

II. 分担研究報告

令和3（2021）年度厚生労働科学研究費補助金等（地域医療基盤開発推進研究事業）

「医療の質および患者アウトカムの向上に資する、看護ニーズに基づく適切な

看護サービス・マネジメント手法の開発（21IA1002）」

分担研究年度終了報告書

看護配置と看護関連アウトカムの関連：文献レビュー

研究代表者 林田 賢史 産業医科大学病院 医療情報部 部長

研究協力者 森岡 典子 東京医科歯科大学大学院 看護ケア技術開発学分野 講師

村上 玄樹 産業医科大学病院 医療情報部 副部長

【研究要旨】

目的:

本研究では、国内外の文献レビューをもとに、看護関連アウトカムに影響する看護資源(量・質)の要素について整理し、我が国の看護サービスと看護関連アウトカムの関係において不足しているエビデンスを明示する。

方法:

英文については、PubMedを、和文については医中誌及びCiNiiを用い、国内外で実施されている研究に関して文献抽出を行った。特に、国内で実施された研究については、タイトル・アブストラクト、本文の2段階スクリーニングを2名の研究者が独立して実施し文献を抽出した。分析対象文献については、Risk of bias評価を実施するとともに、既存レビュー(アンブレラレビュー)の枠組みを参考にしつつ、類似性に沿って整理し、それらの結果を概観した。

結果:

海外での研究については、多数の研究が抽出された一方、国内での研究については、2段階スクリーニング後に、2006年から2021年までに出版された15件(和文及び英文併せて)が抽出された。抽出された文献の研究デザインは、自記式質問紙を用いた研究が9件、DPCデータや症例登録データベースを用いたデータベース研究が6件であった。看護関連アウトカムについては、患者のアウトカム、看護ケアの質、看護師のアウトカムの3つの枠組みで分類し整理した。看護配置については、看護師あたりの患者数、患者1日あたりの看護ケア時間、1ベッドあたりの看護師数の3つに大きく分類された。

結論:

看護関連アウトカムに影響する看護資源要素については、海外では多くの研究がなされており、看護関連アウトカムに影響する看護資源要素についての知見がそろっていた。一方、国内での研究については、国内外の文献検索によって、2006年から2021年までに出版された15件(和文6件、英文9件)が抽出された。わが国での研究はほとんどないことが明らかとなり、国内での研究の必要性が再確認された。また、国内外の文献レビューにより、医療の質や患者アウトカムに影響する

看護関連要素について整理できた。これらの指標は、看護師の適切な配置に資する指標検討の際の候補となりうるであろう。

A. 研究目的

看護サービス(看護資源)と看護関連アウトカムの関係について、欧米では「看護師の受け持ち患者数や配置状況等が患者の死亡率等に影響する」ことが報告されており、看護関連アウトカムである患者アウトカムと看護資源の関連について明らかになっている。

そのような中、日本においても、看護資源(患者に対する看護師数(量)や専門性を有する看護師の配置状況(質)等)が看護関連アウトカムに与える影響について明らかにされつつある。

そこで本研究では、国内外の文献レビューをもとに、看護関連アウトカムに影響する看護資源(量・質)の要素について整理し、我が国の看護サービスと看護関連アウトカムの関係において不足しているエビデンスを明示する

B. 研究方法

国内外の文献レビューをもとに、医療の質や患者アウトカム(転倒転落、30日以内再入院、在院日数、死亡率等)等の看護関連アウトカムに影響する看護関連要素(提供体制、専門性の高い看護師の配置等)を整理する。

そのため、検索データベースとして、英文についてはPubMedを、和文については医中誌及びCiNiiを用い、国内外で実施されている研究に関して文献抽出を行った。

その際、特に国内で実施された研究については、タイトル・アブストラクト、本文の2段階スクリーニングを2名の研究者が独立して実施し文献を抽出した(文献管理にはRayyanを使用)。ま

た不一致項目については、ディスカッションで合意を得て決定した。分析対象文献については、Risk of bias 評価を実施するとともに、既存レビュー(アンブレラレビュー)の枠組みを参考にしつつ、類似性に沿って整理し、それらの結果を概観した。

なお、国内文献のレビューの具体的な検索式は表1の通りである。また文献の包含基準は、①原著論文(original article)※商業誌は除外、②量的研究(研究デザインは不問)※質的研究やレビューは除外、③使用言語:英語もしくは日本語、④setting が日本の病院であるもの、⑤看護配置に関する変数が含まれており看護関連アウトカムの関連を検討しているもの(看護配置の変数が調整変数の場合もアウトカムとの関連が示されていれば対象文献に含む)をすべて満たすものとした。

(倫理面への配慮)

本研究は、産業医科大学倫理審査委員会の承認(承認番号:第H29-246号)を得て実施した。

C. 研究結果

海外での研究については多数の研究が抽出された。そのうちの代表的な論文である原著論文2本、レビュー論文3本、Umbrella review 論文1本を示す(表2参照)。

国内での研究については、2段階スクリーニング後に、2006年から2021年までに出版された15件(和文及び英文併せて)が抽出された

(図1参照)。抽出された文献の研究デザインは、自記式質問紙を用いた研究が9件、DPCデータや症例登録データベースを用いたデータベース研究が6件であった(表3)。

看護関連アウトカム(Nursing sensitivity outcomes)の変数については、先行研究の分類を参考に、患者のアウトカム、看護ケアの質、看護師のアウトカム(Patient outcome, nursing care quality, nurses' outcome)の3つの枠組みで分類し整理した(表4)。Patient outcomeとしては、Readmission, Hospitalization, In hospital mortality, Failure to rescue, Length of hospital stay, In hospital fracture, In hospital pneumonia, Postoperative complications, Seclusion, Pressure ulcer, Physical restraint, Error and/or near missの変数が用いられていた。Nursing care qualityとしては、Nurse reported quality of care, Ability to provide quality nursing care が用いられていた。Nurses' outcomeとしては、Work engagement, Job satisfaction, Intention to leave, Decision to leave, Burn out, Nurse reported better working environment, Ward morale が用いられていた。

また、看護配置変数については、看護配置を示す看護師あたりの患者数、患者1日あたりの看護ケア時間、1ベッドあたりの看護師数(Number of patient per nurse, Nursing hours per patient day, Number of nurses per bed)の3つに大きく分類された。Number of patient per nurseは、病院単位の変数(診療報酬上の届け出区分や全病棟の平均数)、看護師各個人の回答による看護師単位の受け持ち数が用いられていた。Number of nurses per bedも、病院単位と病棟単位の変

数があった。

国内での看護配置と Nursing sensitivity outcomes との関連を検討した研究においては、使用しているアウトカムが様々であり、結果も一致していない状況(表2参照)であった。リスクオブバイアス評価では、serious や critical に該当する研究が多かった。

D. 考察

海外では多くの研究がなされており(多数のレビュー論文やレビュー論文のレビューである umbrella review も存在)、看護関連アウトカムに影響する看護資源要素についての知見がそろっていた。一方、国内での研究については、国内外の文献検索によって、2006年から2021年までに出版された15件(和文6件、英文9件)が抽出され、わが国での研究はほとんどないことが明らかとなった。また、国内での看護配置と Nursing sensitivity outcomes との関連を検討した研究においては、使用しているアウトカムが様々かつ結果も一致していない状況であり、国内での研究の必要性が再確認された。リスクオブバイアス評価では、serious や critical に該当する研究が多く、頑健なデザインに基づく、さらなる検証が必要であった。

E. 結論

本研究では、国内外の文献レビューをもとに、看護関連アウトカムに影響する看護資源(量・質)の要素について整理した。

海外では多くの研究がなされており、看護関連アウトカムに影響する看護資源要素について

の知見がそろっていた一方、国内での研究については、2006年から2021年までに出版された15件であり、ほとんどないことが明らかとなった。これら15件に関して、看護関連アウトカムについては、患者のアウトカム、看護ケアの質、看護師のアウトカムの3つの枠組みで分類し整理した。また、看護配置については、看護師あたりの患者数、患者1日あたりの看護ケア時間、1ベッドあたりの看護師数の3つに大きく分類された。なお、15件の研究で用いているアウトカムは様々かつ結果も一致していない状況であった。国内での研究の必要性が再確認された。また、国内外の文献レビューによって、医療の質や患者アウトカムに影響する看護関連要素について整理できた。これらの指標は、看護師の適切な配置に資する指標検討の際の候補となりうるであろう。

F. 健康危険情報 なし

G. 知的財産権の出願 なし

H. 利益相反 なし

I. 研究発表

①論文発表

なし

②学会・委員会等発表

なし

表 1 国内での研究成果に関する文献レビューの検索式

検索データベース名	検索式
医中誌	<p>((看護師 or 看護職 or 看護職員 or 看護スタッフ) and (数 or 人数 or 配置)) OR (看護量 or 看護の量) OR (看護提供量 or 看護提供体制) OR (患者 and (看護師 or 看護職 or 看護職員 or 看護スタッフ) and (比 or 率 or 比率)) OR (病床 and (看護師 or 看護職 or 看護職員 or 看護スタッフ) and (比 or 率 or 比率)) AND ((患者 and アウトカム) OR (看護の質 or 看護ケアの質)) AND (2000-2021))</p>
CiNii	<p>((看護師 OR 看護職 OR 看護職員 OR 看護スタッフ) AND (数 OR 人数 OR 配置)) OR (看護量 OR 看護の量) OR (看護提供量 OR 看護提供体制) OR (患者 AND (看護師 OR 看護職 OR 看護職員 OR 看護スタッフ) AND (比 OR 率 OR 比率)) OR (病床 AND (看護師 OR 看護職員 OR 看護スタッフ) AND (比 OR 率 OR 比率))) AND ((患者 AND アウトカム) OR (看護の質 OR 看護ケアの質) OR ((職務 OR 業務 OR 仕事) AND 満足) OR (バーンアウト OR 燃え尽き OR 燃えつき) OR (離職 OR 退職 OR 休職 OR 休暇 OR 欠勤))</p>
PubMed	<p>((nurse and (staffing or number or deployment or ratio or rate or proportion)) OR (quantity of nursing care) OR (nursing system)) AND ((patient and outcome) OR (quality of nursing care) OR (job satisfaction) OR (burnout) OR (turnover or (sick leave) or leave) OR (nurse sensitive outcome) OR (nurse sensitive indicator) OR (patient satisfaction)) AND (Japan and hospital))</p>

表 2-1 海外での研究成果(代表的な論文)の概要(原著論文)

著者	タイトル	発行年	掲載誌	データ等	結果
Aiken LH, et al.	Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction.	2002	JAMA;288:1987-1993	Pennsylvania 州の 168 の非連邦成人総合病院 1998 年 4 月 1 日～1999 年 11 月 30 日に退院した一般、整形外科、血管外科の患者データ(232,342 人) 郵送調査より得た看護師データ(10,184 人)	看護師 1 人あたり受け持ち患者数の 1 人増加(4 人から 5 人) ・入院患者の 30 日以内死亡率上昇(OR, 1.07; 95%CI, 1.03-1.12) ・救命不能(合併症後の死亡)率上昇(OR, 1.07; 95%CI, 1.02-1.11)
Needleman J, et al.	Nurse-staffing levels and the quality of care in hospitals.	2002	N Engl J Med 346:1715-1722.	11 州(Arizona, California, Maryland, Massachusetts, Missouri, Nevada, New York, South Carolina, Virginia, West Virginia, Wisconsin)の 799 病院 1997 年の退院患者データ(内科患者 507 万人および外科患者 1,105 万人)	患者 1 人日あたりの看護時間の 1 時間増加 ・内科患者の在院日数短縮 (coefficient (β) , -0.09; 95%CI, -0.13- 0.05) ・尿路感染減少(OR, 0.99; 95%CI, 0.98-1.00) ・上部消化管出血減少(OR, 0.98; 95%CI, 0.97-0.99) ・院内肺炎減少(OR, 0.99; 95%CI, 0.98-1.00) ・外科患者の救命不能(肺炎、ショック、心停止、上部消化管出血、敗血症、深部静脈血栓症による死亡)率減少(OR, 0.98; 95%CI, 0.96-0.99)

表 2-2 海外での研究成果 (代表的な論文) の概要 (レビュー論文)

著者	タイトル	発行年	掲載誌	データ等	結果
Kane RL, et al.	The association of registered nurse staffing levels and patient outcomes: Systematic review and meta-analysis.	2007	Med Care ;45:1195- 1204.	1990 年から 2006 年に発表された 98 文献を対象にしたメタアナリシス	患者 1 人日あたり看護師 (常勤換算) 1 人の増 加 <ul style="list-style-type: none"> • ICU 入院患者の死亡率減少 (OR,0.91; 95%CI., 0.86-0.96) • 外科患者の死亡率減少 (OR,0.84; 95%CI.,0.80-0.89) • 内科患者の死亡率減少 (OR,0.94; 95%CI.,0.94-0.95) • ICU 入院患者の院内肺炎減少 (OR,0.70; 95%CI., 0.56-0.88)、 誤抜管減少 (OR,0.49; 95%CI.,0.36-0.67)、 呼吸不全減少 (OR,0.40; 95%CI.,0.27-0.59)、 心停止減少 (OR,0.72; 95%CI.,0.62-0.84) • 外科患者の救命不能率減少 (OR,0.84; 95%CI., 0.79-0.90) • ICU 入院患者 (OR,0.76; 95%CI.,0.62-0.94) および外科患者 (OR,0.69; 95%CI.,0.55-0.86) の在院日数短縮

表 2-2 海外での研究成果(代表的な論文)の概要(レビュー論文) つづき

著者	タイトル	発行年	掲載誌	データ等	結果
Shekelle PG.	Nurse-patient ratios as a patient safety strategy: A systematic review.	2013	Ann Intern Med ;158:404-409.	2012年9月まで看護師の人員比率と院内死亡に関するエビデンスを系統的にレビュー	<p>看護師配置の増加と入院患者の死亡率の低下との因果関係を裏付ける最も強力な証拠</p> <ul style="list-style-type: none"> •看護師の配置と患者の併存疾患を注意深く考慮した •単一の病院での縦断研究 •看護師の人員配置と死亡に関する観察研究で、「用量 反応関係」を発見したメタアナリシス 看護師の人員配置の増加に関連する深刻な害を報告した研究はなし
Stalpers D, et al.	Associations between characteristics of the nurse work environment and five nurse-sensitive patient outcomes in hospitals: A systematic review of literature.	2015	Int J Nurs Stud 52:817-835.	2004年から2012年に発表された、せん妄、栄養失調、痛み、患者の転倒、褥瘡などの患者の転帰との関連を調べた定量的研究に関するレビュー	<p>転倒</p> <ul style="list-style-type: none"> •看護師の人員配置の増加により減少 •より高い看護師の教育レベルにより減少 •看護経験のレベルが低いほど増加 <p>褥瘡</p> <ul style="list-style-type: none"> •看護師の人員配置の増加で減少、あるいは関連なしなど <p>様々な結果</p> <ul style="list-style-type: none"> •看護経験のレベルが低いほど発生率が高い <p>疼痛管理</p> <ul style="list-style-type: none"> •より良い人員配置が良好な管理 <p>せん妄、栄養失調</p> <ul style="list-style-type: none"> •レビュー基準を満たす論文が見当たらず

表 2-3 海外での研究成果(代表的な論文)の概要(umbrella review)

著者	タイトル	発行年	掲載誌	データ等	結果
Blume KS, et al.	Staffing levels and nursing-sensitive patient outcomes: Umbrella review and qualitative study.	2021	Health Serv Res. ;56(5):885- 907.	<p>看護師の人員配置レベルに関する先行研究と専門家の意見を用いて、nursing-sensitive patient outcomes (NSPO) 看護関連の患者アウトカムの包括的なリストを作成</p> <p>データソース/研究セッティング</p> <ul style="list-style-type: none"> •看護師の人員配置レベルと NSPO 関連に関する文献レビュー (2007 年 1 月～2018 年 6 月に公開されたレビュー論文)およびそのうちの主要な研究、および看護ケアに関する 16 人の専門家へのインタビュー データ収集/抽出方法 •看護師の人員配置レベルと NSPO との関連に関する文献レビューのた めに、3 つの電子データベースをスクリーニング •430 の候補論文から 15 の文献をスクリーニングした後レビュー •22 の固有の NSPO のリストの抽出 •看護師の人員配置との関連エビデンスの強さに応じて体系的にランク付け •専門家へのインタビュー結果に基づいて、NSPO のリストを拡張 	<p>15 の文献レビューから抽出された 22 の NSPO のうち、エビデンスの強さに応じて 4 を高、5 を中、13 を低と評価</p> <p>文献で考慮されていない 4 つの追加の NSPO が、専門家へのインタビューを通じて特定</p>

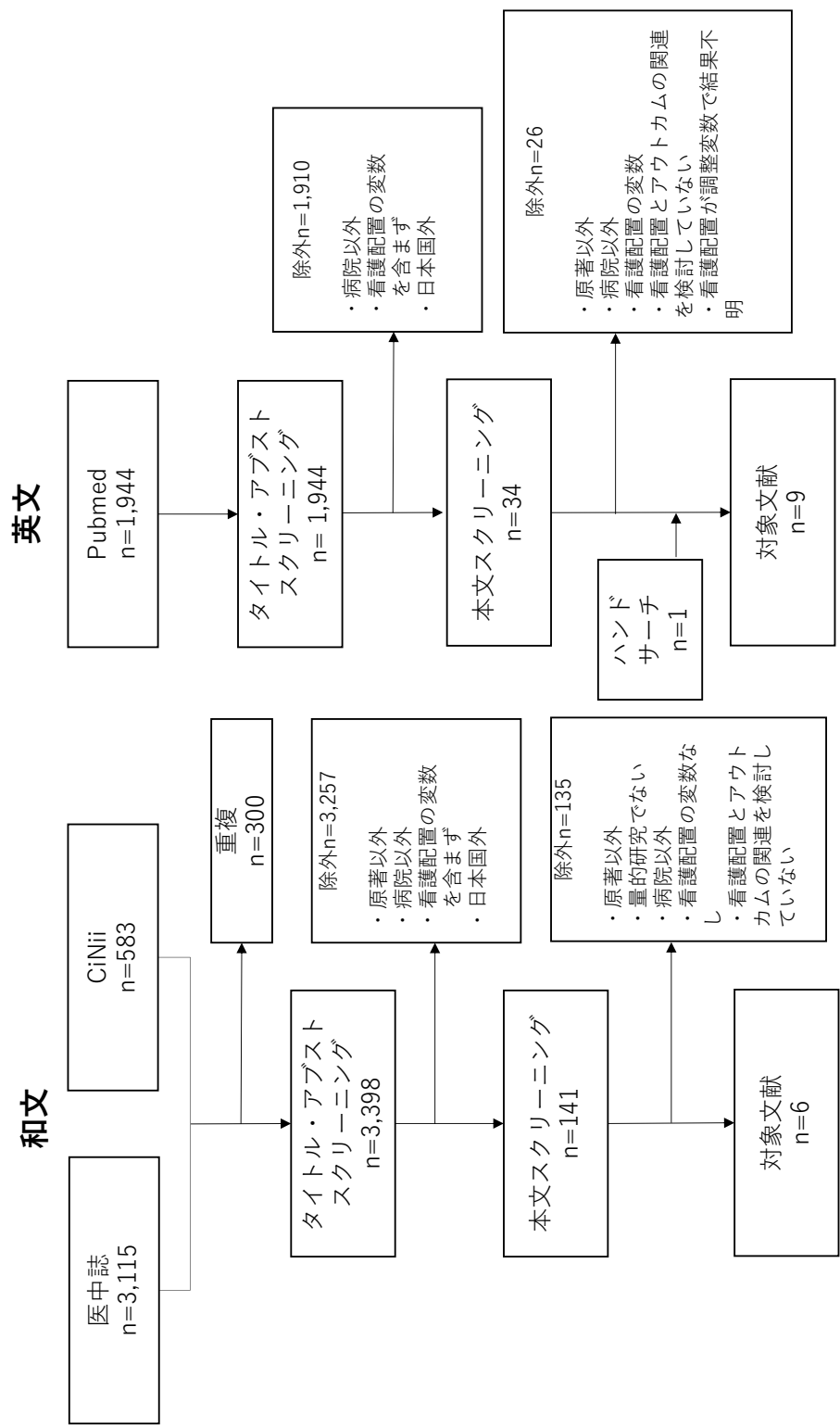


図1 国内での研究成果に関する文献レビュー結果

表 3-1 対象文献のリスト

著者	タイトル	発行年	掲載誌
Nawata S, Yamauchi K, Ikegami N.	Do staffing levels determine outcome in psychiatric inpatient care?: Factors related to the ratio of period hospitalized in Japan,	2006	Psychiatry and Clinical Neurosciences 60:709-717.
Suzuki E, Itomine I, Kanoya Y, et al.	Factors Affecting Rapid Turnover of Novice Nurses in University Hospitals	2006	Journal of Occupational Health 48:49-61.
Ibe T, Ishizaki T, Oku H, et al.	Predictors of pressure ulcer and physical restraint prevalence in Japanese acute care units	2008	Japan Journal of Nursing Science 5:91-98.
Kaneko S, Koinuma N, Ito M.	Relationship between Risk Factors Related Medical Errors and Working Conditions of Nurses in Acute Care Settings	2008	The Journal of the Japan Academy of Nursing Administration and Policies 12:5-15.
Fujimura Y, Tanii H, Saijoh K.	Inpatient satisfaction and job satisfaction/stress of medical workers in a hospital with the 7:1 nursing care system (in which 1 nurse cares for 7 patients at a time)	2011	Environmental health and preventive medicine 16:113-122.
Yasunaga H, Hashimoto H, Horiguchi H, et al.	Variation in cancer surgical outcomes associated with physician and nurse staffing: a retrospective observational study using the Japanese Diagnosis Procedure Combination Database	2012	BMC health services research 12:129.
Namba H, Wakabayashi T, Koike A.	Relationship between nurse-patient ratio and job satisfaction and intention to continue working in the organization	2014	Journal of Mie Prefectural College of Nursing 17:7-16.
Tei-Tominaga M	Factors related to the intention to leave and the decision to resign among newly graduated nurses: a complete survey in a selected prefecture in Japan,	2013	Environmental Health and Preventive Medicine 18:293-305.
Anzai E, Douglas C, Bonner A.	Nursing practice environment, quality of care, and morale of hospital nurses in Japan	2014	Nurs Health Sci 16:171-178.

Morita K, Matsui H, Fushimi K, Yasunaga H.	Association between Nurse Staffing and In-Hospital Bone Fractures: A Retrospective Cohort Study	2017	Health Serv Res 52:1005–1023.
Fukasawa M, Miyake M, Suzuki Y, et al.	Relationship between the use of seclusion and mechanical restraint and the nurse-bed ratio in psychiatric wards in Japan,	2018	Int J Law Psychiatry 60:57–63.
Ito k, Kawano K, Hatanaka J, Goto Y.	Factors influencing work engagement of night shift work nurses in a group hospitals	2018	Journal of Yokkaichi Nursing and Medical Care University 11:1–12.
Morioka N, Moriwaki M, Tomio J, et al.	Structure and process of dementia care and patient outcomes after hip surgery in elderly people with dementia: A retrospective observational study in Japan	2020	Int J Nurs Stud 102:103470.
Morioka N, Moriwaki M, Tomio J, et al.	Dementia and patient outcomes after hip surgery in older patients: A retrospective observational study using nationwide administrative data in Japan	2021	PloS one 16:e0249364.
Hirose N, Morita K, Matsui H, et al.	Dose-response association between nurse staffing and patient outcomes following major cancer surgeries using a nationwide inpatient database in Japan,	2021	J Clin Nurs

表 3-2 対象文献の概要一覧

author, year	design & datasource	setting & participants & sample size	measurement of staffing	outcome measures	potential confounders measured and included in analysis	results
Nawata <i>et al.</i> , 2006	Two-wave questionnaire surveys	Setting: Two units (1 closed, 1 open) were selected from 18 psychiatric hospitals The number of patients was 2386 at the first survey in October 1993 and 1131 patients remained after the second survey in October 1999.	Staffing level at the first survey: 4 categories (1 nurse or aide per 2.5-3 patients, 1 nurse or aide per 4 patients, 1 nurse or aide per 5-6 patients, lower than 1 nurse or aide per 5-6 patients)	Percentage of followed-up period hospitalized: cumulative number of days hospitalized from first survey to second survey / 2192 days as number of days from first survey to second survey	Not applicable (multivariate analysis was not conducted)	The correlation coefficient between the staffing level regardless of the ownership, and the percentage of followed-up period hospitalized was 0.102.
Suzuki <i>et al.</i> , 2006	Longitudinal questionnaire survey	1203 novice full-time nurses from 20 university hospitals who commenced their nursing careers in 2003 Nurses who responded to the first survey in June 2003 were followed until December 2003.	Ratio of patients per nurse: 2.5:1, 2:1	Rapid turnover among novice nurses: retirement of novice nurses was confirmed by their birthdays, which were provided by the director of the nursing service department in each hospital.	Not applicable (multivariate analysis was not conducted)	Bivariate analysis showed that there was no statistically significant difference between nurses who turned over and those who did not.
Ibe <i>et al.</i> , 2008	Longitudinal questionnaire survey	98 hospital nursing unit managers from 42 hospitals who attended the Research Committee of the	Register nurse hours per patient (daily): The productive hours worked by nursing staff (registered nurses, associate	Pressure ulcer: All patients on the study day with stage I, II, III, or IV ulcers divided by the average daily number of patients (16 years old and older)	associate nurses hours per patient (daily), other hours per patient (daily), registered nurses	Pressure ulcer: Multiple regression analysis showed that standardized coefficient of registered nurse

Kaneko <i>et al.</i> , 2008	Cross-sectional questionnaire survey	Nurse Staffing System for Hospital Safety in 2003	nurses, and care workers) divided by the average number of inpatients	<p>Physical restraint: All patients on the study day with restraints (limb, vest, side rails, other) divided by the average daily number of patients (16 years old and older)</p>	hours, Nursing- care Needs Score	hours per patient (daily) was 0.321 (p=.072). Physical restraint: Multiple regression analysis showed that standardized coefficient of registered nurse hours per patient (daily) was 0.156 (p=.353).
Kaneko <i>et al.</i> , 2008	Cross-sectional questionnaire survey	1,339 nurses from 6 hospitals in a 政令指定都市 The hospitals were designated as 臨床研修病院 and 救急指定病院	<p>受け持ち患者数: self-reported by respondents</p>	<p>Medical error and mistakes: respondents were asked to report the experience of medical error and mistakes during 6 months before questionnaire survey.</p>	age	Univariable logistic regression analysis showed that an odds ratio of 受け持ち患者数 in daytime shift was 1.10 [95% confidence interval, 0.97-1.06], and that of 受け持ち患者数 in nighttime shift was 0.99 [0.95-1.03].
Fujimura <i>et al.</i> , 2011 Inpatient survey	Questionnaire survey	202 inpatients, who were discharged from the Departments of Cardiology and Metabolism of a specific function hospital from January to December 2008 were surveyed.	<p>Patients to nurse ratio (dichotomous, 7 : 1 or 10 : 1)</p>	<p>Quality of life: The Japanese version of the Short-Form 36-Item Health Survey (SF-36). Inpatient satisfaction: 7 items (Explanation, Easiness of Consultation, Dealing with Patients, Reliability, Coping with Patients' Pain/Indisposition, Coping with Patients' Anxiety/Mental Care, and Satisfaction) were selected and modified with reference to a nationwide survey in 2003.</p>	Not applicable (multivariate analysis was not conducted)	<p>Quality of life: no statistically significant difference in each norm of SF-36 (Table 1). Inpatient satisfaction: the 7:1 system inpatients showed statistically greater satisfaction in all subcategories (Table 1).</p>

<p>Fujimura <i>et al.</i>, 2011 Medical workers survey</p>	<p>Questionnaire before and after introduction of 7:1 system (decrease of patients to nurse ratio)</p>	<p>Medical workers at a 50-bed ward for internal diseases were surveyed. The first survey was in February 2008 (under the 10:1 system) and the second survey was in October 2008 (after the introduction of the 7:1 system). 36 physicians and 14 nurses responded to the first survey. 33 physicians and 25 nurses responded to the second survey.</p>	<p>Job satisfaction: the physicians' and nurses' estimation of their Working Hours, Income, Number of Physicians in the Ward, and Number of Nurses in the Ward</p> <p>Effects of the diagnosis procedure combination (DPC): DPC-specific questionnaire consisting of 11 items regarding their estimation of the desired effects, efficiencies, and results after introducing the DPC ("I have sufficient knowledge of DPC," Medical/nursing care was carried out efficiently, changed the contents of medical/nursing care, I changed the medicine/medical material, the average LOS was shortened, I became aware of cost performance, the quality of medical/nursing care was improved, working environment was improved, paperwork/data input increased, shortening of the LOS increased work load, paperwork/data input increased work load)</p> <p>Stress of medical workers: the Simplified Job Stressor Questionnaire (Workload, Control, Personal Relations, Conformity, and Support by Coworkers/Supervisor and responses to stress with Mental Stress and Physical Stress)</p>	<p>Not applicable (multivariate analysis was not conducted)</p>	<p>Job satisfaction: Working hours of nurses under the 7:1 system judged that their working hours were shortened compared to those under the 10:1 system, however, their real working hours were unaltered. Nurses under the 7:1 system judged that number of nurses in the ward were significantly higher than those under the 10:1 system. (Figure 1)</p> <p>Effects of the diagnosis procedure combination (DPC): Improvement of working environment rated by nurses under the 7:1 system was higher ($p < .05$) than that those under the 10:1 system. (Figure 1)</p> <p>Stress of medical workers:</p>
--	--	--	---	---	--

<p>Retrospective observational study</p> <p>Data source: Japanese Diagnosis Procedure Combination on inpatient (DPC) database the Survey of Medical Institutions data</p>	<p>131,394 patients who underwent elective cancer surgery from 5.85 million discharge cases between 2007 and 2008</p>	<p>Four categories using the number of physicians per 100 beds and the number of nurses per 100 beds:</p> <p>Group A (below median PBR and below median NBR),</p> <p>Group B (below median PBR and above median NBR),</p> <p>Group C (above median PBR and below median NBR), and (iv) Group D (above median PBR and above median NBR).</p> <p>The number of nurses included the full-time equivalent numbers of licensed nurses.</p>	<p>Postoperative complications: surgical site infection (T793, T814), peritonitis (K65), sepsis (A40, A41), respiratory complications (pneumonia [J12-J18], postprocedural respiratory disorders [J95] or respiratory failure [J96]), pulmonary embolism (I26), cardiac events (acute coronary events [I21-I24] or heart failure [I50]), stroke (cerebral infarction or hemorrhage [I60-I64]), and acute renal failure (N17).</p> <p>In-hospital mortality</p> <p>Failure to rescue: the proportion of in-hospital death cases among those who had experienced a postoperative complication</p>	<p>Failure to rescue: Logistic regression analysis showed that failure to rescue rates were significantly different between Groups A and D (odds ratio, 0.76 [95% confidence interval, 0.63-0.90]; $p = .002$), but not between Groups A and B (0.94 [0.78-1.13]; $p = .505$) or between Groups A and C (0.91 [0.73-1.13]; $p = .379$).</p> <p>Postoperative complications: Logistic regression analysis showed that postoperative complication rates were not different among the groups (1.01 [0.90-1.13]; $p = .918$ for Group D vs. Group A).</p> <p>In-hospital mortality: Logistic regression analysis showed that Group D showed a significantly lower mortality compared with Group A (0.82 [0.71-0.95]; $p = 0.009$).</p> <p>age, sex, Charlson comorbidity index, hospital volume (low, medium, high)</p>
--	---	--	--	---

Yasunaga
et al.,
2012

<p>Namba <i>et al.</i>, 2014</p>	<p>Cross-sectional questionnaire survey</p>	<p>2213 full-time nurses of 15 hospitals (97 wards) in a prefecture; all hospitals were DPC 算定病院; from April 22 2009 to May 28 2009</p>	<p>Patients to nurse ratio (dichotomous, 7 : 1 or 10 : 1)</p>	<p>Measurement of Nurses' Job Satisfaction 看護師の職務満足度尺度, total score and sub-scale scores (pay 給料, professional status 職業的地位, doctor-nurse relationship 医師と看護師の関係, administration 看護管理, autonomy 専門職としての自律, task requirement 看護業務, interaction 看護師間相互の影響 英語は原典の尾崎ら, 1998 (による); Retention Potential Scale for Nurses 看護師の定着可能度分析尺度, total score and sub-scale (organizational satisfaction 組織満足度, sense of belonging to organization 組織帰属度, previous retention degree 過去の定着度, intention to continue working 今後の継続意思)</p>	<p>Not applicable (multivariate analysis was not conducted)</p>	<p>Measurement of Nurses' Job Satisfaction 看護師の職務満足度尺度: professional status 7 to 1 3.64±0.76, 10 to 1 3.52±0.83, p=.008, interaction 看護師間相互の影響 7 to 1 3.93±0.83, 10 to 1 3.72±0.88, p=.001, other sub-scale scores は p>.05; Retention Potential Scale for Nurses 看護師の定着可能度分析尺度: total score 3 groups (stable to retent 定着可能群, unstable to retent 定着不安定群, unable to retent 定着不可能群) no statistical significance, organizational satisfaction 組織満足度 p=.000 other sub-scale score は p>.05</p>
<p>Tei-Tominaga, 2013</p>	<p>Cross-sectional questionnaire survey</p>	<p>1477 newly graduated nurses in 353 hospitals; 39% of hospitals had more than 200 beds; in December 2009; 600 (41%) responded; 493 completed female data were used for analysis</p>	<p>Patients to nurse ratio (dichotomous, 7 : 1 or 10 : 1)</p>	<p>Intention to leave; 6-item scale developed by Tei and Yamazaki (2003), Decision to resign; dichotomous data using one item, 'Will you resign from your current organization within this fiscal year (within 3 months)?', each outcome was dichotomized by the upper quartile of the intention to leave and the decision to resign in multivariate logistic regression analysis</p>	<p>Employment and organizational characteristics; desirable position (in a word), working more than 51 hours per week, break facilities and amount of permitted rest time in the hospital, hospital type (public hospital or not), Individual factors; being personally suited for nursing work, 12-item General Health</p>	<p>Intention to leave; statistically significant (p=.043) in bivariate analysis, but not statistically significant (p=.291) in multivariate logistic regression analysis. Decision to resign; statistically significant (p=.002) in bivariate analysis, but not statistically significant (p=.060) in multivariate logistic regression analysis.</p>

<p>Anzai <i>et al.</i>, 2014</p>	<p>Cross-sectional questionnaire survey</p>	<p>341 nurses in 12 acute-care (i.e., medical, surgical, and mixed) inpatient wards in a large teaching hospital situated in the middle of Japan. Nurses working in pediatric, psychiatric, and obstetric wards, as well as those in outpatient care departments, were excluded.</p>	<p>Number of patients in usual day shift: self-rated by 4-point scale (<5, 5, 6, ≥7)</p>	<p>Ability to provide quality nursing care: 4-point Likert scale from strongly disagree to strongly agree.</p> <p>Quality of care: 11-point scale (0 = poor, 10 = excellent).</p> <p>Ward morale: 11-point scale (0 = very low, 10 = very high).</p>	<p>Questionnaire, 13-item Cumulative Fatigue, Psychosocial factors in the work environment; 2 subscales of social support in 57-item simplified work-related stress questionnaire (supervisor support, coworker support), Japanese short version of the Copenhagen Psychosocial Questionnaire (quantitative demands, cognitive demands, emotional demands, demands for hiding emotions, sensory demand), presence of a role model.</p> <p>Demographic characteristics: gender, nursing experience, nursing education.</p> <p>Work characteristics: nurse manager position, shift type, number of total shifts, percentage of day shifts, hours overtime during previous work.</p> <p>Japanese version of Practice Environment Scale of the Nursing Work Index (PES-NWI) subscales: nurse</p>	<p>Multiple regression analyses showed that number of patients on day shift was not significantly related with ability to provide quality nursing care ($\beta = 0.02$, $p > .05$), quality of patient care ($\beta = -0.05$, $p > .05$), ward morale ($\beta = -0.07$, $p > .05$).</p>
----------------------------------	---	--	--	---	--	--

<p>Morita <i>et al.</i>, 2017</p>	<p>Retrospective cohort study</p> <p>Japanese Diagnosis Procedure Combinati on inpatient (DPC) database the Surveys for Medical Institution</p>	<p>770,373 patients from 1,074 hospitals who were aged 50 years or older and underwent planned major surgery for some forms of cancer or cardiovascular diseases from July 2010 to March 2014</p>	<p>Nurses-to-occupied bed ratio: The number of inpatient nurses per 100 occupied beds for each hospital. The number of nurses included the full-time equivalent registered nurses and licensed practical nurses at inpatient hospital wards and units, but it did not include nursing assistants. NBR was categorized into quartiles (lowest, lower middle, higher middle, and highest), with an approximately equal number of patients in each group.</p>	<p>The occurrence of in-hospital bone fractures identified by ICD-10 codes (in parentheses) and postoperative procedure codes associated with fractures</p>	<p>patient age, sex, smoking status, body mass index, ADL score for walking on a flat floor, Charlson comorbidity index, comorbid medical conditions related to falls or bone fracture, and use of drugs</p>	<p>participation in hospital affairs, nursing foundations for quality of care, nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, collegial nurse-physician relations.</p>	<p>Logistic regression analysis showed that the proportion of in-hospital fractures in the group with the highest nurses-to-occupied bed ratio was significantly lower than that in the group with the lowest nurses-to-occupied bed ratio (adjusted odd ratios, 0.67; 95 % confidence interval, 0.44-0.99; p = .048).</p>
-----------------------------------	---	---	---	--	--	---	--

Fukasawa <i>et al.</i> , 2018	Secondary analysis of clinical database	10,013 admissions from April 2015 to March 2017 in 113 wards 23 hospitals participating in the Psychiatric Electronic Clinical Observation (PECO) system	Number of nurses divided by the number of beds, (multiplied by 10 to measure the number of nurses per 10 beds)	Use of seclusion or mechanical restraint during the first 90 days of admission; the number of admissions exposed to at least one episode of seclusion or mechanical restraint was counted.	Sex, age, psychiatric diagnosis (ICD10), Admission form at the time of admission (voluntary / involuntary), dose of antipsychotics, Global Assessment of Functioning (GAF), type of ward (ordinary / acute), location (rural / urban), random parameter	Seclusion: adjusted odds ratio 2.36 [95% confidence interval 1.55–3.60]. Restraint: 1.74 [1.35–2.24]
Ito <i>et al.</i> , 2018	Cross-sectional questionnaire survey	1,800 shift-work nurses from 13 hospitals 1,275 nurses were analysed. Hospitals were randomly selected from 111 public hospitals of the same organization ある1病院グループからの無作為抽出。 Survey was conducted from 5 December 2013 to 25 December 2013	Patients to nurse ratio: 2 to 1 or 4 to 1, 7 to 1, 10 to 1, 13 to 1 or 15 to 1	Work engagement: Japanese version of the Utrecht Work Engagement Scale	Not applicable (multivariate analysis was not conducted)	Bivariate analysis showed that there was no statistically relationship between patients-to-nurse ratio and scores of work engagement.
Morioka <i>et al.</i> , 2020	Retrospective observational study Data source: Japanese Diagnosis	20,393 patients (from 405 hospitals) with dementia who were aged 65 years or older, underwent hip surgeries and discharged from	Patient-to-nurse ratio: an average inpatient-to-nurse ratio per shift was used. Nurses included national licensed nurse and associate nurse licensed by	In-hospital mortality: the all-cause death during hospitalization readmission within 30 days: readmission to the same hospital within 30 days post-discharge	In-hospital mortality: dementia care status, nurse staffing, skill mix, sex, body mass index, Charlson comorbidity index, type of surgery, psychotropic drug use,	In-hospital mortality: logistic regression analysis showed that an adjusted odds ratio of patient-to-nurse ratio was 1.03 [95% confidence interval, 0.90–1.17, p = .715].

<p>Procedure Combinati on inpatient (DPC) database Reporting on medical functions of hospital beds data</p>	<p>April 2016 to March 2017.</p>	<p>prefectural government.</p>	<p>length of hospital stay: the number of hospitalization days from admission to discharge.</p> <p>The patients who died during hospitalization were excluded in the calculation of readmission and length of hospital stay.</p>	<p>and number of hospital beds</p> <p>Readmission within 30 days: dementia care status, nurse staffing, skill mix, sex, body mass index, Charlson comorbidity index, type of surgery, psychotropic drug use, and types of residence after discharge</p> <p>Length of hospital stay: dementia care status, nurse staffing, skill mix, sex, body mass index, Charlson comorbidity index, type of surgery, psychotropic drug use, types of residence before admission and after discharge, interaction term between types of residence before admission and after discharge, and number of hospital</p>	<p>Readmission within 30 days: logistic regression analysis showed that an adjusted odds ratio of patient-to-nurse ratio was 1.09 [0.98–1.22, p=.125]</p> <p>Length of hospital stay: regression analysis showed that an adjusted coefficient of patient-to- nurse ratio was 2.25 [1.00–3.51, p<.001]</p>
<p>Morioka <i>et al.</i>, 2021</p>	<p>48,797 patients (from 404 acute care hospitals) with dementia who were aged 65 years or older, underwent hip surgeries and discharged from</p>	<p>Patient-to-nurse ratio: The average number of in-patients per nurse and associate nurses per shift at general acute care</p>	<p>In-hospital mortality: all-cause death during hospitalization</p> <p>in-hospital pneumonia: identified by the type of pneumonia (community-</p>	<p>Length of hospital stay: sex, body mass index, Charlson comorbidity index, type of surgery, psychotropic drug use, types of established organization of</p>	<p>Length of hospital stay: Multilevel logistic regression analysis showed that a higher number of in-patients per nurse and associate nurse was significantly associated with 7.8%</p>

	<p>Japanese Diagnosis Procedure Combinati on inpatient (DPC) database Reporting on medical functions of hospital beds data</p>	<p>April 2016 to March 2017</p>	<p>wards were calculated.</p>	<p>acquired, in-hospital, and other)</p> <p>in-hospital fracture: at least one fracture post-admission</p> <p>length of hospital stay: the number of hospitalization days from admission to discharge</p>	<p>hospitals and number of hospital beds</p>	<p>(95% CI = 4.2-11.5%) longer length of hospital stay.</p>
<p>Hirose <i>et al.</i>, 2021</p>	<p>Retrospective observational study</p> <p>Data source: Japanese Diagnosis Procedure Combinati on inpatient (DPC) database the Annual Report for Functions of Medical Institution in 2014</p>	<p>645687 eligible patients from 1360135 patients aged 20-99 years who underwent major cancer surgeries from July 2010 to March 2018</p>	<p>Patient-to-nurse ratio per shift: total inpatient days / number of nursing staff \times 800 hours / 24 hours Number of nursing staff was the number of registered nurses who worked in general wards of each hospital. 1800 hours represented the working hours per nurse per year. Nurses working in non-surgical wards, outpatient clinics, operation rooms and other non-inpatient departments were excluded.</p>	<p>30-day in-hospital mortality</p> <p>Failure to rescue: The denominator was the number of six treatable postoperative complications (deep venous thrombosis, pneumonia, cardiac arrest, shock, gastrointestinal bleeding and sepsis) (Silber et al., 2018), and the nominator was the number of death of patients suffering from the complications.</p> <p>Postoperative complications: deep venous thrombosis, pneumonia, cardiac arrest, and sepsis</p>	<p>Patient-level variables: age, sex, smoking status, activities of daily living, Charlson comorbidity index, body mass index, type of surgery, laparoscopic surgery, cancer recurrence, and chemotherapy use</p> <p>Hospital-level variables: type of hospital, hospital volume, patient turnover rate and number of physicians per 100 occupied beds</p>	<p>Failure to rescue and 30-day in-hospital mortality: Restricted cubic spline regression analyses showed insignificant associations of patient-to-nurse ratio with failure to rescue and 30-day in-hospital mortality with no threshold.</p> <p>Postoperative complications: Restricted cubic spline regression analyses showed that a reverse J-shaped association with postoperative complications with a threshold of patient-to-nurse ratio per shift of 5.4.</p>

表 4 我が国における看護配置と看護関連アウトカムとの関連に関するエビデンスの概要

Patient outcome	Number of patient per nurse		Nursing hours per patient day		Number of nurses per bed		
	Patient – nurse ratio requirement in the fee schedule (hospital level)	Patient-to-nurse ratio per shift (hospital level: all ward average)	Patient-to-nurse ratio on day/night shift (nurse individual level)	Registered nurse hours per patient day (ward level)	Associate nurse hours per patient day (ward level)	In patient nurse to occupied bed ratio (hospital level)	Nurse per 10 bed in each ward (ward level)
Readmission	++	N.S. (Morioka et al., 2020)					
Hospitalization	N.S. (Nawata et al.,2006)						
In hospital mortality	+	N.S. (Morioka et al.,2020;Morioka 2021; Hirose et al., 2021)				N.S. (Yasunaga et al.,2012)	
Failure to rescue	+	N.S. (Hirose et al., 2021)				↓ (Yasunaga et al., 2012)	
Length of hospital stay	++	↑ (Morioka et al.,2020&Morioka 2021)					
In hospital fracture		N.S. (Morioka et al., 2020)				↓ (Morita et al., 2017)	
In hospital pneumonia	+	N.S. (Morioka et al., 2020)					
Post operative complications		↓ (Hirose et al., 2021)				N.S. (Yasunaga et al., 2012)	
Seclusion							↑ (Fukasawa et al., 2018)

Pressure ulcer		N.S. (Ibe et al., 2008)	↓ (Ibe et al., 2008)
Physical restraint		N.S. (Ibe et al., 2008)	N.S. (Ibe et al., 2008)
Error and/or near miss	+	N.S. (Kaneko et al., 2008)	
Nurse reported quality of care	++	N.S. (Fujimura et al., 2011)	N.S. (Anzai et al., 2014)
Ability to provide quality nursing care		N.S. (Anzai et al., 2014)	
Nurses' work engagement		N.S. (Ito et al., 2018)	
Job satisfaction		N.S. (Namba et al., 2013)	
Intention to leave		↑ (Tei-tominaga et al., 2013)	
Decision to leave		↑ (Tei-tominaga et al., 2013) N.S. (Suzuki et al., 2006)	
Burn out			
Nurse reported better working environment		↑ (Fujimura et al., 2011)	
Ward morale			↓ (Anzai et al., 2014)

↑ : positive relation

↓ : negative relation

N.S.: not statistically significant relation

++: The previous umbrella review (Blume et al.,2021) suggested the strength of evidence was high

+: The previous umbrella review (Blume et al.,2021) suggested the strength of evidence was moderate

