial ICU stay plus those dying after ICU discharge, including deaths in a step-down unit, on a general floor, or during an ICU readmission. The secondary outcome of ICU death included deaths occurring during the initial ICU admission plus patients discharged from the ICU in a moribund state.</p> <p><u>Results</u></p> <p>Quotes:</p> <p>"In adjusted analyses including patient-level covariates and all three strain variables without interaction terms, standardized ICU census on the day of admission was associated with increased odds that admitted patients would die in the hospital (OR for a standardized unit increase, 1.02; 95% CI: 1.00, 1.03). The proportion of ICU admissions was inversely associated with the odds of inhospital death (OR for a 10% increase in admissions, 0.98; 95% CI: 0.96, 0.99), and ICU acuity had no significant effect (OR for a 10% increase in acuity, 1.00; 95% CI: 0.97, 1.02)."</p> <p>"Similar results were observed for the secondary outcome of ICU death. There was a significant interaction between standardized census and acuity for both in-</p>
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			<p>hospital death (P value for interaction &lt; 0.01) and ICU death (P value for interaction = 0.04), such that standardized ICU census was more strongly associated with death when the standardized census comprised sicker patients. For example, the OR for in-hospital death for each standardized unit increase in ICU census is 1.06 (95% CI: 1.01, 1.11) for the highest decile of ICU acuity, and 0.98 (95% CI: 0.93, 1.03) for the lowest decile of ICU acuity.”</p> <p>“The effect of standardized census on in-hospital death was greater among ICUs with closed physician staffing models (OR, 1.07; 95% CI: 1.02, 1.12) than among ICUs with open physician staffing models (OR, 1.01; 95% CI: 0.99, 1.03) (P value for interaction = 0.02). Similar effects were noted for ICU death. Corresponding interactions between ICU capacity strain measures and the ICU characteristics of annualized patient volume, nocturnal intensivist staffing, academic affiliation, and medical– surgical case mix were all nonsignificant.”</p>
Town, 2014	<p>Observational cohort study</p> <p>Between January 1, 2009, and December 31, 2011, at a tertiary care academic medical</p>	<p>Over the study period, there were 60,355 admissions over 2,190 consecutive shifts, of which 2,086 (95.3%) had complete data.</p>	<p>The article reports ICU readmission rates by ICU bed availability in quartiles (see also Figure 1 in the article).</p> <p>Quote: “The odds of readmission to the ICU significantly increased with each unit decrease in total ICU bed</p>

	<p>center with 63 total adult ICU beds, including specialized medical, cardiac, surgical, and neurological ICUs, and 272 adult general inpatient ward beds.</p> <p>ICU bed availability was collected in a handwritten institutional log. At the start of each 7 am and 7 pm shift, the ICU manager or charge nurse recorded the census and capacity of each ICU. The “census” refers to the number of patients within the ICU at the start of the shift. The “capacity” refers to the total number of beds available to accommodate patients with the available nurses for the shift. Therefore, if there were 10 physical beds, but only enough nurses to care for eight patients, then the capacity would have been logged as eight. Bed availability represents the capacity minus the census.</p> <p>The final models were adjusted for potential confounders by adding the variables of calendar year (2008, 2009, etc.), season (Summer, Spring, etc.), day of week (Monday, Tuesday, etc.), and time of day (day vs night).</p>	<p>The mean age of all admitted patients was <math>54 \pm 18</math> years, 43% were men, and 24% were surgical admissions.</p>	<p>availability after adjusting for potential confounders (odds ratio [OR] = 1.06; 95% CI, 1.00–1.12; <math>p = 0.03</math>).”</p>
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**Table 4.** *Non-comparative studies*

## Level of evidence of the literature

### *Mortality*

The level of evidence regarding the outcome measure mortality was downgraded by two levels to **very low** because of study limitations in the study of Wilcox et al. (risk of bias, -1); and the confidence intervals around the point estimates crossing either the upper or lower boundary for clinical relevance (imprecision, -1).

### *Readmission*

The level of evidence regarding the outcome measure readmissions was downgraded by two levels to **very low** because of study limitations (risk of bias, -1); and the confidence intervals around the point estimates crossing either the upper or lower boundary for clinical relevance (imprecision, -1).

### *Complications, patient satisfaction, absenteeism from work, and employee satisfaction*

No study reported these outcome measures, and these could therefore not be graded.

## **Conclusions**

### *Mortality*

<b>Very low GRADE</b>	The evidence is very uncertain about the effect of different bed occupancy rates on mortality when comparing adult patients admitted to the ICU.  <i>Source: Wilcox, 2020; Iwashyna, 2009</i>
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### *Readmissions*

<b>Very low GRADE</b>	The evidence is very uncertain about the effect of different bed occupancy rates on readmissions in adult patients admitted to the ICU.  <i>Source: Iwashyna, 2009</i>
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### *Complications, patient satisfaction, absenteeism from work, and employee satisfaction*

<b>No GRADE</b>	No evidence was found regarding the effect of different bed occupancy rates on complications, patient satisfaction, absenteeism from work, and employee satisfaction in adult patients admitted to the ICU.
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## Implementatieplan

Aanbeveling	Tijdsplan voor implementatie : < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdsplan)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijke(n) voor acties	Overige opmerkingen
<p>Neem maatregelen om een hoge bedbezetting en/of een laag aantal beschikbare IC-bedden te voorkomen.</p> <p>Houd bij eventueel te nemen maatregelen rekening met het aantal operationele bedden en de dynamiek en het karakter van de eigen afdeling en organisatie. Een bedbezetting van 80% tot 90% kan gezien worden als optimaal. Naarmate het aantal operationele bedden kleiner is lijkt het</p>	1-3 jaar	Evt toename vanwege uitbreiding IC-capaciteit	<ul style="list-style-type: none"> <li>- bedbezetting tussen de 80 - 90%</li> <li>- bijpassende financiering</li> <li>- mogelijkheid om formatie uit te breiden</li> </ul>	<ul style="list-style-type: none"> <li>- personeelsgebrek</li> <li>- fysieke uitbreiding IC-capaciteit</li> <li>- regiofunctie IC-afdeling</li> <li>- financiering</li> <li>- inzetten capaciteit IC-netwerk om lokale afdeling te faciliteren</li> </ul>	<ul style="list-style-type: none"> <li>- Creëren uitbreiding fysieke IC-capaciteit</li> <li>- Opleiden en aantrekken extra personeel</li> </ul>	<p>Medisch en bestuurlijk manager IC-afdeling evenals RvB IC-netwerk van desbetreffende IC-afdeling</p>	

raadzaam om te streven naar een lager maximaal bedbezettingspercentage binnen de genoemde bandbreedte.							
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## Evidence tables

### Evidence table for intervention studies

Study reference	Study characteristics	Patient characteristics <sup>2</sup>	Intervention (I)	Comparison / control (C) <sup>3</sup>	Follow-up	Outcome measures and effect size <sup>4</sup>	Comments															
Wilcox, 2020	<p>Type of study: large, multicenter, observational cohort study</p> <p>Setting and country: 215 adult general ICUs in 213 hospitals in United Kingdom, Wales, and Northern Ireland</p> <p>Funding and conflicts of interest: Nothing to declare.</p>	<p><u>Inclusion criteria:</u> All participating ICUs are closed, patients are primarily cared for by Anesthetists with specific Critical Care training, and nurses provide one-to-one care to patients. Analyses were restricted to participating ICUs that had submitted a minimum of 1 year's data</p>	<p>Describe intervention (treatment/procedure/test):</p> <p>Three groups compared: low (intervention 1), typical (intervention 2) or high (control) ICU capacity strain.</p> <p>The strain metrics used were defined in three ways (1): bed census, (2) severity-weighted bed census, and (3) activity-weighted bed census.</p> <p>For each strain metric, patients were then categorized as having been admitted to ICU during periods of <b>low</b>, <b>typical</b>, and <b>high</b> ICU capacity strain for that ICU, defined by being admitted on that calendar day during</p>	<p>Describe control (treatment/procedure/test):</p> <p>See intervention description.</p>	<p><u>Length of follow-up:</u> Hospital discharge</p> <p><u>Loss-to-follow-up:</u> Excluded from the analysis (total): N=19,715 out of 335,703 (5.9%)</p> <p>Reasons: 0.7% admitted before Jan 2015 4.7% readmission within the same acute hospital stay 0.1% dead on admission or organ donation 0.2% missing acute hospital outcome 0.2% missing all physiology</p> <p><u>Incomplete outcome data:</u></p>	<p><u>Mortality</u> Logistic regression analyses for the relationship between ICU capacity strain on day of admission and risk-adjusted acute hospital and ICU mortality for weekdays during daytime hours:</p> <table border="1"> <thead> <tr> <th>Strain metrics</th> <th>Acute hospital mortality</th> <th>ICU mortality</th> </tr> </thead> <tbody> <tr> <td><i>Bed census – typical</i></td> <td>1</td> <td>1</td> </tr> <tr> <td><i>Bed census – low</i></td> <td>0.94 (95%CI 0.90 to 0.99)</td> <td>0.99 (95%CI 0.94 to 1.04)</td> </tr> <tr> <td><i>Bed census – higher</i></td> <td>1.04 (95%CI 1.00 to 1.10)</td> <td>1.04 (95%CI 0.98 to 1.09)</td> </tr> <tr> <td><i>Severity-weighted bed</i></td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Strain metrics	Acute hospital mortality	ICU mortality	<i>Bed census – typical</i>	1	1	<i>Bed census – low</i>	0.94 (95%CI 0.90 to 0.99)	0.99 (95%CI 0.94 to 1.04)	<i>Bed census – higher</i>	1.04 (95%CI 1.00 to 1.10)	1.04 (95%CI 0.98 to 1.09)	<i>Severity-weighted bed</i>	1	1	<p><u>Author's conclusion:</u> In closed staffing models of care, variations in bed census within individual ICUs was associated with patient's predicted risk of acute hospital mortality, particularly when its standardized bed census consisted of sicker patients.</p> <p>Limitations: we are unable to provide unit-level data on key organizational covariates such as educational qualifications of nursing staff or experienced strain in the emergency department or ward on the index day of ICU admission or on important outcomes that</p>
Strain metrics	Acute hospital mortality	ICU mortality																				
<i>Bed census – typical</i>	1	1																				
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<i>Bed census – higher</i>	1.04 (95%CI 1.00 to 1.10)	1.04 (95%CI 0.98 to 1.09)																				
<i>Severity-weighted bed</i>	1	1																				

		<p>within the 2-year study period. Only the first ICU admission in each patient's hospital stay was included so as to not double count hospital deaths.</p> <p><u>Exclusion criteria:</u> missing data (e.g. date and timing of discharge, primary outcome, or all physiologic variables) or death at admission or admitted for organ the sole purpose of organ procurement</p> <p><u>N total at baseline:</u></p>	<p>daytime hours at least 10% below or above the median value for bed census (1) and activity-weighted bed census (3) or 20% below or above the median value for severity-weighted bed census (2), where these percentage thresholds were chosen to ensure that approximately 50% of patients fell into each metric's typical strain category. In this way, low or high ICU capacity strain was estimated relative to the typical ICU capacity strain for each ICU.</p>		<p>See above, patients with missing data were excluded</p>	<table border="1"> <tr> <td><i>census – typical</i></td> <td></td> <td></td> </tr> <tr> <td><i>Severity-weighted bed census – low</i></td> <td>0.99 (95%CI 0.95 to 1.04)</td> <td>1.04 (95%CI 0.99 to 1.10)</td> </tr> <tr> <td><i>Severity-weighted bed census – high</i></td> <td>1.05 (95%CI 1.01 to 1.10)</td> <td>1.02 (95%CI 0.97 to 1.07)</td> </tr> <tr> <td><i>Activity-weighted bed census – typical</i></td> <td>1</td> <td>1</td> </tr> <tr> <td><i>Activity-weighted bed census – low</i></td> <td>0.97 (95%CI 0.93 to 1.01)</td> <td>0.98 (95%CI 0.93 to 1.03)</td> </tr> <tr> <td><i>Activity-weighted bed census – high</i></td> <td>1.05 (95%CI 1.00 to 1.09)</td> <td>1.01 (95%CI 0.96 to 1.07)</td> </tr> </table> <p><u>Readmission</u> Not reported.</p> <p><u>Complications</u> Not reported</p> <p><u>Patient satisfaction</u> Not reported</p> <p><u>Absenteeism from work</u> Not reported</p>	<i>census – typical</i>			<i>Severity-weighted bed census – low</i>	0.99 (95%CI 0.95 to 1.04)	1.04 (95%CI 0.99 to 1.10)	<i>Severity-weighted bed census – high</i>	1.05 (95%CI 1.01 to 1.10)	1.02 (95%CI 0.97 to 1.07)	<i>Activity-weighted bed census – typical</i>	1	1	<i>Activity-weighted bed census – low</i>	0.97 (95%CI 0.93 to 1.01)	0.98 (95%CI 0.93 to 1.03)	<i>Activity-weighted bed census – high</i>	1.05 (95%CI 1.00 to 1.09)	1.01 (95%CI 0.96 to 1.07)	<p>have been suggested to contribute to mortality during periods of high strain (e.g. provision of deep vein thrombosis prophylaxis or availability of a pharmacist for best possible medication review). Although analyses of the interaction between the effect of strain and acute severity of illness showed no statistically significant heterogeneity, the study was likely to be underpowered to detect such a relationship, and we cannot rule out the potential for endogeneity between severity, capacity strain and mortality</p>
<i>census – typical</i>																									
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		<p>Intervention 1: 38,125 Intervention 2: 68,403 Control: 35,782</p> <p><u>Important prognostic factors</u><sup>2</sup>: <i>For example</i> <i>age ± SD:</i> I1: 62.9±17.2 I2: 61.9±17.2 C: 62.6±17.2</p> <p><i>Sex:</i> I1: 54.9% M I2: 55.3% M C: 54.9% M</p> <p><i>Presence of any severe comorbidity, n (%)</i> I1: 7,231 (19.0) I2: 13,426 (19.6) C: 6,385 (17.8)</p> <p>Groups are comparable at baseline</p>				<p><u>Employee satisfaction</u> Not reported</p>	
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Iwashyna, 2009	<p>Type of study: large, multicenter, observational study</p> <p>Setting and country: 108 ICUs in 46 hospitals in the USA</p> <p>Funding and conflicts of interest: supported by NIH/NHLBI 5T32HL007891 and K08-HL091249 (to TJI). Dr. Kramer is employed by Cerner Corporation and has stock ownership and stock options in Cerner Corporation, which provides the APACHE data systems used as a basis of</p>	<p><u>Inclusion criteria:</u> All patients admitted to APACHE ICUs were eligible for the study</p>	<p>Describe intervention (treatment/procedure/test):</p> <p>High census days</p> <p>Census is defined as the total number of patients who spent at least 2 hours in each ICU on the calendar day on which a given patient was admitted. The mean census of each ICU across the study period was computed. ICU census is analyzed as the ratio of the day-of-admission census to the mean census, divided into deciles.</p> <p>Mean daily census was 12.8 across ICUs, with a median of 11 and an interquartile range of 9–15. There was wide variability in the day-of-admission census. The lowest decile of patients were admitted to ICUs with a census at 65% of their mean daily census; the highest decile of patients were admitted to ICUs operating at 147% of their mean daily census.</p>	<p>Describe control (treatment/procedure/test):</p> <p>Low census days</p> <p>See intervention description</p>	<p><u>Length of follow-up:</u> Hospital discharge</p> <p><u>Loss-to-follow-up:</u> For length of stay in the ICU, 16,400 patients (total) in eight ICUs were excluded from analysis. Reason: the precise entrance and exit times within a given day are not in the dataset.</p> <p><u>Incomplete outcome data:</u> See above</p>	<p><u>Mortality</u></p> <table border="1"> <thead> <tr> <th></th> <th>Outcome strata</th> <th>In-hospital death (n=108 ICUs, n=196,877 patients) OR (95% CI)</th> </tr> </thead> <tbody> <tr> <td rowspan="10" style="writing-mode: vertical-rl; transform: rotate(180deg);">Census low to high (ratio to mean census)</td> <td>Decile 1</td> <td>1.01 (0.939 to 1.086)</td> </tr> <tr> <td>Decile 2</td> <td>0.952 (0.886 to 1.023)</td> </tr> <tr> <td>Decile 3</td> <td>0.972 (0.905 to 1.044)</td> </tr> <tr> <td>Decile 4</td> <td>0.986 (0.917 to 1.059)</td> </tr> <tr> <td>Decile 5</td> <td>0.934 (0.868 to 1.005)</td> </tr> <tr> <td>Decile 6</td> <td>Reference</td> </tr> <tr> <td>Decile 7</td> <td>0.985 (0.916 to 1.06)</td> </tr> <tr> <td>Decile 8</td> <td>1.051 (0.977 to 1.13)</td> </tr> <tr> <td>Decile 9</td> <td>0.995 (0.925 to 1.071)</td> </tr> <tr> <td>Decile 10</td> <td>0.983 (0.911 to 1.062)</td> </tr> </tbody> </table>			Outcome strata	In-hospital death (n=108 ICUs, n=196,877 patients) OR (95% CI)	Census low to high (ratio to mean census)	Decile 1	1.01 (0.939 to 1.086)	Decile 2	0.952 (0.886 to 1.023)	Decile 3	0.972 (0.905 to 1.044)	Decile 4	0.986 (0.917 to 1.059)	Decile 5	0.934 (0.868 to 1.005)	Decile 6	Reference	Decile 7	0.985 (0.916 to 1.06)	Decile 8	1.051 (0.977 to 1.13)	Decile 9	0.995 (0.925 to 1.071)	Decile 10	0.983 (0.911 to 1.062)	<p>Author's conclusion: Our results demonstrate that unusually high census on day of admission is not associated with clinically meaningful negative outcomes among critically ill patients across a range of conditions. This implies, but does not yet prove, that patients may be concentrated in high-volume ICUs without overwhelming those ICUs, and without thereby losing the potential benefits of concentration.</p>
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<p><u>Exclusion criteria:</u> Patients with CABG, and ICUs caring for fewer than 100 patients in the data and the first 100 patients at a site to ensure that our census measures were stable</p> <p><u>N total at baseline:</u> Not reported per group. Total: 200,499</p> <p><u>Important prognostic factors:</u></p>																																

	<p>the analysis. The remaining authors have not disclosed any potential conflicts of interest</p>	<p><i>Not reported per group age ± SD (total), y: 61.54±17.60</i></p> <p><i>Sex: Not reported</i></p> <p><i>Acute Physiology Score, median: 34</i></p> <p>Groups comparable at baseline? Not compared, only baseline data from total population available</p>				<p><u>Readmission</u></p> <table border="1"> <thead> <tr> <th rowspan="10">Census low to high (ratio to mean census)</th> <th>Outcome strata</th> <th>Readmission to the intensive care unit within 7 days of discharge (n=108 ICUs, n=196,877 patients) OR (95% CI)</th> </tr> </thead> <tbody> <tr> <td>Decile 1</td> <td>1.001 (0.891 to 1.125)</td> </tr> <tr> <td>Decile 2</td> <td>0.986 (0.88 to 1.105)</td> </tr> <tr> <td>Decile 3</td> <td>1.02 (0.911 to 1.143)</td> </tr> <tr> <td>Decile 4</td> <td>1.078 (0.963 to 1.206)</td> </tr> <tr> <td>Decile 5</td> <td>0.944 (0.839 to 1.062)</td> </tr> <tr> <td>Decile 6</td> <td>Reference</td> </tr> <tr> <td>Decile 7</td> <td>1.007 (0.895 to 1.132)</td> </tr> <tr> <td>Decile 8</td> <td>1.004 (0.896 to 1.126)</td> </tr> <tr> <td>Decile 9</td> <td>1.034 (0.922 to 1.16)</td> </tr> <tr> <td>Decile 10</td> <td>1.002 (0.889 to 1.129)</td> </tr> </tbody> </table>	Census low to high (ratio to mean census)	Outcome strata	Readmission to the intensive care unit within 7 days of discharge (n=108 ICUs, n=196,877 patients) OR (95% CI)	Decile 1	1.001 (0.891 to 1.125)	Decile 2	0.986 (0.88 to 1.105)	Decile 3	1.02 (0.911 to 1.143)	Decile 4	1.078 (0.963 to 1.206)	Decile 5	0.944 (0.839 to 1.062)	Decile 6	Reference	Decile 7	1.007 (0.895 to 1.132)	Decile 8	1.004 (0.896 to 1.126)	Decile 9	1.034 (0.922 to 1.16)	Decile 10	1.002 (0.889 to 1.129)	
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### Risk of bias table for interventions studies

Author, year	Selection of participants	Exposure	Outcome of interest	Confounding-assessment	Confounding-analysis	Assessment of outcome	Follow up	Co-interventions	Overall Risk of bias
	Was selection of exposed and non-exposed cohorts drawn from the same population?	Can we be confident in the assessment of exposure?	Can we be confident that the outcome of interest was not present at start of study?	Can we be confident in the assessment of confounding factors?	Did the study match exposed and unexposed for all variables that are associated with the outcome of interest or did the statistical analysis adjust for these confounding variables?	Can we be confident in the assessment of outcome?	Was the follow up of cohorts adequate? In particular, was outcome data complete or imputed?	Were co-interventions similar between groups?	
	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Definitely yes, probably yes, probably no, definitely no	Low, Some concerns, High
Wilcox, 2020	<i>Probably yes</i>  Reason: All ICU admissions within a 24 hour time frame were identified	<i>Probably no</i>  Reason: low or high ICU capacity strain was estimated relative to the typical ICU capacity strain for each ICU	<i>Definitely yes</i>  Reason: Outcome of interest is hospital mortality, participants were excluded if dead on admission	<i>Probably yes</i>  Reason: Primary and secondary outcomes were analyzed by multilevel mixed effects logistic regression, with	<i>Probably no</i>  Reason: Outcomes were risk adjusted. However, key organizational covariates such as educational qualifications of nursing staff or	<i>Probably yes</i>  Reason: Reasons for missing outcome data unlikely to be related to true outcome	Definitely yes  Reason: follow up was adequate for all outcomes. Missing data cases were excluded.	<i>Unclear</i>	<b>Some concerns (mortality)</b>  Due to no correction for key organizational confounders

				<p>separate models for each strain metric, including random effects for each ICU, and with the following covariates: ICU capacity strain (high and low vs typical), age (linear), sex, severe comorbidities, dependency prior to ICU admission, location prior to ICU admission, urgency (elective/ emergency) of surgery, ICNARC Physiology Score (linear) (10), primary reason for ICU admission (categorized according to the ICNARCH-2015 risk prediction</p>	<p>experienced strain in the emergency department or ward could contribute to mortality, and were not taken into account.</p>				
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				model) (11), and time trend (linear).					
Iwashyna, 2009	<i>Probably yes</i> Reason: All participants were admitted to APACHE ICUs, no further selection made	<i>Probably no</i> Reason: Daily census on the day of admission was estimated for each patient and defined in relation to the mean census.	Definitely yes Reason: outcome of interest is mortality, and therefore quite certainly not present at start of the study	Probably yes; Reason: adjustment for all plausible confounding variables	Probably yes; Reason: Quote from method section: "risk adjustment was performed using the APACHE IV risk-adjustment formulae. The risk equations include the day one acute physiology score, age, select chronic health items, primary diagnosis, hospital admission source, pre-ICU length of stay, whether a sedated patient could have his/her Glasgow Coma Score assessed, a patient was receiving invasive mechanical ventilation, and the	Probably no Reason: 16,400 patients excluded for length of ICU stay. Not reported in which decile they belong.	Definitely yes Reason: follow up was adequate for all outcomes.	<i>Unclear</i>	<b>Low (mortality)</b> <b>Some concerns (readmissions)</b>

					<p>patient had received emergency surgery.”</p> <p>However, a lot of data was presented as unadjusted. For readmissions, no information was given as to whether this data was adjusted or not.</p>				
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**Table of excluded studies**

Reference	Reason for exclusion
Botros AR, El Razik GM, Alanwer KM, Abd El Salam MM. The association between ICU occupancy rate and each of premature discharge, early readmission, and mortality rate. J Cardiovasc Dis Res. 2021;12(4):476. doi: 10.31838/jcdr.2021.12.04.53	Setting not relevant
Esparza. Analysis of the intensive care unit bed occupancy and its relationship with the length of stay of admitted patients. Intensive Care Medicine Experimental. 2019	Wrong publication type (meeting abstract)
Holmberg, M. and Steins, K. and Walther, S. M. Does high ICU occupancy have adverse effects on patient outcomes? an observational multicentre study of the relationship between occupancy, length-of-stay and mortality. Intensive Care Medicine. 2013; 39 :S464	Wrong publication type (conference paper)
Kim SH, Chan CW, Olivares M, Escobar GJ. Association Among ICU Congestion, ICU Admission Decision, and Patient Outcomes. Crit Care Med. 2016 Oct;44(10):1814-21. doi: 10.1097/CCM.0000000000001850. PMID: 27332046.	Different study aim/wrong outcome (effect of ICU occupancy on ICU admission)
Mathews KS, Durst MS, Vargas-Torres C, Olson AD, Mazumdar M, Richardson LD. Effect of Emergency Department and ICU Occupancy on Admission Decisions and Outcomes for Critically Ill Patients. Crit Care Med. 2018 May;46(5):720-727. doi: 10.1097/CCM.0000000000002993. PMID: 29384780; PMCID: PMC5899025.	Different study aim/wrong outcome (effect of ICU occupancy on ICU admission)
Nguyen YL, Wallace DJ, Yordanov Y, Trinquart L, Blomkvist J, Angus DC, Kahn JM, Ravaud P, Guidet B. The Volume-Outcome Relationship in Critical Care: A Systematic Review and Meta-analysis. Chest. 2015 Jul;148(1):79-92. doi: 10.1378/chest.14-2195. PMID: 25927593; PMCID: PMC4493880.	Wrong topic/comparison (not about occupancy rate)
Robert R, Coudroy R, Ragot S, Lesieur O, Runge I, Souday V, Desachy A, Gouello JP, Hira M, Hamrouni M, Reignier J. Influence of ICU-bed availability on ICU admission decisions. Ann Intensive Care. 2015 Dec;5(1):55. doi: 10.1186/s13613-015-0099-z. Epub 2015 Dec 30. PMID: 26714805; PMCID: PMC4695477.	Wrong outcome (triage decisions)
Sasabuchi Y, Yasunaga H, Matsui H, Lefor AK, Horiguchi H, Fushimi K, Sanui M. The Volume-	Wrong topic/comparison (not about occupancy rate)

Outcome Relationship in Critically Ill Patients in Relation to the ICU-to-Hospital Bed Ratio. Crit Care Med. 2015 Jun;43(6):1239-45. doi: 10.1097/CCM.0000000000000943. PMID: 25756414.	
Stelfox HT, Hemmelgarn BR, Bagshaw SM, Gao S, Doig CJ, Nijssen-Jordan C, Manns B. Intensive care unit bed availability and outcomes for hospitalized patients with sudden clinical deterioration. Arch Intern Med. 2012 Mar 26;172(6):467-74. doi: 10.1001/archinternmed.2011.2315. Epub 2012 Mar 12. PMID: 22412076.	Wrong population (patients not yet admitted to ICU)
Varney J, Bean N, Mackay M. The self-regulating nature of occupancy in ICUs: stochastic homeostasis. Health Care Manag Sci. 2019 Dec;22(4):615-634. doi: 10.1007/s10729-018-9448-4. Epub 2018 May 3. PMID: 29725895.	Wrong study design (simulation study)
Wortel SA, de Keizer NF, Abu-Hanna A, Dongelmans DA, Bakhshi-Raiez F. Number of intensivists per bed is associated with efficiency of Dutch intensive care units. J Crit Care. 2021 Apr;62:223-229. doi: 10.1016/j.jcrc.2020.12.008. Epub 2020 Dec 19. PMID: 33434863.	Wrong topic/comparison (number of intensivists per bed)
Yergens DW, Ghali WA, Faris PD, Quan H, Jolley RJ, Doig CJ. Assessing the association between occupancy and outcome in critically ill hospitalized patients with sepsis. BMC Emerg Med. 2015 Oct 19;15:31. doi: 10.1186/s12873-015-0049-y. PMID: 26481448; PMCID: PMC4610044.	Wrong population (patients not yet admitted to ICU)

## Zoekverantwoording

### Algemene informatie

Cluster/richtlijn: NVIC – organisatie van zorg op de IC	
Uitgangsvraag/modules: 7 Wat is het minimale bedbezettingspercentage en de bedden capaciteit op de IC?	
Database(s): Embase.com, Ovid/Medline	Datum: 26-10-2023
Periode: vanaf 2000	Talen: geen restrictie
Literatuurspecialist: Ingeborg van Dusseldorp	Rayyan review: <a href="https://rayyan.ai/reviews/818713">https://rayyan.ai/reviews/818713</a>
BMI-zoekblokken: voor verschillende opdrachten wordt (deels) gebruik gemaakt van de zoekblokken van BMI-Online <a href="https://blocks.bmi-online.nl/">https://blocks.bmi-online.nl/</a> Bij gebruikmaking van een volledig zoekblok zal naar de betreffende link op de website worden verwezen.	
<b>Toelichting:</b> Voor deze vraag is gezocht met de concepten:  IC EN bedbezetting en bedden capaciteit EN volwassenen  Vanwege de hoge aantallen worden in eerste instantie de SRs en RCTs aangeboden. Als daarin niet voldoende bewijs wordt gevonden kunnen de 1031 observationele studies worden toegevoegd.  12-01-2024: De 1031 observationele studies zijn in Rayyan toegevoegd.  De 6 sleutelartikelen worden gevonden met deze search	
Te gebruiken voor richtlijntekst: In de databases Embase.com en Ovid/Medline is op 26-10-2023 systematisch gezocht vanaf 2000 naar systematische reviews, RCTs en observationele studies over bedbezetting en bedden capaciteit op de IC. De literatuurzoekactie leverde 1585 unieke treffers op.	

### Zoekopbrengst

	EMBASE	OVID/MEDLINE	Ontdubbeld
SR	48	24	58
RCT	429	128	496
Observationele studies	847	467	1031
<b>Totaal</b>	1324	619	<b>1585*</b>

**\*in Rayyan**  
**Zoekstrategie**

**Embase.com**

No.	Query	Results
#1	'intensive care'/de OR 'intensive care unit'/exp OR 'artificial feeding'/exp OR 'artificial ventilation'/exp OR 'early goal-directed therapy'/exp OR 'sepsis'/exp OR 'acute respiratory failure'/exp OR 'respiratory tract intubation'/exp OR 'critically ill patient'/exp OR (((intensive OR critical OR medium) NEAR/2 care):ti,ab,kw) OR 'critically ill':ti,ab,kw OR 'acutely ill':ti,ab,kw OR weaning:ti,kw OR (((mechanical* OR artificial) NEAR/2 ventilat*):ti,ab,kw)	1170582
#2	'hospital bed utilization'/exp OR 'hospital bed capacity'/exp OR (((ratio* OR reduc* OR capacit*) NEAR/3 (bed OR beds)):ti,ab,kw) OR 'occupanc* rate':ti,ab,kw OR 'bed use':ti,ab,kw OR 'bed utiliz*':ti,ab,kw OR 'bed occupanc*':ti,ab,kw	29752
#3	#1 AND #2	3386
#4	#3 AND [2000-2024]/py NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp) NOT (('child'/exp OR child*:ti,ab,kw OR schoolchild*:ti,ab,kw OR infant*:ti,ab,kw OR girl*:ti,ab,kw OR boy*:ti,ab,kw OR teen:ti,ab,kw OR teens:ti,ab,kw OR teenager*:ti,ab,kw OR youth*:ti,ab,kw OR pediatr*:ti,ab,kw OR paediatr*:ti,ab,kw OR puber*:ti,ab,kw) NOT ('adult'/exp OR 'aged'/exp OR 'middle aged'/exp OR adult*:ti,ab,kw OR man:ti,ab,kw OR men:ti,ab,kw OR woman:ti,ab,kw OR women:ti,ab,kw))	1677
#5	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab)) OR metasynthes*:ti,ab OR 'meta synthes*':ti,ab	971882
#6	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3899806

#7	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	7896434
#8	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*':ti,ab,kw OR cross?ectional*:ti,ab,kw OR multigent*:ti,ab,kw OR 'multi-cent*':ti,ab,kw OR consecutive*:ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*:ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*:ti,ab,kw OR 'odds ratio*':ab OR 'relative odds':ab OR 'risk ratio*':ab OR 'relative risk*':ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (((or' OR 'rr') NEAR/6 ci):ab)))	14520192
#9	#4 AND #5 <b>SR</b>	48
#10	#3 AND #6 NOT #9 <b>Clinical trials</b>	429
#11	(#7 OR #8) AND #4 NOT #9 NOT #10 <b>OBS</b>	847
#12	#9 OR #10 OR #11	1324
#13	'a mathematical model for simulating daily bed occupancy in an intensive care unit'	1
#14	'the relationship between labour cost per patient and the size of intensive care units: a multicentre prospective study'	1

#15	volume AND of AND activity AND occupancy AND rate AND in AND intensive AND care AND units. AND association AND with AND mortality	1
#16	'rationing critical care beds: a systematic review'	1
#17	'evaluation of icu and weight of quality control indicators: an exploratory study based on chinese icu quality data from 2015 to 2020'	1
#18	#13 OR #14 OR #15 OR #16 OR #17 sleutelartikelen	5
#19	#12 AND #18 sleutelartikelen gevonden	5

## Ovid/Medline

#	Searches	Results
1	Critical Care/ or Critical Illness/ or Early Goal-Directed Therapy/ or exp Intensive Care Units/ or exp Sepsis/ or exp Respiratory Distress Syndrome/ or exp Respiration, Artificial/ or exp Intubation, Intratracheal/ or Ventilator Weaning/ or weaning.ti,ab,kf. or ((intensive or critical) adj2 care).ti,ab,kf. or critically ill.ti,ab,kf. or acutely ill.ti,ab,kf. or (mechanical* or artificial adj2 ventilat*).ti,ab,kf. or intubat*.ti,ab,kf.	628749
2	exp bed occupancy/ or exp Hospital Bed Capacity/ or "bed occupanc*".ti,ab,kf. or "occupanc* rate".ti,ab,kf. or "bed use".ti,ab,kf. or "bed utiliz*".ti,ab,kf. or ((ratio* or reduc*) adj3 (bed or beds)).ti,ab,kf.	29658
3	1 and 2	2345
4	limit 3 to yr="2000 -Current"	1294
5	4 not ((exp animals/ or exp models, animal/) not humans/) not (letter/ or comment/ or editorial/) not ((Adolescent/ or Child/ or Infant/ or adolescen*.ti,ab,kf. or child*.ti,ab,kf. or schoolchild*.ti,ab,kf. or infant*.ti,ab,kf. or girl*.ti,ab,kf. or boy*.ti,ab,kf. or teen.ti,ab,kf. or teens.ti,ab,kf. or teenager*.ti,ab,kf. or youth*.ti,ab,kf. or pediatr*.ti,ab,kf. or paediatr*.ti,ab,kf. or puber*.ti,ab,kf.) not (Adult/ or adult*.ti,ab,kf. or man.ti,ab,kf. or men.ti,ab,kf. or woman.ti,ab,kf. or women.ti,ab,kf.))	1072
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*)).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or data-base*)).ti,ab,kf. or (("data extraction" or "data source*") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*)).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*)).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	701591

7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2646651
8	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4560645
9	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multigent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or ('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or ("OR" or "RR") adj6 CI).ab.))	5537929
10	5 and 6 <b>SR</b>	24
11	(5 and 7) not 10 <b>Clinical trials</b>	128
12	(5 and (8 or 9)) not 10 not 11 <b>OBS</b>	467
13	10 or 11 or 12	619

## **Bijlage - Module 6 Rol van IC professionals buiten de IC**

### **Samenvatting literatuur**

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, de evaluatie van de kwaliteitsstandaard uit 2016 en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
<b>Beademing buiten de IC</b> Neem als intensivist het initiatief om instellingsbreed beleid op te stellen ten aanzien van niet-invasieve ademhalingsondersteuning (NIV en HFNO) buiten de IC. Beschrijf hierin hoe patiënten bewaakt moeten worden en wat triggers zijn voor consultatie van de intensivist / IC-voorwacht en IC-verpleegkundige.	1 tot 3 jaar	geen	Betrokkenheid van alle specialismen van afdelingen waar non invasieve beademing toegepast wordt	Samenwerking en verschillende gedachtes over invulling van beleid tussen specialismen in een ziekenhuis	Maken van samenwerking afspraken tussen specialismen	Intensivist verantwoordelijk voor opstellen instellingsbreed beleid	geen
<b>SIT</b> Een SIT wordt bij voorkeur samengesteld uit een intensivist of IC-voorwacht (werkend onder supervisie van een	1 tot 3 jaar	Afname kosten bij mogelijk minder IC opnames	Waarschijnlijk al aan voldaan, aangezien dit waarschijnlijk in alle ziekenhuizen al geregeld is	geen	n.v.t.	Intensivist en IC verpleegkundigen voor vastleggen rol van IC-professionals binnen SIT	geen

<p>intensivist) en een IC-verpleegkundige.</p> <p>Volg de leidraad vitaal bedreigde patiënt voor het signaleren van de vitaal bedreigde patiënt en de randvoorwaarden voor organisatie van zorg.</p> <p>Maak lokale afspraken over de rol van IC-professionals bij vitaal bedreigde patiënten buiten de IC om verslechtering te voorkomen.</p>							
<p><b>Reanimatie team</b> Leg de rol van IC-professionals in het reanimatieteam lokaal vast en evalueer dit periodiek.</p>	1 tot 3 jaar	geen	Betrokkenheid van alle specialismen bij het reanimatieteam binnen een ziekenhuis	Samenwerking tussen verschillende specialismen binnen een ziekenhuis	Maken van afspraken van rol IC-professionals binnen reanimatieteam	Intensivist en IC verpleegkundigen voor vastleggen rol van IC-professionals binnen reanimatieteam	geen
<p><b>Consultatief intensive care verpleegkundige (CIV)</b></p>	1 tot 3 jaar	Geen (meerkosten van	Opstellen van protocol inzet van een CIV en	Onvoldoende (daarvoor opgeleide) IC	Maken van afspraken rol CIV en opleiden	IC-verpleegkundigen voor opstellen en	geen

<p>Zorg voor de beschikbaarheid van een CIV voor de ondersteuning van de zorg bij kritiek zieke patiënten of complexe situaties buiten de IC.</p> <p>Zorg voor follow-up van hoog risico patiënten na ontslag van de IC. Leg de rol en taken van de CIV vast en evalueer dit periodiek.</p>		opleiden en inzet CIV vs. mogelijke afname kosten heropnames)	maken van een opleidingsplan voor IC verpleegkundigen voor deze rol als CIV	verpleegkundigen voor invullen van rol als CIV	van IC verpleegkundigen voor deze rol	implementatie van CIV opleidingsplan en protocol	
<p><b>Nazorg</b> Volg de richtlijn Nazorg en revalidatie van intensive care patiënten voor de inrichting van IC-nazorg en de rol van de IC-verpleegkundige, de IC-voorwacht en de intensivist hierin.</p>	1 tot 3 jaar	Toename kosten bij opzetten van IC nazorg door personele inzet	Betrokkenheid andere specialismen bij IC nazorg, naast inzet IC-professionals	Mogelijk beperkte inzet van IC-professionals voor IC-nazorg, gezien personeelstekort	Opzetten van een IC-nazorg traject binnen het ziekenhuis	Intensivist en IC verpleegkundigen voor opzetten IC-nazorg traject	geen
<p><b>Ketenzorg</b> Overweeg om de IC-professional een rol te geven in proactieve</p>	1 tot 3 jaar	Geen (activiteit uit te voeren binnen	Betrokkenheid van alle specialismen binnen het ziekenhuis die	Samenwerking en verschillende gedachten over invulling van beleid tussen	Opzetten ziekenhuisbreed protocol voor betrokkenheid van IC-	Intensivist voor vastleggen rol van IC-professional buiten de muren van de IC bij de	geen

<p>zorgplanning voor kritiek zieke patiënten.</p> <p>Leg lokaal de rol van de IC-professional vast buiten de muren van de IC om de ketenzorg voor de kritiek zieke patiënt te bevorderen.</p>		<p>huidige formatie)</p>	<p>een rol spelen bij de zorg voor kritisch zieke patiënten</p>	<p>specialismen in een ziekenhuis</p>	<p>professionals bij kritisch zieke patiënten</p>	<p>behandeling van de kritisch zieke patiënt</p>	
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## **Bijlage - Module 7 Regionale samenwerking van IC zorg in Nederland**

### **Samenvatting literatuur**

De aanbevelingen zijn, gezien de aard van de uitgangsvragen en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, de evaluatie van de kwaliteitsstandaard uit 2016 en inbreng van de commissies Landelijk Netwerk IC regio's (LNIC), Landelijk Netwerk Intensive Care Verpleegkundigen (LNIC-V), Landelijk overleg Hoofden IC (LHIC) en Nationale Kwaliteitsvisite Intensive Care (NKIC).

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
Alle IC-afdelingen zijn onderdeel van (niet meer dan) één IC-regio. Samen vormen de IC-regio's een landelijk dekkend systeem met als doel het maximaliseren van de efficiëntie, kwaliteit en beschikbaarheid van IC-zorg in Nederland.	< 1 jaar	geen					
De IC-regio bepaalt in gezamenlijkheid en op basis van expertise en	< 1 jaar	geen				Leden van de regio	

exposure welke IC zorg op welke IC-afdeling geleverd kan worden ('de juiste zorg op de juiste plek').							
Alle IC-patiënten binnen een IC-regio vallen te allen tijde onder de individuele verantwoordelijkheid van de behandelend intensivist van de afdeling waar de patiënt zich op dat moment bevindt, passend bij diens autonomie en bij de (juridische) relatie van de patiënt met zijn behandelend arts.	< 1 jaar	geen				Leden van de regio	
Het is de verantwoordelijkheid van de behandelend intensivist om in het kader van expertise of exposure advies te	< 1 jaar	geen				Leden van de regio	

vragen binnen de regio, evenals de manier waarop dit advies een plek krijgt in de behandeling van de patiënt.							
De afspraken die tussen de IC-afdelingen in de regio gemaakt worden, worden vastgelegd in het regionaal samenwerkingsplan IC.	< 1 jaar	geen			Kwaliteitsvisite	Leden van de regio	
De IC-regio stimuleert de gezamenlijke kwaliteitsverbetering door het delen en bespreken van kwaliteitsrapportages, verbeteracties, best practices en protocollen. De onderlinge samenwerking in de	< 1 jaar	geen	Verantwoordelijkheid van het regiobestuur.	Te weinig vertrouwen in de onderlinge relatie.	Kwaliteitsvisite Versterken van onderling vertrouwen	Leden van de regio	

IC-regio wordt jaarlijks geëvalueerd in een jaarplan en een jaarverslag.							
Om de coördinatie, uitvoering en continuïteit van de regio afspraken te borgen heeft elke regio een vaste overlegstructuur. Dit overleg wordt gevormd uit zowel medische als verpleegkundige (of bestuurlijke) afgevaardigden van de afzonderlijke IC-afdelingen en komt met een vaste frequentie bij elkaar.	< 1 jaar	Kosten voor organisatie, catering. Aanstelling van een regiomanager.			Kwaliteitsvisite	Leden van de regio	
Om elkaar beter te leren kennen en meer inzicht in elkaars handelen en organisatie te krijgen organiseert de IC-	< 1 jaar	Kosten voor organisatie, catering.			Kwaliteitsvisite	Leden van de regio	

<p>regio onderlinge uitwisseling voor zowel intensivisten als IC-verpleegkundigen, in de vorm van bijvoorbeeld 'gluren bij de burens'.</p> <p>Daarnaast wordt voor alle deelnemers minimaal één keer per jaar een kwaliteitsbijeenkomst georganiseerd waar kwaliteitsrapportages, verbeteracties en best practices van de deelnemende IC-afdelingen gedeeld worden.</p>							
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## Bijlage - Module 8 (Interklinisch) transport

### Onderbouwing

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk, op basis van de evaluatie van de kwaliteitsstandaard uit 2016 en de bijbehorende 'blauwdruk', de Bijlagen bij Kwaliteitsstandaard Organisatie van Intensive Care onderbouwingsdocument en de richtlijn Interklinisch transport van IC-patiënten 2019 (NVIC).

#### Resultaten

Het vervoer van IC-patiënten is soms nodig, maar niet zonder risico. Interklinisch transport is geassocieerd met incidenten en fysiologische verslechtering van de patiënt, die mede afhankelijk is van de duur van transport en de mate van ziek zijn van de patiënt (Kanter, 1989). De incidentie van transport geassocieerde problemen varieert enorm, tussen de 3 en 75% (Barry, 1994; Ligtenberg, 2005; Philpot, 2008). De reden van deze enorme variatie is de afwezigheid van een algemeen geaccepteerde definitie van transport geassocieerde incidenten. Hierdoor gebruiken verschillende studies verschillende definities. Incidenten kunnen worden onderverdeeld in medisch en technisch. Medische problemen tijdens transport zijn met name cardiovasculair (hypo- en hypertensie, ritmestoornissen) of respiratoir (oxygenatie en/of beademings-problemen). Technische problemen betreffen m.n. defecte apparatuur of storingen van de apparatuur en behelzen tot 46% van alle gemelde incidenten (Beckmann, 2004; Flabouris, 2006; Papson, 2007), met een incidentie van 9% tot 36% (Gillman, 2006; Hatherill, 2003; Wiegersma, 2011). Van alle incidenten worden er tot 31% geclassificeerd als significant (Beckman, 2004; Wallen, 1995) en tot 79% van alle incidenten vereisen een interventie (Papson, 2007). Opvallend genoeg blijken tot 91% van alle incidenten te voorkomen te zijn geweest (Flabouris, 2006). In verband met het frequent voorkomen van transport geassocieerde problemen werd al sinds de jaren tachtig gepleit voor het oprichten van speciaal getrainde transport teams (Kanter, 1989; Pearl, 1987; Wallen, 1995).

Van 2008 tot 2012 gold de tijdelijke regeling MICU binnen de Wet Bijzondere Medische Verrichtingen om het MICU-transport in Nederland vorm te geven. Hiertoe werden 7 MICU centra aangewezen, welke een landelijk dekkend netwerk leveren.

Ondanks dat veel observationele studies lagere incidenties lieten zien van transport gerelateerde problemen, bleek bij een grote review in 2006 door Belway (Belway 2006) er geen bewijs te zijn dat transporten uitgevoerd door gespecialiseerde transport teams leiden tot een betere uitkomst voor de patiënt. In deze review werden 39 studies geanalyseerd. Hiervan werden er 33 uitgesloten vanwege een niet aanwezige of niet-adequate controle groep. In slechts 1 van de overige 6 studies waren interventie en controle groep gematched. In deze laatste studie door Bellingan werd door het gebruik van een gespecialiseerd transport team een vroege IC-mortaliteitsreductie gevonden en een betere fysiologische toestand van de patiënt na transport (Bellingan, 2000). Sinds de review van Belway zijn er nog enkele studies naar het nut van een gespecialiseerd transport team verschenen. In Noordoost Nederland werd een voor- en na-studie gedaan na het opstarten van het MICU-

centrum Groningen. Vooraf werden patiënten al dan niet door de verwijzer zelf vervoerd. Dit leidde in 34% van de transporten tot problemen. 70% van deze problemen werd als vermijdbaar ingeschat (Ligtenberg 2005). Een eerste analyse na de start van het MICU-centrum toonde bij 12,5% van de transporten een incident, allemaal technisch van aard met weinig invloed op de toestand van de patiënt. Bovenal bleken er in de tweede studie veel ziekere patiënten vervoerd te worden dan in de eerste studie (Wiegersma, 2011). Een soortgelijke reductie (van 8% naar 1,7%) werd in 2011 gevonden door Kue (2011) bij een onderzoek naar het installeren van een gespecialiseerd transport team voor transport binnen het ziekenhuis (Kue, 2011). Observationele studies van Ramnarayan en Kim toonden een mortaliteitsvoordeel bij het interklinisch vervoer van kritiek zieke patiënten door gespecialiseerde teams (Kim, 2020; Ramnarayan, 2010).

Daarnaast is in 2008 gekeken wat de Nederlandse intensivist belangrijk vindt bij de inschatting van het al dan niet vervoeren van een patiënt. De ernst van de ziekte of de mate van ondersteuning bleek hierbij van weinig invloed. Het ging bij deze beslissing met name om de aan- of afwezigheid van IC-arts en IC-verpleegkundige tijdens het transport alsmede het gebruik van een MICU in plaats van een standaard ambulance (van Lieshout 2008). Aangezien het doel tijdens transport is om de IC-behandeling te continueren, lijkt het voor de hand liggend het MICU-transport te laten begeleiden door een intensivist. Helaas zijn er geen prospectieve gerandomiseerde studies die hier uitsluitsel over geven. In een retrospectieve studie werd bij 130 kindertransporten het percentage incidenten bepaald bij transporten uitgevoerd door een gespecialiseerd transport team met arts, een gespecialiseerd transport team zonder arts en een team zonder specifieke transport training. Het percentage incidenten bleek respectievelijk 8%, 20% en 72% (Macnab, 1991). Een *randomised controlled trial* binnen de MICU in Noordwest Nederland om de toegevoegde waarde van de intensivist ten opzichte van een team met MICU- en ambulanceverpleegkundige te onderzoeken was niet conclusief (van Lieshout 2016). Zover bekend zijn er geen andere studies gedaan die puur keken naar de samenstelling van het team.

In de richtlijn “interklinisch transport van IC-patiënten” uit 2019 wordt onderscheid gemaakt tussen MICU-transport, spoedtransport en begeleid IC-transport. In de tussentijd is er geen literatuur bijgekomen om deze onderverdeling te veranderen. De beschikbare literatuur geeft geen duidelijkheid over welk type patiënt welk type transport nodig heeft. De huidige transport-risico scores zijn nog onvoldoende gevalideerd voor klinisch gebruik in triage tussen de verschillende transportvormen (Etxebarria, 1998; Markakis, 2006; Strauch, 2017; Strauch, 2021).

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
<p><u>Algemeen</u> Stel een transportprotocol op waarin lokale afspraken, verantwoordelijkheden en voorwaarden hierover worden vastgelegd. Zorg er ook voor dat, in geval de dienstdoende intensivist het (spoed)transport begeleidt, is afgesproken op welke wijze de zorg voor de (potentiële) IC-patiënten is geregeld en leg dit eveneens vast in het protocol.</p> <p>De verwijzend intensivist bepaalt of een IC-patiënt moet worden overgeplaatst.</p>	<1 jaar	geen	geen	geen	geen	geen	

<p>De indicatie voor spoed, begeleid of MICU-transport wordt gesteld door de verwijzend intensivist. Zo nodig kan hiervoor overlegd worden met de regionale MICU-coördinator.</p> <p>De begeleidend arts is verantwoordelijk gedurende het transport en bepaalt of het transport daadwerkelijk doorgang kan vinden en bepaalt het te voeren beleid tijdens transport, indien het een medisch specialist betreft. Bij vervoer door een IC-voorwacht blijft de verwijzend intensivist verantwoordelijk.</p> <p>Documenteer de overwegingen voorafgaand aan elke overplaatsing (MICU, spoed of begeleid) in de status.</p>							
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Leg het beloop vast tijdens transport en zorg voor een goede overdracht.							
<u>MICU-transport</u> Verricht het transport van een IC-patiënt met een gespecialiseerd transport team, bestaande uit in ieder geval een intensivist en IC-verpleegkundige, beiden bekwaam in het uitvoeren van MICU-transport.  Gebruik een MICU-trolley: een in samenspraak met de vervoerder ontwikkelde geïntegreerde opstelling, in beheer en onderhoud bij het MICU-centrum.	<1 jaar	geen	geen	geen	geen	geen	
<u>Spoed en begeleid IC-transport</u> Verricht spoedtransport bij een IC-patiënt, waarbij de indicatie van het transport	3 jaar	Eenmalig	Aanschaf transportopstelling	Systeem: afstemming met ambulancedienst	Kwaliteitsvisitatie, afspraken tussen IC's en ambulancediensten	IC's, ziekenhuisbestuurders en ambulancediensten	

<p>een aanvullende spoedbehandeling is. Hierbij dient de te verwachten winst van de behandeling dusdanig groot te zijn dat deze opweegt tegen het risico van een transport zonder MICU.</p> <p>Elk ziekenhuis moet in samenwerking met de regionale ambulancedienst in staat zijn een patiënt met spoed over te plaatsen, moet hiervoor de benodigde apparatuur en personeel beschikbaar hebben en dit geprotocolleerd hebben.</p> <p>Verricht begeleid transport bij IC-patiënten die dusdanig stabiel zijn dat zij naar het oordeel van de verwijzend intensivist hiervoor in aanmerking komen en waarbij niet verwacht wordt dat patiënt op korte termijn</p>							
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<p>zodanig zal verslechteren dat een MICU-transport of spoedtransport alsnog vereist is.</p> <p>Voor beide geldt dat de patiënt bij voorkeur wordt begeleid door een intensivist.</p> <p>Indien dat niet mogelijk is dan kunnen deze patiënten ook begeleid worden door:</p> <ul style="list-style-type: none"> <li>• Een medisch specialist met een gelijkwaardig profiel voor de behandeling van vitaal bedreigde patiënten (te weten anesthesiologen en SEH-artsen);</li> <li>• Een aantoonbaar bekwame IC-voorwacht (onder verantwoordelijkheid van de insturend intensivist), mits</li> </ul>							
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<p>aannemelijk gemaakt kan worden dat de complexiteit van casuïstiek in overeenstemming is met scholing en ervaring van betreffende arts.</p> <p>Vervoer patiënten met een transportopstelling, waarbij de benodigde apparatuur op veilige wijze kan worden gefixeerd aan brancard of ambulance.</p>							
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## **Bijlage - Module 9.1 Kwaliteitssysteem**

### **Onderbouwing**

#### Methode

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk en waar mogelijk onderbouwd door niet-systematisch literatuuronderzoek.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijk en voor acties <sup>3</sup>	Overige opmerkingen
<p>Een IC-afdeling beschrijft en werkt met een integraal kwaliteitssysteem.</p> <p>Verplichte onderdelen van een integraal kwaliteitssysteem zijn:</p> <ul style="list-style-type: none"> <li>• Werken met behulp van lokale protocollen die gebaseerd zijn op richtlijnen van de medische en verpleegkundige beroepsverenigingen welke op elkaar afgestemd zijn;</li> <li>• Actief en aantoonbaar Leren en Verbeteren. Voor Leren en Verbeteren zijn</li> </ul>	1-3 jaar	Afhankelijk van de benodigde verbeteractie(s)	Prioritering onderwerp door management en voldoende tijd en middelen.	Onvoldoende wetenschappelijk bewijs voor kwaliteitsverbeteringen	Agenderen kwaliteit en continue leren en verbeteren	Management team IC-afdeling	

<p>verschillende methoden beschikbaar;</p> <ul style="list-style-type: none"> <li>• Registreren, analyseren en bespreken van indicatoren in de minimale data set (in NICE) aangevuld met eventuele andere door de beroepsverenigingen benoemde indicatoren;</li> <li>• Registreren van minimaal twee verbeterdomeinen en aantoonbare verbetercyclus;</li> <li>• Publiceren van een publiekswaliteitsjaarverslag waarin de MDS, APACHE IV SMR, complicaties, patiëntervaringen, lange termijn uitkomsten (o.a. mortaliteit, functionele uitkomsten en kwaliteit van leven) en kwaliteitsverbeterprojecten worden gerapporteerd;</li> </ul>							
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<ul style="list-style-type: none"> <li>• Openbaar maken van de APACHE IV SMR op de NICE website “data in beeld”;</li> </ul> <p>Iedere IC-afdeling dient minimaal eens in de vijf jaar gevisiteerd te worden door de NVIC.</p>							
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## Bijlage - Module 9.2 Veiligheidscultuur

### Search and select

A systematic review of the literature was performed to answer the following question:  
Which factors promote the safety culture in intensive care units?

For this question, we ideally wanted to find prognostic models predicting what factors have a positive influence on the safety culture in intensive care units. Because of a lack of such studies, an additional PICO was formulated.

#### PICO 1

<b>P (Patiënten)</b>	= ICU-personeel
<b>I (Interventie)</b>	= model predicting a positive influence on safety culture (for example: ethical decision climate, psychological safety, collaboration between physicians and nurses, leadership, organizational environment, work environment, CRM, team training, cooperation/teamwork job/employee satisfaction, work values, employee engagement and empowerment)
<b>C (Comparison)</b>	= other model / no model
<b>O (Outcomes)</b>	= predictive value / model performance
<b>T/S (Timing)</b>	= intensive care units

#### PICO 2

<b>P (Patiënten)</b>	= ICU-personeel
<b>I (Interventie)</b>	= intervention to promote safety culture in intensive care units
<b>C (Comparison)</b>	= no intervention
<b>O (Outcomes)</b>	= safety culture (measured with questionnaires, e.g. the Hospital Survey on Patient Safety Culture)

### Relevant outcome measures

The guideline development group considered patient safety culture as a critical outcome measure for decision making.

A priori, the working group did not define the outcome measure safety culture but used the definitions used in the studies.

The working group defined the following clinically important difference:

- Safety culture (measured with questionnaires specified in included studies): 5% (5 points on a 100 points scale, 0.5 point on a 10 points scale)

### Search and select (Methods)

The databases Embase.com, Ovid/Medline, Ovid/PsycInfo and Ebsco/CINAHL were searched with relevant search terms from 2000 until November 28<sup>th</sup>, 2023. The detailed search

strategy is depicted under the tab Methods. The systematic literature search resulted in 462 hits. Studies were selected based on the following criteria:

- Systematic review or Randomized Controlled Trial
- Describing prognostic factors or comparing interventions promoting the safety culture in intensive care units

Nineteen studies were initially selected based on title and abstract screening. After reading the full text, seventeen studies were excluded (see the table with reasons for exclusion under the tab Methods), and two studies were included.

## Results

Two studies were included in the analysis of the literature. Important study characteristics and results are summarized in the evidence tables. The assessment of the risk of bias is summarized in the risk of bias tables.

### **Summary of literature**

#### Description of studies

No prognostic studies predicting factors with a positive influence on the safety culture in intensive care units were found (PICO 1). Two studies were included that describe an intervention to promote safety culture in intensive care units (PICO 2).

**Amiri (2018)** performed a randomized controlled trial with pre-test and post-test control groups to determine the effect of an educational empowerment program on patient safety culture in adult ICUs. The study was conducted between April and September 2015 in six adult ICUs located at Namazi Hospital in Shiraz, Iran. Included ICUs were similar in terms of patient safety policies. A total of 60 nurses and 20 supervisors (nurses with at least a Bachelor's degree and responsible for oversight nursing services in the studied ICUs) were included from a sample of 160 nurses and 20 supervisors. The intervention and control group both consisted of 30 nurses and 10 supervisors from hospital 1, 3, and 6, and hospital 2, 4, and 5, respectively. The intervention consisted of an educational empowerment program. The educational program started with a two-day workshop, followed by hanging posters and handing out educational pamphlets to the nurses and supervisors. The workshop included education on patient safety, patient safety culture, and training in speak out in a situation of a threat to patient safety, communication, leadership, mutual support, and situational monitoring skills. The control group did not receive any intervention. Data was collected using the Persian version of Hospital Survey on Patient Safety Culture (HSOPSC) developed by the AHRQ. The HSOPSC questionnaire has 42 items in 12 dimensions. These dimensions include: teamwork within units; manager expectations and actions promoting patient safety; organizational learning and continuous improvement; Management support for patient safety; overall perception of patient safety; feedback and communication on errors; communication openness; frequency of events reported; team work across hospital units; staffing; handoffs and transitions; non-punitive response to errors. The items were answered on a five-point Likert scale, from completely disagree (1) to completely agree (5) or from never (1) to always (5). The post-test scores were measured at three months follow-up. The mean age in the intervention group was 34.87 years (SD 7.8), versus 36.05 years (SD 8.03) in the control group. The intervention group consisted of 27 females (90%), versus 26 females (SD 83.8%) in the control group. Groups were comparable at baseline.

**Kok (2023b)** performed a parallel cluster randomized trial to assess whether structural moral case deliberation (MCD) in ICUs reduces burn-out symptoms and moral distress and strengthens the team climate among ICU professionals. The study was conducted between Januari 1, 2020 and October 1, 2021 in six ICUs in two hospitals located in Nijmegen, the Netherlands. Five of the ICUs were part of a university medical center (two adult ICUs, an ICU specializing in weaning patients off mechanical ventilation, a step-down unit, and a PICU) and one ICU was an adult ICU, also including step-down care beds. The intervention consisted of organizing structural MCD in the ICU. "Structural" means that MCD was embedded into the regular ICU workflow and that it was organized at least once a month. Moral issues were prospectively or retrospectively discussed and related either to medical-ethical decision-making in patient cases, or to broader moral issues arising from ICU practice. Control ICUs did not receive team-based ethical dialogue, but they still retained the possibility to request MCD. A total of 435 ICU professionals were included, of whom 288 had analyzable responses for one or more of the outcome variables in the baseline survey. At baseline, 178 respondents were included in the intervention group (three ICUs), versus 110 respondents in the control group (three ICUs). Additionally, 86 and 61 respondents were enrolled at follow-up measurements in the intervention and control group, respectively. Characteristics per ICU are provided in the evidence table. This article reported on team climate using the Team Climate Inventory from the Safety Attitude Questionnaire, which contains six items with Likert scales ranging from completely disagree (0) to completely agree (4). Additionally, this study reported on organizational culture measured by the culture of care barometer which includes five dimensions of organizational culture: supportive organization, leadership, relational atmosphere, relationship with supervisor, and participation opportunities. All were measured on five-point Likert scales also ranging from completely disagree (0) to completely agree (4). Follow-up measurements took place at 6, 12 and 21 months.

## Results

### Comparison 1: educational empowerment program versus no intervention

#### Safety culture (critical outcome)

##### Total score of patient safety culture

In **Amiri (2018)** the total post scores of the outcome measure patient safety culture was measured 3 months after the workshop (intervention) using the Persian version of Hospital Survey on Patient Safety Culture (HSOPSC). In the group whom received the intervention, the total post-test mean scores of the patient safety culture was  $3.46 \pm 0.26$ , in the control group the post-test mean scores of the patient safety culture was  $2.84 \pm 0.37$  (MD: 0.62, 95% CI 0.48 to 0.76). This difference is considered clinically relevant in favor of the intervention group.

##### *Dimensions of the HSOPSC*

**Amiri (2018)** also reported on the following dimensions: teamwork within units, manager expectations and actions promoting patient safety, organizational learning and continuous improvement, management support for patient safety, overall perception of patient safety, feedback and communication on errors, communication openness, frequency of events reported, teamwork across hospital units, staffing, handoffs and transitions, and non-punitive response to errors. All dimensions were measured 3 months after the workshop (intervention). Results are reported in Table 1.

Dimension	Post-test mean score intervention group (SD)	Post-test mean score control group (SD)	Mean difference, 95% CI
<i>Teamwork within units</i>	3.95 ( $\pm 0.43$ )	2.69 ( $\pm 0.80$ )	1.26, 95% CI 0.98 to 1.54
<i>Manager expectations and actions promoting patient safety</i>	4.22 ( $\pm 0.31$ )	3.23 ( $\pm 0.76$ )	0.99, 95% CI 0.74 to 1.24
<i>Organizational learning and continuous improvement</i>	4.45 ( $\pm 0.45$ )	3.13 ( $\pm 0.86$ )	1.32, 95% CI 1.02 to 1.62
<i>Management support for patient safety</i>	3.26 ( $\pm 0.94$ )	3.31 ( $\pm 0.99$ )	-0.05, 95% CI -0.47 to 0.37
<i>Overall perception of patient safety</i>	3.08 ( $\pm 0.53$ )	3.23 ( $\pm 0.73$ )	-0.15, 95% CI -0.43 to 0.13
<i>Feedback and communication on errors</i>	3.56 ( $\pm 0.72$ )	3.52 ( $\pm 0.77$ )	0.04, 95% CI -0.29 to 0.37
<i>Communication openness</i>	4.22 ( $\pm 0.44$ )	2.51 ( $\pm 0.74$ )	1.71, 95% CI 1.44 to 1.98
<i>Frequency of events reported</i>	2.76 ( $\pm 1.04$ )	2.51 ( $\pm 0.68$ )	0.25, 95% CI -0.14 to 0.64
<i>Teamwork across hospital units</i>	3.06 ( $\pm 0.84$ )	3.15 ( $\pm 0.81$ )	-0.09, 95% CI -0.45 to 0.27
<i>Staffing</i>	1.97 ( $\pm 0.52$ )	1.68 ( $\pm 0.57$ )	0.29, 95% CI 0.05 to 0.53
<i>Handoffs and transitions</i>	4.23 ( $\pm 0.69$ )	2.69 ( $\pm 0.66$ )	1.54, 95% CI 1.24 to 1.84
<i>Non-punitive response to errors</i>	2.78 ( $\pm 0.94$ )	2.46 ( $\pm 1.17$ )	0.32, 95% CI -0.15 to 0.79

**Table 1. Dimensions of patient safety culture measured with the Persian version of Hospital Survey on Patient Safety Culture, reported in Amiri (2018)**

Abbreviations: SD, standard deviation; CI, confidence interval.

## **Comparison 2: Moral case deliberation versus no intervention**

### **Safety culture (critical outcome)**

#### Team climate (measured with the Safety Attitude Questionnaire)

**Kok (2023b)** reported on Team climate using the Team Climate Inventory from the Safety Attitude Questionnaire, which contains six items with Likert scales ranging from completely disagree (0) to completely agree (4). Post intervention, team climate score did increase in favor of the intervention group (effect size: 0.03, 95%CI: -0.07 to 0.12). This difference was not considered clinically relevant.

#### Organizational culture (measured with the Culture of care Barometer)

**Kok (2023b)** reported on multiple dimensions of organizational culture measured with the Culture of care Barometer, which measured the items on five-point Likert scales ranging from completely disagree (0) to completely agree (4). Results are reported in Table 2. All differences were not considered clinically relevant.

<b>Dimension</b>	<b>Increase in post intervention score, 95% CI</b>
<i>Leadership</i>	0.19, 95%CI: 0.08 to 0.30
<i>Participation opportunities with supervisor</i>	0.13, 95%CI: 0.00 to 0.25
<i>Collegiality</i>	0.07, 95%CI: -0.02 to 0.15
<i>Supportive organisation</i>	0.15, 95%CI: 0.04 to 0.26
<i>Relationship with supervisor</i>	-0.03, 95%CI: -0.15 to 0.09

**Table 2. Dimensions of organizational culture measured with the Culture of care Barometer, reported in Kok (2023b)**

Abbreviations: CI, confidence interval.

## Level of evidence of the literature

### **Comparison 1. Educational empowerment program versus no intervention**

#### **Safety culture (critical outcome)**

Total score for patient safety culture (Hospital Survey on Patient Safety Culture)

The level of evidence regarding the outcome measure **patient safety culture** was downgraded by two levels to **low** because of study limitations (high risk of bias, -1) and the OIS not being met (imprecision, -1).

### **Comparison 2: Moral case deliberation versus no intervention**

#### **Safety culture (critical outcome)**

Team climate (Safety Attitude Questionnaire)

The level of evidence regarding the outcome measure **team climate** was downgraded by two levels to **low** because of study limitations (high risk of bias, -1) and the OIS not being met (imprecision, -1).

Organizational culture (Culture of Care Barometer)

The level of evidence regarding the outcome measure **organizational culture** was downgraded by two levels to **low** because of study limitations (high risk of bias, -1) and the confidence intervals around the point estimates crossing the upper threshold for clinical relevance (imprecision, -1).

## Conclusions

### **Comparison 1. Educational empowerment program versus no intervention**

#### **Safety culture (critical outcome)**

Total score for patient safety culture (Hospital Survey on Patient Safety Culture)

<b>Low GRADE</b>	An educational empowerment program in intensive care units may increase <b>patient safety culture</b> when compared with no intervention in ICU-personnel.  <i>Source: Amiri (2018)</i>
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### **Comparison 2: Moral case deliberation versus no intervention**

#### **Safety culture (critical outcome)**

Team climate (Safety Attitude Questionnaire)

<b>Low GRADE</b>	Moral case deliberation may result in little to no difference in <b>team climate</b> when compared with no intervention in ICU-personnel.  <i>Source: Kok (2023b)</i>
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Organizational culture (Culture of Care Barometer)

<b>Low GRADE</b>	Moral case deliberation may result in little to no difference in <b>organizational culture</b> when compared with no intervention in ICU-personnel.  <i>Source: Kok (2023b)</i>
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## Implementatieplan

Aanbeveling	Tijdspad voor implementatie : < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie	Te ondernemen acties voor implementatie	Verantwoordelijken voor acties	Overige opmerkingen
<p>Iedere IC-afdeling werkt aantoonbaar aan een zo goed mogelijke veiligheidscultuur.</p> <p>Overweeg hierbij het introduceren van:</p> <ul style="list-style-type: none"> <li>• een educatie programma over patiëntveiligheid voor alle zorgverleners op de IC;</li> <li>• een multidisciplinair moreel beraad;</li> <li>• het trainen van teamsamenwerking, bijvoorbeeld met</li> </ul>	<1	beperkt	Prioritering onderwerp door management, voldoende tijd en follow up	afwezig gevoel voor urgentie bij management/RvB	Agenderen veiligheidscultuur	Afdelingsleiding	

<p>simulatietraining (CRM);</p> <ul style="list-style-type: none"> <li>• een interventie voor het versterken van het geven en ontvangen van feedback;</li> <li>• een interventie gericht op het verbeteren van psychologische veiligheid.</li> </ul> <p>Overweeg het structureel meten van veiligheidscultuur.</p>							
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## Evidence tables

### Evidence table for intervention studies

Study reference	Study characteristics	Patient characteristics <sup>2</sup>	Intervention (I)	Comparison / control (C) <sup>3</sup>	Follow-up	Outcome measures and effect size <sup>4</sup>	Comments
Amiri, 2018	<p><u>Type of study:</u> RCT</p> <p><u>Setting and country:</u> 6 adult ICUs at Namazi Hospital, Shiraz, Iran.</p> <p><u>Funding and conflicts of interest:</u> The present study was financially supported by the Vice Chancellor of Research of Shiraz University of Medical Sciences,</p>	<p><u>Inclusion criteria:</u> Having at least 6 months experience in an adult ICU and at least a Bachelor's degree in nursing.</p> <p><u>Exclusion criteria:</u> The unwillingness to participate, failure to complete the pre-test, and lack of participation in training sessions.</p> <p><u>N total at baseline:</u> Intervention: 30 nurses and 10 supervisors Control: 30 nurses and 10 supervisors</p> <p><u>Important prognostic factors</u> Age, mean (SD) I: 34.87 (SD 7.8) C: 36.06 (SD 8.03)</p> <p>Sex female, n (%) I: 27 (90%) C: 26 (83.8%)</p> <p>Education, n (%)</p>	<p><u>Describe intervention (treatment/procedure/test):</u> Educational empowerment program</p> <p>This program started with a two-day workshop (8 h), followed by hanging posters and handing out educational pamphlets to the nurses and supervisors of the experimental group at their workplace. The educational contents of the workshop, posters, and pamphlets were matched. The workshop included education on patient safety, patient safety culture, speak out in a situation of a threat to patient safety, and the skills of Team Strategies and Tools to</p>	<p><u>Describe control (treatment/procedure/test):</u> No intervention</p>	<p><u>Length of follow-up:</u> 3 months</p> <p><u>Loss-to-follow-up:</u> <b>Intervention:</b> 9 nurses and 1 supervisor were lost to follow-up</p> <p>Reasons: 8 nurses and 1 supervisor did not receive the intervention, and 1 nurse did not complete the post-test</p>	<p><b>Persian version of Hospital Survey on Patient Safety Culture (HSOPSC).</b> <i>The pre-test was completed individually before the workshop. Three months after the workshop, the post-test was conducted individually in both groups.</i></p> <p><u>Dimensions (mean (SD))</u> Teamwork within units I: Pre-test: 2.91(±0.74) Post-test: 3.95(±0.43) C: Pre-test: 2.51 (± 0.82) Post-test: 2.69(±0.80)</p>	

	<p>Shiraz, Iran (Grant No. 5793). The funding body did not play any roles in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.</p>	<p>Bachelor's degree I: 26 (86.7%) C: 30 (96.8%)</p> <p>Master's degree I: 4 (13.3%) C: 1 (3.2%)</p> <p>Position Nurse I: 21 (70%) C: 27 (87.1%) Supervisor I: 9 (30%) C: 4 (12.9%)</p> <p>Groups comparable at baseline? Yes</p>	<p>Enhance Performance and Patient Safety (TeamSTEPPS). TeamSTEPPS was developed by the Agency for Healthcare Research and Quality (AHRQ) to improve patient outcomes. It included communication, leadership, mutual support, and situational monitoring skills. The workshop consisted of a lecture, group discussion, and presenting scenarios. In addition, some textual and graphical posters (related to TeamSTEPPS skills, speak up, and patient safety culture) were placed on the walls of patient's unit in the ICUs of the experimental group for a period of 6 weeks. During the following 6 weeks, every week one pamphlet was handed out to the nurses in the experimental groups. Pamphlets contents included communication, mutual support, situation monitoring, leadership, speak up, and patient safety culture.</p>		<p><b>Control:</b> 3 nurses and 6 supervisors were lost to follow-up</p> <p>Reasons: 3 nurses and 4 supervisors did not complete the pre-test, and 2 supervisors did not complete the post-test</p> <p><u>Incomplete outcome data:</u> Data from participants who completed the pre- and post-test were analysed.</p>	<p>Manager expectations and actions promoting patient safety</p> <p>I: Pre-test: 3.48 (±0.83) Post-test: 4.22 (±0.31)</p> <p>C: Pre-test: 3.22 (±0.68) Post-test: 3.23 (±0.76)</p> <p>Organizational learning and continuous improvement</p> <p>I: Pre-test: 3.83 (±0.65) Post-test: 4.45 (±0.45)</p> <p>C: Pre-test: 3.49 (±0.82) Post-test: 3.13 (±0.86)</p> <p>Management support for patient safety</p> <p>I: Pre-test: 3.15 (±1.05) Post-test: 3.26 (±0.94)</p> <p>C: Pre-test: 2.97 (±1.04) Post-test: 3.31 (±0.99)</p> <p>Overall perception of patient safety</p> <p>I: Pre-test: 2.92 (±0.62) Post-test: 3.08 (±0.53)</p> <p>C: Pre-test: 3.29 (±0.63)</p>	
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						<p>Post-test: 3.23 (<math>\pm 0.73</math>)</p> <p>Feedback and communication on errors</p> <p>I:</p> <p>Pre-test: 3.25 (<math>\pm 0.85</math>) Post-test: 3.56 (<math>\pm 0.72</math>)</p> <p>C:</p> <p>Pre-test: 3.53 (<math>\pm 0.78</math>) Post-test: 3.52 (<math>\pm 0.77</math>)</p> <p>Communication openness</p> <p>I:</p> <p>Pre-test: 2.72 (<math>\pm 0.67</math>) Post-test: 4.22 (<math>\pm 0.44</math>)</p> <p>C:</p> <p>Pre-test: 2.80 (<math>\pm 0.79</math>) Post-test: 2.51 (<math>\pm 0.74</math>)</p> <p>Frequency of events reported</p> <p>I:</p> <p>Pre-test: 2.91 (<math>\pm 0.56</math>) Post-test: 2.76 (<math>\pm 1.04</math>)</p> <p>C:</p> <p>Pre-test: 2.66 (<math>\pm 0.66</math>) Post-test: 2.51 (<math>\pm 0.68</math>)</p> <p>Teamwork across hospital units</p> <p>I:</p> <p>Pre-test: 2.94 (<math>\pm 0.93</math>) Post-test: 3.06 (<math>\pm 0.84</math>)</p> <p>C:</p> <p>Pre-test: 3.17 (<math>\pm 0.76</math>) Post-test: 3.15 (<math>\pm 0.81</math>)</p>	
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						<p>Staffing</p> <p>I: Pre-test: 1.84 (<math>\pm 0.62</math>) Post-test: 1.97 (<math>\pm 0.52</math>)</p> <p>C: Pre-test: 1.69 (<math>\pm 0.46</math>) Post-test: 1.68 (<math>\pm 0.57</math>)</p> <p>Handoffs and transitions</p> <p>I: Pre-test: 2.75 (<math>\pm 0.91</math>) Post-test: 4.23 (<math>\pm 0.69</math>)</p> <p>C: Pre-test: 2.42 (<math>\pm 0.80</math>) Post-test: 2.69 (<math>\pm 0.66</math>)</p> <p>Non-punitive response to errors</p> <p>I: Pre-test: 2.25 (<math>\pm 0.93</math>) Post-test: 2.78 (<math>\pm 0.94</math>)</p> <p>C: Pre-test: 2.45 (<math>\pm 1.15</math>) Post-test: 2.46 (<math>\pm 1.17</math>)</p> <p>Total scores of the patient safety culture</p> <p>I: Pre-test: 2.91 (<math>\pm 0.4</math>) Post-test: 3.46 (<math>\pm 0.26</math>)</p> <p>C: Pre-test: 2.86 (<math>\pm 0.37</math>) Post-test: 2.84 (<math>\pm 0.37</math>)</p> <p>Safety score</p>
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								I: Pre-test: 2.63 (±0.7) Post-test: 3.37 (±0.5) C: Pre-test: 2.88 (±0.4) Post-test: 2.90 (±0.5)																																																
Kok, 2023	<p><u>Type of study:</u> Parallel cluster RCT</p> <p><u>Setting and country:</u> Six ICUs in two hospitals located in Nijmegen, the Netherlands</p> <p><u>Funding and conflicts of interest:</u> This research was supported by ZonMw, the Netherlands Organisation for Health Research and Development (grant 516012513).</p>	<p><u>Inclusion criteria:</u> ICU professionals with responsibilities in the provision of intensive care, that is, ICU nurses, intensivists, fellows, and residents, were eligible for inclusion.</p> <p><u>Exclusion criteria:</u> N.R.</p> <p><u>N total at baseline:</u></p> <table border="1"> <thead> <tr> <th></th> <th>ICU1</th> <th>ICU2</th> <th>ICU3</th> <th>ICU4</th> <th>ICU5</th> <th>ICU6</th> </tr> </thead> <tbody> <tr> <td>Respondents enrolled at baseline, n</td> <td>85</td> <td>30</td> <td>63</td> <td>15</td> <td>68</td> <td>27</td> </tr> <tr> <td>Respondents enrolled at follow-up, n</td> <td>42</td> <td>19</td> <td>25</td> <td>9</td> <td>42</td> <td>10</td> </tr> <tr> <td>Total respondents, n</td> <td>127</td> <td>49</td> <td>88</td> <td>24</td> <td>110</td> <td>37</td> </tr> <tr> <td>Nursing staff per unit, %</td> <td>76.3</td> <td>65.5</td> <td>83.9</td> <td>93.3</td> <td>77.6</td> <td>88</td> </tr> <tr> <td>Residents per unit, %</td> <td>15.8</td> <td>0</td> <td>8.9</td> <td>6.7</td> <td>13.8</td> <td>4</td> </tr> <tr> <td>Intensivists per unit, %</td> <td>7.9</td> <td>34.5</td> <td>7.1</td> <td>0</td> <td>8.6</td> <td>8</td> </tr> </tbody> </table> <p>Intervention and control group characteristics</p>		ICU1	ICU2	ICU3	ICU4	ICU5	ICU6	Respondents enrolled at baseline, n	85	30	63	15	68	27	Respondents enrolled at follow-up, n	42	19	25	9	42	10	Total respondents, n	127	49	88	24	110	37	Nursing staff per unit, %	76.3	65.5	83.9	93.3	77.6	88	Residents per unit, %	15.8	0	8.9	6.7	13.8	4	Intensivists per unit, %	7.9	34.5	7.1	0	8.6	8	<p><u>Describe intervention (treatment/procedure/test):</u></p> <p>The intervention consisted of organizing structural MCD in the ICU. "Structural" means that MCD was embedded into the regular ICU workflow and that it was organized at least once a month. Moreover, in each ICU, appointed ICU physicians and ICU nurses kept track of moral issues affecting the professionals, and organized the MCDs. All professionals in the unit were invited, but participation was not mandatory. Moral issues were prospectively or retrospectively discussed and related either to medical-ethical decision-making in patient cases, or to broader moral issues</p>	<p><u>Describe control (treatment/procedure/test):</u></p> <p>No team-based ethical dialogue was offered on the control ICUs. Control ICUs, however, retained the possibility to request MCD.</p>	<p><u>Length of follow-up:</u> 6, 12 and 21 months</p> <p><u>Loss-to-follow-up and incomplete outcome data:</u> Per-protocol analyses: 346 participants. ITT analysis: 435 participants</p> <p>The study cohort was open. ICU professionals could therefore leave or be added to the cohort over</p>	<p>Team climate Effect: 0.03 95%CI: -0.07 to 0.12</p> <p>Supportive organization Effect: 0.15 95%CI: 0.04 to 0.26</p> <p>Leadership Effect: 0.19 95%CI: 0.08 to 0.30</p> <p>Collegiality Effect: 0.07 95%CI: -0.02 to 0.15</p> <p>Relationship with supervisor Effect: -0.03 95%CI: -0.15 to 0.09</p> <p>Participation opportunities Effect: 0.13 95%CI: 0.00 to 0.25</p>	ITT analyses were performed
	ICU1	ICU2	ICU3	ICU4	ICU5	ICU6																																																		
Respondents enrolled at baseline, n	85	30	63	15	68	27																																																		
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<p>Dr. Kok's institution received funding from ZonMw. Dr. van Gorp's institution received funding from The Netherlands Organisation for Health Research and Development; he received support for article research from The Netherlands Organisation for Health Research and Development. The remaining authors have disclosed that they do not have any potential conflicts of interest.</p>		ICUs with MCD (k=3)	ICUs without MCD (k=3)	<p>arising from ICU practice, for example, prejudices about unvaccinated COVID-19 patients or ICU nurse's proper role in end-of-life care and death rituals on the PICU. A fixed pool of five facilitators (four ethicists and one spiritual counselor, all experienced in facilitating MCD) presided over the meetings according to availability. Facilitators were independent and not involved in conducting the study. They were informed about the research project. Generally, a single MCD lasted an hour.</p> <p>MCD was implemented at the randomly assigned timepoint.</p>	<p>time. ICU professionals with full data on the outcomes, but not at all timepoints, were also included in the analysis.</p>		
	Respondents enrolled at baseline, n	178	110				
	Respondents enrolled at follow-up, n	86	61				
	Total respondents, n	264	171				
	Nursing staff per unit, %	203 (77%)	141 (82.7%)				
	Residents per unit, %	28 (10.6%)	17 (10.2%)				
	Intensivists per unit, %	33 (12.4%)	12 (7.1%)				
	Emotional exhaustion, median (IQR)	1.12 (0.62–1.37)	1.25 (0.62–1.87)				
	Depersonalization, median (IQR)	0.60 (0.40–1.20)	0.80 (0.20–1.20)				
	Personal accomplishment, median (IQR)	4.43 (3.86–5.00)	4.43 (3.71–5.14)				
	Groups comparable at baseline?						
	Yes						

### Risk of bias table for intervention studies

Study reference (first author, publication year)	Was the allocation sequence adequately generated?	Was the allocation adequately concealed?	Blinding: Was knowledge of the allocated interventions adequately prevented?  Were patients blinded?  Were healthcare providers blinded?  Were data collectors blinded?  Were outcome assessors blinded?  Were data analysts blinded?	Was loss to follow-up (missing outcome data) infrequent?	Are reports of the study free of selective outcome reporting?	Was the study apparently free of other problems that could put it at a risk of bias?	Overall risk of bias If applicable/necessary, per outcome measure
Amiri, 2018	Definitely no  Reason: Permuted block randomization based	No information	Probably no  Reason: The educational empowerment program was carried	Probably no  Reason: The loss to follow-up after allocation and	Definitely yes  Reason: All relevant outcomes were reported	Definitely yes  Reason: No other problems noted	<b>HIGH (all outcomes)</b>  Reason: No high confidence in randomisation procedure and blinding

	<p>on hospital, but not clear how</p> <p>Citation:  <i>The nurses were selected based on proportional stratified sampling. Therefore, the number of selected nurses from each ICU was proportional to the total number of its nurses. To randomly allocate nurses, a number was assigned to each ICU and categorized into the control and experimental groups, based on permuted block randomization. In total, 30 nurses from ICUs number 1, 3, and 6 (surgical, neurosurgical, and general ICU) were assigned to the experimental group. In addition, 30 nurses from ICUs number 2, 4, and 5 (medical, neurosurgical, and general ICU) were assigned to the control group.</i></p>		<p>out by one of the researchers.</p>	<p>after follow-up relatively big.</p> <p><u>Loss-to-follow-up:</u>  <b>Intervention:</b> 9 nurses and 1 supervisor were lost to follow-up  Reasons: 8 nurses and 1 supervisor did not receive the intervention, and 1 nurse did not complete the post-test</p> <p><b>Control:</b> 3 nurses and 6 supervisors were lost to follow-up  Reasons: 3 nurses and 4 supervisors did not complete the pre-rest, and 2 supervisors did not complete the post-test</p> <p>Only the data from participants who completed the pre- and post-test were analysed.</p>			
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Kok, 2023	<p>Probably yes</p> <p>Reason: Envelopes contained the names of the participating ICU's.</p>	<p>Definitely yes</p> <p>Reason: ICUs were randomized by N.K. and M.Z. using sealed envelopes containing the names of the participating ICUs apart from ICU 1, which was already in the intervention condition at the start of the study. An independent researcher was present during randomization.</p>	<p>Probably no</p> <p>Reason: Blinding was not possible as ICU professionals would be aware of MCD structurally taking place in their ICU.</p>	<p>Probably no</p> <p>Reason: Loss to follow-up and incomplete data was high. Per-protocol analyses: 346 participants. ITT analysis: 435 participants</p> <p>Citation from study: <i>It is likely that the questionnaires were mostly returned by ICU professionals without burnout symptoms, leading to a selection bias known as the "healthy worker effect," which may increase the likelihood of false-negative findings. This bias works in two ways. First, professionals with burnout at the start of the study who improved over time may not have participated in the baseline measurement but might</i></p>	<p>Definitely yes</p> <p>Reason: All relevant outcomes were reported</p>	<p>Definitely yes</p> <p>Reason: No other problems noted</p>	<p>HIGH (all outcome measures)</p> <p>Reason: high loss to follow-up with possible healthy-worker effect and no blinding</p>
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				<p><i>have returned follow-up questionnaires: the so-called healthy worker selection effect.</i></p> <p><i>Second, it is likely that those ICU professionals who over the course of the study developed burnout symptoms dropped out and did not complete follow-up questionnaires: the so-called healthy worker survivor effect.</i></p>			
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## Table of excluded studies

Reference	Reason for exclusion
Etemadifar, Shahram and Sedighi, Zeynab and Sedehi, Morteza and Masoudi, Reza The effect of situation, background, assessment, recommendation-based safety program on patient safety culture in intensive care unit nurses. Journal of education and health promotion. 2021; 10 :422	Wrong study design
Kemper, Peter F. and de Bruijne, Martine and van Dyck, Cathy and So, Ralph L. and Tangkau, Peter and Wagner, Cordula Crew resource management training in the intensive care unit. A multisite controlled before-after study. BMJ quality & safety. 2016; 25 (8) :577-587	Wrong study design (no randomization took place)
Sexton, J. B. and Berenholtz, S. M. and Goeschel, C. A. and Watson, S. R. and Holzmuller, C. G. and Thompson, D. A. and Hyzy, R. C. and Marsteller, J. A. and Schumacher, K. and Pronovost, P. J. Assessing and improving safety climate in a large cohort of intensive care units. Critical Care Medicine. 2011; 39 (5) :934-939	Wrong study design
Ling, Lowell and Gomersall, Charles David and Samy, Winnie and Joynt, Gavin Matthew and Leung, Czarina C. H. and Wai-Tat, Wong and Lee, Anna and Leung, Czarina Ch and Wong, Wai-Tat The Effect of a Freely Available Flipped Classroom Course on Health Care Worker Patient Safety Culture: A Prospective Controlled Study. Journal of Medical Internet Research. 2016; 18 (7) :26	Wrong study design
Ling, Lowell and Gomersall, Charles David and Samy, Winnie and Joynt, Gavin Matthew and Leung, Czarina Ch and Wong, Wai-Tat and Lee, Anna The Effect of a Freely Available Flipped Classroom Course on Health Care Worker Patient Safety Culture: A Prospective Controlled Study. Journal of medical Internet research. 2016; 18 (7) :e180	Wrong study design
Ling, L. and Joynt, G. and Lee, A. and Samy, W. and Fung, H. and Gomersall, C. D. Prospective controlled study to compare the effects of a basic patient safety course on healthcare worker patient safety culture. Critical Care. 2015; 19 :S180	Wrong study design
Al Ma'mari, Qasim and Sharour, Loai Abu and Al Omari, Omar Fatigue, burnout, work environment, workload and perceived patient safety culture among critical care nurses. British Journal of Nursing. 2020; 29 (1) :28-34	among critical care nurses; including neonatal intensive care units (NICUs), paediatric ICUs, adult ICUs, coronary care units and post-cardiac surgery units,  Wrong study design

Alrabae, Yaseen Mohammed A. and Aboshaiqah, Ahmad E. and Tumala, Regie B. The association between self-reported workload and perceptions of patient safety culture: A study of intensive care unit nurses. <i>Journal of Clinical Nursing</i> (John Wiley & Sons, Inc.). 2021; 30 (7) :1003-1017	Wrong study design
Armellino, Donna and Griffin, Mary T. Quinn and Fitzpatrick, Joyce J. Structural empowerment and patient safety culture among registered nurses working in adult critical care units. <i>Journal of Nursing Management</i> . 2010; 18 (7) :796-803	Wrong study design
Collier, Susan L. and Fitzpatrick, Joyce J. and Siedlecki, Sandra L. and Dolansky, Mary A. Employee Engagement and a Culture of Safety in the Intensive Care Unit. <i>JONA: The Journal of Nursing Administration</i> . 2016; 46 (1) :49-54	Wrong study design
de Lima Silva Nunes, Ranielle and de Camargo Silva, Ana Elisa Bauer and de Lima, Juliana Carvalho and Carvalho, Dayse Edwiges and Bernardes, Cristina Alves and Sousa, Tanielly Paula and Gimenes, Fernanda Raphael Escobar and Pires, Ana Claudia Andrade Cordeiro Factors influencing the patient safety climate in intensive care units: cross-sectional study. <i>BMC nursing</i> . 2021; 20 (1) :125	Wrong study design
Dodek, Peter M. and Wong, Hubert and Jaswal, Danny and Heyland, Daren K. and Cook, Deborah J. and Rocker, Graeme M. and Kutsogiannis, Demetrios J. and Dale, Craig and Fowler, Robert and Ayas, Najib T. Organizational and safety culture in Canadian intensive care units: Relationship to size of intensive care unit and physician management model. <i>Journal of Critical Care</i> . 2012; 27 (1) :11-17	Wrong study design
Meurling, Lisbet and Hedman, Leif and Sandahl, Christer and Fellander-Tsai, Li and Wallin, Carl-Johan Systematic simulation-based team training in a Swedish intensive care unit: a diverse response among critical care professions. <i>BMJ quality &amp; safety</i> . 2013; 22 (6) :485-494	Wrong study design
Ng, George Wing Yiu and Pun, Jack Kwok Hung and So, Eric Hang Kwong and Chiu, Wendy Wai Hang and Leung, Avis Siu Ha and Stone, Yuk Han and Lam, Chung Ling and Lai, Sarah Pui Wa and Leung, Rowlina Pui Wah and Luk, Hing Wah and Leung, Anne Kit Hung and Au Yeung, Kin Wah and Lai, Kang Yiu and Slade, Diana and Chan, Engle Angela Speak-up culture in an intensive care unit in Hong Kong: a cross-sectional survey exploring the communication openness perceptions of Chinese doctors and nurses. <i>BMJ open</i> . 2017; 7 (8) :e015721	Wrong study design

<p>Pronovost, P. and Weast, B. and Rosenstein, B. and Sexton, J. B. and Holzmueller, C. G. and Paine, L. and Davis, R. and Rubin, H. R. Implementing and validating a comprehensive unit-based safety program. <i>Journal of Patient Safety</i>. 2005; 1 (1) :33-40</p>	<p>Wrong outcome and study design</p>
<p>Tlili, M. A. and Aouicha, W. and Sahli, J. and Mellouli, A. and Hiab, M. B. and Chelbi, S. and Rejeb, M. B. and Mallouli, M. Assessing anesthesiologists' patient safety culture and its associated factors in Tunisian intensive care units. <i>Anesthesia and Analgesia</i>. 2021; 133 (3) :1644</p>	<p>Wrong study design</p>
<p>Vifladt, Anne and Simonsen, Bjoerg O. and Lydersen, Stian and Farup, Per G. Changes in patient safety culture after restructuring of intensive care units: Two cross-sectional studies. <i>Intensive &amp; Critical Care Nursing</i>. 2016; 32 :58-65</p>	<p>Wrong study design</p>

## Literature search strategy

### Zoekverantwoording

#### Algemene informatie

Cluster/richtlijn: NVIC Leidraad Organisatie van Intensive Care	
Uitgangsvraag/modules: Hoe bevorderen we een positieve veiligheidscultuur op IC-afdelingen?	
Database(s): Embase.com, Ovid/Medline	Datum: 28 november 2023
Periode: vanaf 2000	Talen: geen restrictie
Literatuurspecialist: Alies van der Wal	Rayyan review: <a href="https://rayyan.ai/reviews/858695">https://rayyan.ai/reviews/858695</a>
BMI-zoekblokken: voor verschillende opdrachten wordt (deels) gebruik gemaakt van de zoekblokken van BMI-Online <a href="https://blocks.bmi-online.nl/">https://blocks.bmi-online.nl/</a>	
Deduplication: voor het ontdebellen is gebruik gemaakt van <a href="http://dedupendnote.nl/">http://dedupendnote.nl/</a>	
<b>Toelichting:</b> Voor deze vraag is gezocht op de elementen: <ul style="list-style-type: none"><li>- intensive care</li><li>- veiligheidscultuur</li></ul> →De sleutelartikelen worden niet gevonden met deze search doordat ze niet specifiek over IC gaan. Er is voor gekozen om de search in eerste instantie wel op IC te richten. Eventueel kan in een later stadium breder worden gezocht, mocht deze strategie onvoldoende opleveren.	
Te gebruiken voor richtlijntekst: In de databases Embase.com, Ovid/Medline, Ovid/PsycInfo en Ebsco/CINAHL is op 28 november 2023 systematisch gezocht naar systematische reviews, RCTs en observationele studies over veiligheidscultuur op IC-afdelingen. De literatuurzoekactie leverde 462 unieke treffers op.	

### Zoekopbrengst

	EMBASE	OID/MEDLINE	OID/PSYCINFO	EBSCO CINAHL	Ontdubbeld
SR	9	12	11	15	41
RCT	53	67	6	111	190
Observationele studies	121	141	45	97	231
<b>Totaal</b>	<b>183</b>	<b>220</b>	<b>62</b>	<b>223</b>	<b>462*</b>

*\*in Rayyan*

### Zoekstrategie

#### Embase.com

No.	Query	Results
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#1	'intensive care unit'/exp OR 'intensive care'/exp OR 'intensive care':ti,ab,kw OR icu:ti,ab,kw OR 'critical care':ti,ab,kw	1205986
#2	'organizational culture'/exp/mj OR (((work OR workplace OR organisation* OR organization* OR institution* OR safety OR team) NEAR/3 (cultur* OR climate)):ti,kw)	7547
#3	#1 AND #2	366
#4	#3 NOT ('conference abstract'/it OR 'editorial'/it OR 'letter'/it OR 'note'/it) NOT (('animal'/exp OR 'animal experiment'/exp OR 'animal model'/exp OR 'nonhuman'/exp) NOT 'human'/exp)	305
#5	#3 AND [2000-2024]/py	362
#6	'meta analysis'/exp OR 'meta analysis (topic)'/exp OR metaanaly*:ti,ab OR 'meta analy*':ti,ab OR metanaly*:ti,ab OR 'systematic review'/de OR 'cochrane database of systematic reviews'/jt OR prisma:ti,ab OR prospero:ti,ab OR (((systemati* OR scoping OR umbrella OR 'structured literature') NEAR/3 (review* OR overview*)):ti,ab) OR ((systemic* NEAR/1 review*):ti,ab) OR (((systemati* OR literature OR database* OR 'data base*') NEAR/10 search*):ti,ab) OR (((structured OR comprehensive* OR systemic*) NEAR/3 search*):ti,ab) OR (((literature NEAR/3 review*):ti,ab) AND (search*:ti,ab OR database*:ti,ab OR 'data base*':ti,ab)) OR (('data extraction':ti,ab OR 'data source*':ti,ab) AND 'study selection':ti,ab) OR ('search strategy':ti,ab AND 'selection criteria':ti,ab) OR ('data source*':ti,ab AND 'data synthesis':ti,ab) OR medline:ab OR pubmed:ab OR embase:ab OR cochrane:ab OR (((critical OR rapid) NEAR/2 (review* OR overview* OR synthes*)):ti) OR (((critical* OR rapid*) NEAR/3 (review* OR overview* OR synthes*)):ab) AND (search*:ab OR database*:ab OR 'data base*':ab) OR metasynthes*:ti,ab OR 'meta synthes*':ti,ab	981669
#7	'clinical trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp OR 'placebo'/exp OR 'prospective study'/exp OR rct:ab,ti OR random*:ab,ti OR 'single blind':ab,ti OR 'randomised controlled trial':ab,ti OR 'randomized controlled trial'/exp OR placebo*:ab,ti	3925045
#8	'major clinical study'/de OR 'clinical study'/de OR 'case control study'/de OR 'family study'/de OR 'longitudinal study'/de OR 'retrospective study'/de OR 'prospective study'/de OR 'comparative study'/de OR 'cohort analysis'/de OR ((cohort NEAR/1 (study OR studies)):ab,ti) OR (('case control' NEAR/1 (study OR studies)):ab,ti) OR (('follow up' NEAR/1 (study OR studies)):ab,ti) OR (observational NEAR/1 (study OR studies)) OR ((epidemiologic NEAR/1 (study OR studies)):ab,ti) OR (('cross sectional' NEAR/1 (study OR studies)):ab,ti)	7953101
#9	'case control study'/de OR 'comparative study'/exp OR 'control group'/de OR 'controlled study'/de OR 'controlled clinical trial'/de OR 'crossover	14617226

	<p>procedure'/de OR 'double blind procedure'/de OR 'phase 2 clinical trial'/de OR 'phase 3 clinical trial'/de OR 'phase 4 clinical trial'/de OR 'pretest posttest design'/de OR 'pretest posttest control group design'/de OR 'quasi experimental study'/de OR 'single blind procedure'/de OR 'triple blind procedure'/de OR (((control OR controlled) NEAR/6 trial):ti,ab,kw) OR (((control OR controlled) NEAR/6 (study OR studies)):ti,ab,kw) OR (((control OR controlled) NEAR/1 active):ti,ab,kw) OR 'open label*':ti,ab,kw OR (((double OR two OR three OR multi OR trial) NEAR/1 (arm OR arms)):ti,ab,kw) OR ((allocat* NEAR/10 (arm OR arms)):ti,ab,kw) OR placebo*:ti,ab,kw OR 'sham-control*':ti,ab,kw OR (((single OR double OR triple OR assessor) NEAR/1 (blind* OR masked)):ti,ab,kw) OR nonrandom*:ti,ab,kw OR 'non-random*':ti,ab,kw OR 'quasi-experiment*':ti,ab,kw OR crossover:ti,ab,kw OR 'cross over':ti,ab,kw OR 'parallel group*':ti,ab,kw OR 'factorial trial':ti,ab,kw OR ((phase NEAR/5 (study OR trial)):ti,ab,kw) OR ((case* NEAR/6 (matched OR control*)):ti,ab,kw) OR ((match* NEAR/6 (pair OR pairs OR cohort* OR control* OR group* OR healthy OR age OR sex OR gender OR patient* OR subject* OR participant*)):ti,ab,kw) OR ((propensity NEAR/6 (scor* OR match*)):ti,ab,kw) OR versus:ti OR vs:ti OR compar*:ti OR ((compar* NEAR/1 study):ti,ab,kw) OR (('major clinical study'/de OR 'clinical study'/de OR 'cohort analysis'/de OR 'observational study'/de OR 'cross-sectional study'/de OR 'multicenter study'/de OR 'correlational study'/de OR 'follow up'/de OR cohort*:ti,ab,kw OR 'follow up':ti,ab,kw OR followup:ti,ab,kw OR longitudinal*:ti,ab,kw OR prospective*:ti,ab,kw OR retrospective*:ti,ab,kw OR observational*:ti,ab,kw OR 'cross sectional*':ti,ab,kw OR cross?ectional*:ti,ab,kw OR multicient*:ti,ab,kw OR 'multi-cent*':ti,ab,kw OR consecutive*:ti,ab,kw) AND (group:ti,ab,kw OR groups:ti,ab,kw OR subgroup*:ti,ab,kw OR versus:ti,ab,kw OR vs:ti,ab,kw OR compar*:ti,ab,kw OR 'odds ratio*':ab OR 'relative odds':ab OR 'risk ratio*':ab OR 'relative risk*':ab OR 'rate ratio':ab OR aor:ab OR arr:ab OR rrr:ab OR (((or' OR 'rr') NEAR/6 ci):ab)))</p>	
#10	#5 AND #6 - SR	9
#11	#5 AND #7 NOT #10 - RCT	53
#12	#5 AND (#8 OR #9) NOT (#10 OR #11) - observationeel	121
#13	#10 OR #11 OR #12	183

#### Ovid/Medline

#	Searches	Results
1	exp Critical Care/ or exp Intensive Care Units/ or 'intensive care'.ti,ab,kf. or icu.ti,ab,kf. or 'critical care'.ti,ab,kf.	307646
2	exp Organizational Culture/ or ((work or workplace or organisation* or organization* or institution* or safety or team) adj3 (cultur* or climate)).ti,kf.	22491

3	1 and 2	684
4	3 not (comment/ or editorial/ or letter/) not ((exp animals/ or exp models, animal/) not humans/)	652
5	limit 4 to yr="2000 -Current"	620
6	meta-analysis/ or meta-analysis as topic/ or (metaanaly* or meta-analy* or metanaly*).ti,ab,kf. or systematic review/ or cochrane.jw. or (prisma or prospero).ti,ab,kf. or ((systemati* or scoping or umbrella or "structured literature") adj3 (review* or overview*).ti,ab,kf. or (systemic* adj1 review*).ti,ab,kf. or ((systemati* or literature or database* or data-base*) adj10 search*).ti,ab,kf. or ((structured or comprehensive* or systemic*) adj3 search*).ti,ab,kf. or ((literature adj3 review*) and (search* or database* or data-base*).ti,ab,kf. or (("data extraction" or "data source*") and "study selection").ti,ab,kf. or ("search strategy" and "selection criteria").ti,ab,kf. or ("data source*" and "data synthesis").ti,ab,kf. or (medline or pubmed or embase or cochrane).ab. or ((critical or rapid) adj2 (review* or overview* or synthes*).ti. or (((critical* or rapid*) adj3 (review* or overview* or synthes*)) and (search* or database* or data-base*).ab. or (metasynthes* or meta-synthes*).ti,ab,kf.	710647
7	exp clinical trial/ or randomized controlled trial/ or exp clinical trials as topic/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	2663255
8	Epidemiologic studies/ or case control studies/ or exp cohort studies/ or Controlled Before-After Studies/ or Case control.tw. or cohort.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/ [Onder exp cohort studies vallen ook longitudinale, prospectieve en retrospectieve studies]	4594775
9	Case-control Studies/ or clinical trial, phase ii/ or clinical trial, phase iii/ or clinical trial, phase iv/ or comparative study/ or control groups/ or controlled before-after studies/ or controlled clinical trial/ or double-blind method/ or historically controlled study/ or matched-pair analysis/ or single-blind method/ or (((control or controlled) adj6 (study or studies or trial)) or (compar* adj (study or studies)) or ((control or controlled) adj1 active) or "open label*" or ((double or two or three or multi or trial) adj (arm or arms)) or (allocat* adj10 (arm or arms)) or placebo* or "sham-control*" or ((single or double or triple or assessor) adj1 (blind* or masked)) or nonrandom* or "non-random*" or "quasi-	5569029

	experiment*" or "parallel group*" or "factorial trial" or "pretest posttest" or (phase adj5 (study or trial)) or (case* adj6 (matched or control*)) or (match* adj6 (pair or pairs or cohort* or control* or group* or healthy or age or sex or gender or patient* or subject* or participant*)) or (propensity adj6 (scor* or match*))).ti,ab,kf. or (confounding adj6 adjust*).ti,ab. or (versus or vs or compar*).ti. or ((exp cohort studies/ or epidemiologic studies/ or multicenter study/ or observational study/ or seroepidemiologic studies/ or (cohort* or 'follow up' or followup or longitudinal* or prospective* or retrospective* or observational* or multigent* or 'multi-cent*' or consecutive*).ti,ab,kf.) and ((group or groups or subgroup* or versus or vs or compar*).ti,ab,kf. or ('odds ratio*' or 'relative odds' or 'risk ratio*' or 'relative risk*' or aor or arr or rrr).ab. or ("OR" or "RR") adj6 CI).ab.))	
10	5 and 6 - SR	12
11	(5 and 7) not 10 - RCT	67
12	(5 and (8 or 9)) not (10 or 11) - observationeel	141
13	10 or 11 or 12	220

#### Ovid/PsycInfo

#	Searches	Results
1	exp Intensive Care/ or (intensive care or icu or critical care).ti,ab,id.	13663
2	exp Organizational Culture/ or ((work or workplace or organisation* or organization* or institution* or safety or team) adj3 (cultur* or climate)).ti,ab,id.	33670
3	1 and 2	153
4	limit 3 to yr="2000 -Current"	147
5	((literature review or systematic review or meta analysis).md. or "literature review"/ or meta analysis/ or (((meta adj2 analy*) or metaanaly* or (synthes* adj2 (literature* or research* or studies or data)) or (pooled and analys*) or ((data adj1 pool*) and studies) or medline or medlars or embase or cinahl or scisearch or psychlit or psyclit or cinhal or cancerlit or cochrane or bids or pubmed or ovid or ((hand or manual or database* or computer*) adj1 search*) or (electronic adj1 (database* or data base or data bases))).ti,ab,id. or (review* or overview).ti. or (bibliograph* or relevant journals or ((review* or overview*) adj9 (systematic* or methodologic* or quantitativ* or research* or literature* or studies or trial* or effective*))).ab.)) not (((retrospective* or record* or case* or patient*) adj1 review*) or ((patient* or review*) adj1 chart*).ti,ab,id.	482880
6	exp clinical trial/ or randomized controlled trial/ or randomized controlled trials as topic/ or Random Allocation/ or Double-Blind Method/ or Single-Blind Method/ or (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or controlled clinical trial or randomized controlled trial or multicenter study or clinical trial).pt. or random*.ti,ab. or (clinic* adj	293465

	trial*).tw. or ((singl* or doubl* or treb* or tripl*) adj (blind\$3 or mask\$3)).tw. or Placebos/ or placebo*.tw.	
7	Epidemiologic studies/ or case control studies/ or exp Cohort Analysis/ or Controlled Before-After Studies/ or Case control.tw. or cohort*.tw. or Cohort analy\$.tw. or (Follow up adj (study or studies)).tw. or (observational adj (study or studies)).tw. or Longitudinal.tw. or Retrospective*.tw. or prospective*.tw. or consecutive*.tw. or Cross sectional.tw. or Cross-sectional studies/ or historically controlled study/ or interrupted time series analysis/	466124
8	4 and 5 - SR	11
9	(4 and 6) not 8 - RCT	6
10	(4 and 7) not (8 or 9) - observationeel	45
11	8 or 9 or 10	62

### Ebsco/CINAHL

#	Searches	Results
S1	(MH "Intensive Care Units+") OR (MH "Critical Care Nursing+") OR (MH "Critical Care+") OR TI ("critical care" OR "intensive care" OR icu) OR AB ("critical care" OR "intensive care" OR icu)	163,47
S2	(MM "Organizational Culture") OR TI (((work OR workplace OR organisation* OR organization* OR institution* OR safety OR team) N3 (cultur* OR climate)))	11,599
S3	S1 AND S2	390
S4	(MH "Meta Analysis") or TX (meta-analy* or metanaly* or metaanaly* or meta analy*) or TX (systematic* N5 review*) or (evidence* N5 review*) or (methodol* N5 review*) or (quantitativ* N5 review*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (systematic* N5 survey*) or (evidence* N5 survey*) or (methodol* N5 survey*) or (quantitativ* N5 survey*) or TX (systematic* N5 overview*) or (evidence* N5 overview*) or (methodol* N5 overview*) or (quantitativ* N5 overview*) or TX (pool* N2 data) or (combined N2 data) or (combining N2 data) or (pool* N2 trials) or (combined N2 trials) or (combining N2 trials) or (pool* N2 studies) or (combined N2 studies) or (combining N2 studies) or (pool* N2 results) or (combined N2 results) or (combining N2 results)	320,934
S5	(MH "Clinical Trials+") OR (PT (Clinical trial)) OR (MH "Random Assignment") OR (MH "Quantitative Studies") OR TX ((clini* N1 trial*) OR (singl* N1 blind*) OR (singl* N1 mask*) OR (doubl* N1 blind*) OR (doubl* N1 mask*) OR (tripl* N1 blind*) OR (tripl* N1 mask*) OR (random* N1 allocat*) OR placebo* OR ((waitlist* OR (wait* and list*)) and (control* OR group)) OR "treatment as usual" OR tau OR (control* N3 (trial* OR study OR studies OR group*)) OR randomized OR randomised))	1,987,559

S6	(MH "Case Control Studies+") OR (MH "Case Studies") OR (MH "Cross Sectional Studies") OR (MH "Prospective Studies+") OR (MH "Retrospective Panel Studies") OR (MH "Correlational Studies") OR TI "case control" OR TI "case referent" OR AB "case referent*" OR TI "case stud*" OR AB "case stud*" OR TI "case series" OR AB "case series" OR TI cohort* OR AB cohort* OR TI "cross sectional" OR AB "cross sectional" OR TI "follow up" OR AB "follow up" OR TI longitudinal OR AB longitudinal OR TI retrospective* OR AB retrospective* OR TI prospective* OR AB prospective* OR TI observational OR AB observational OR TI "Controlled before and after" OR AB "Controlled before and after" OR TI "Interrupted time series" OR AB "Interrupted time series" OR TI Correlational OR AB Correlational	1,575,205
S7	S3 AND S4 - SR	15
S8	S3 AND S5 NOT S7 - RCT	111
S9	S3 AND S6 NOT (S7 OR S8) - observationeel	97
S10	S7 OR S8 OR S9	223

## **Bijlage - Module 10 Werkwijze tijdens een crisis**

### **Samenvatting literatuur**

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie gebaseerd op overwegingen en op bestaande aanbevelingen en niet op wetenschappelijke literatuur.

### Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
<p>Tijdens een crisis</p> <ul style="list-style-type: none"> <li>• Is de definitie van de IC-patiënt niet anders;</li> <li>• Kunnen IC-patiënten buiten de IC behandeld worden, mits de juiste apparatuur en personeel daar aanwezig zijn;</li> <li>• Blijven intensivist en IC-verpleegkundige regiebehandelaars van de IC-patiënt, ook als die buiten de IC behandeld wordt.</li> </ul> <p>Iedere IC heeft een crisisopschalingsplan als onderdeel van het ZBP. Beschrijf daarin de volgende punten:</p> <ul style="list-style-type: none"> <li>• De opschalingsfasen die het plan heeft en wat in elke fase de behandelcapaciteit is. De koppeling van deze fasen</li> </ul>	<1 jaar	geen	reeds aanwezig	geen	geen	nvt	Geen

<p>en de behandelcapaciteit aan regionale en landelijk afspraken;</p> <ul style="list-style-type: none"> <li>• Hoe de regionale samenwerking en coördinatie plaatsvinden;</li> <li>• Criteria voor op- en afschalen;</li> <li>• Bevoegdheid van op- en afschalen;</li> <li>• De communicatie tijdens op- en afschalen;</li> <li>• De commandostructuur tijdens op- en afschalen;</li> <li>• De wijze waarop professionals worden ingezet;</li> <li>• De wijze waarop middelen worden ingezet;</li> <li>• De maximale span-of-control voor IC-verpleegkundigen, intensivisten en IC-voorwachten per opschalingsfase;</li> <li>• De inzet van niet-IC personeel en de wijze waarop eindverantwoordelijkheid voor de behandeling (verpleegkundig en medisch) belegd is;</li> </ul>							
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<ul style="list-style-type: none"> <li>• De organisatie van samenwerking en communicatie met de regiopartners;</li> <li>• De organisatie van samenwerking en communicatie met de verschillende afdelingen in het ziekenhuis;</li> <li>• De ondersteuning die gegeven moet worden aan professionals om hun taken optimaal te kunnen doen. Denk aan kinderopvang, mental support, etc.</li> </ul> <p>Evalueer en actualiseer het crisisopschalingsplan periodiek (minstens 1 keer per 5 jaar).</p>							
<p>Overweeg het paraat hebben staan van extra in te zetten personeel uit andere disciplines op de IC onder supervisie van een intensivist en/of IC-verpleegkundige om zo op te kunnen schalen ten tijde van een crisis.</p>	< 1 jaar	Mogelijk extra kosten door opleiding/training en verlies aan inkomsten bij inzet ramp	Tijdens COVID crisis reeds toegepast	Beschikbaarheid personeel en kosten	Inventariseren beschikbaar personeel	Ziekenhuis	Geen

## **Bijlage - Module 11 Zorgbeleidsplan**

### **Samenvatting literatuur**

De aanbevelingen zijn, gezien de aard van de uitgangsvraag en de specifieke Nederlandse situatie, uitsluitend gebaseerd op overwegingen. Deze overwegingen zijn opgesteld door de werkgroepleden op basis van kennis uit de praktijk en de evaluatie van de kwaliteitsstandaard uit 2016.

## Implementatieplan

Aanbeveling	Tijdspad voor implementatie: < 1 jaar, 1 tot 3 jaar of > 3 jaar	Verwacht effect op kosten	Randvoorwaarden voor implementatie (binnen aangegeven tijdspad)	Mogelijke barrières voor implementatie <sup>1</sup>	Te ondernemen acties voor implementatie <sup>2</sup>	Verantwoordelijken voor acties <sup>3</sup>	Overige opmerkingen
Alle aanbevelingen in module 11 - Zorgbeleidsplan	<1 jaar	geen	Draagvlak management IC en RvB	Tijd, prioritering	geen	Management IC	

