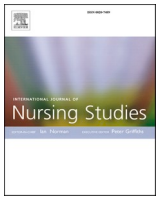
International Journal of Nursing Studies 167 (2025) 105056

Contents lists available at ScienceDirect

International Journal of Nursing Studies

journal homepage: www.elsevier.com/locate/ns



How can we optimise nurse staffing systems? Insights from a comparative document analysis of 10 widely used models and focused interpretative review of implementation experiences

Davina Allen [a,*], Heather Strange [b], Nina Jacob [b], Anne Marie Rafferty [c]

[a] School of Healthcare Sciences, Cardiff University, Cardiff, UK
[b] Centre for Trials Research, Cardiff University, Cardiff, UK
[c] Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care, King's College London, UK

ARTICLE INFO

Keywords:
Nursing staff
Organisation and administration
Personnel staffing and scheduling
Policy
Workforce
Workload
Complex systems thinking
Actor network theory

ABSTRACT

Background: A diverse range of formal systems have been implemented in high income countries to ensure safe nurse staffing. Evidence reviews indicate that no one best model exists and recommends optimising existing systems. As a result of the Covid-19 pandemic and a global nursing workforce crisis, healthcare systems and the nursing profession face a challenging future. Nurse staffing systems must be fit for purpose.
Aim: Identify, describe and compare the core components of nurse staffing systems, assess the conditioning effects of context on their mechanisms of action, and explore front-line implementation experiences to inform system optimisation.
Sample: Ten widely used nurse staffing systems deployed in high-income western healthcare systems.
Theory: Complex interventions thinking and Actor Network Theory.
Methods: Phase 1: Document analysis of formal published accounts of nurse staffing systems. Phase 2: Focused interpretative review of evidential fragments on implementation experiences and contextual influences from available evaluation studies.
Conclusions: Systems varied in their complexity, core components, and organising logics. Nurses experience a range of implementation challenges, but workforce shortages and budgetary constraints were the principal contextual influences. Prospective strategies to optimise nurse staffing systems must be tailored to system and context but include strategies and tools to augment professional authority, more granular workload measurement, improved outcome measurements, strengthened digital infrastructures, enhanced governance arrangements and increased public accountability. Benchmarking approaches should be used with caution, given the normative impulse to depress staffing levels. In the context of a global workforce shortage, consideration should also be given to the impacts of nurse staffing models on the wider healthcare system.
Tweetable abstract: How can we optimise safe nurse staffing systems? Insights from a document analysis and interpretative review informed by actor network theory.

What is already known

- High-income countries have implemented diverse nurse staffing systems to inform workforce planning and staff deployment.
- Evidence reviews indicate that there is no single best model and recommend research to optimise existing systems.
- Previous research on nurse staffing systems has focused on outcomes leaving their core components and inner workings hidden from view.

What this paper adds

- Conceptualising nurse staffing systems as complex interventions, Actor Network Theory is deployed to identify, describe and compare their core components and front-line implementation experiences.
- Systems vary in their complexity, organising logics and core components, and nurses experience a range of implementation

* Corresponding author at: Ty'r Garth, Room 1.13, Heath Park West, St. Agnes Rd., Cardiff CF14 4US, UK.
E-mail address: allenda@cardiff.ac.uk (D. Allen).
@allen_davina (D. Allen)

https://doi.org/10.1016/j.ijnurstu.2025.105056
Received 12 July 2024; Received in revised form 3 February 2025; Accepted 13 March 2025
Available online 18 March 2025

challenges, with financial constraints and workforce shortages common contextual influences.
- Prospective interventions for improvement include tools to augment professional authority, more granular workload measurement, evidence-based outcomes indicators, investment in digital literacy and infrastructures, strengthened governance systems and public accountability.

1. Introduction

Over the past two decades, high-income countries have developed national, state, or institutional policies to enable nurses to deliver safe and effective care. Although a variety of approaches have emerged, recent reviews (Van den Heede et al., 2020; Griffiths et al., 2020; Twigg et al., 2021) suggest there is no single effective solution. Cautioning against further development activity, Griffiths et al. (2020) recommend that future research focuses on how best to use nurse staffing systems to identify the required staffing level to meet varying patient need and their costs and consequences. Following the Covid-19 pandemic, healthcare systems worldwide face significant challenges, challenges exacerbated by a global nursing shortage (Buchan and Catton, 2023). Discontent about staffing levels is affecting workforce retention, the attractiveness of nursing as a career, and student nurse attrition. It is critical, then, that nurse staffing systems are fit for purpose.

Nurse staffing systems are complex interventions (Skivington et al., 2021); they comprise a combination of methods, have distinctive governance processes, enrol multiple agents in decision-making, deploy different healthcare management technologies and measurement systems, and are implemented in dynamic contexts which condition their effects. Research on nurse staffing systems has typically focused on outcomes, leaving the core components and inner workings of staffing systems hidden from view. System optimisation requires a better understanding of these relationships, which necessitates the use of different study designs.

We present findings from document analysis of 10 widely-used nurse staffing models and a focused interpretative review of implementation experiences. This study was designed to open the black box of nurse staffing systems in order to examine these relationships. The aim was to produce insights to aid decision-makers in optimising nurse staffing systems by comparing their core components and interrelations, front-line nurses' implementation experiences, and the mediating effects of context on systems' mechanisms of action.

2. Conceptualisation and theoretical framework

Nurse staff systems were conceptualised as complex interventions (Skivington et al., 2021) and data extraction and analysis were informed by Actor Network Theory (Latour, 2005). A complex intervention is a constellation of activities, materials or procedures designed to bring about a certain outcome. They are complex because they typically include multiple interacting components influenced by factors within the context they are implemented. Actor Network Theory is well suited to researching complex interventions. It is characterised by a commitment to studying both social (human) and material/technical (non-human) elements within the phenomenon of interest, with the aim of understanding how networks of socio-material relations have their effects. In this study, we examined the policy, regulatory, and governance frameworks associated with nurse staffing methodologies. We focused on the people involved, their knowledge and expertise, and their involvement in decision-making processes. We analysed tools, documents, and technologies, and paid attention to their assumptions (scripts) about the contexts in which they are used. We analysed systems of measurement and classification, and how nursing work, patient care, and care quality were quantified. Finally, we considered the distribution of activity between humans and non-humans within systems, attending to the work delegated to materials and technologies, and the work prescribed to nursing staff.

3. Methods and materials

3.1. Aim

This study aimed to: (i) identify, describe, and compare the core components of ten widely used nurse staffing systems, and (ii) explore front-line implementation experiences, along with the contextual factors that mediate systems' mechanisms of action, to provide insights for their optimisation.

3.2. Sample

The staffing systems included in the analysis (Table 1) were selected following an initial scoping search of published and grey literature and advice from an international expert group of senior nurse leaders, policy makers, and researchers in the field of workforce planning and nurse staffing systems (see acknowledgements). The sample size reflected the alignment of the study aims with available research resources. System selection was informed by considerations of scale (i.e. widely used systems), availability of formal documentation in the English language, and parity of implementation context, i.e. western healthcare systems in high-income countries.

3.3. Structure and methods

The study had two phases. Phase 1 was a document analysis designed to identify, describe and compare the core components of nurse staffing systems. Widely used in social sciences and health policy research, document analysis is a qualitative method focused on the examination of documents to gain understanding (Dalglish et al., 2020). Formal written documents – which can be physical or virtual - are a key mechanism through which organisations and society function, and document analysis is useful in understanding organisational processes and existing polices (Katchmarchi et al., 2018; Adebiyi et al., 2019).

Phase 2 was a focused interpretative review of recent available evaluations of the staffing systems included in Phase 1 which aimed to understand implementation experiences and the conditioning effects of context. Often used in social sciences, humanities and qualitative research, this kind of review focuses on a particular theme or question. The purpose was not the exhaustive aggregation of evidence, but to develop an understanding to identify opportunities for system optimisation.

Table 1
Nurse staffing systems included in the review.

Index term	Description
England	Safe Staffing Policy
Wales	All-Wales Safe Nurse Staffing System
Scotland	Scottish Common Staffing Method
Northern Ireland	The Delivering Care Framework
New Zealand	The Care Capacity Demand Management System
Australia	Nursing Hours Per Patient Day Method
	System applies to 5 Australian states: Western Australia, Tasmania, New South Wales, Australian Capital Territory, Northern Territory.
Nurse Staffing Committees	System applies to 5 US states: Illinois, Oregon, Washington, Ohio, Connecticut, Nevada, Texas
California	Mandated Minimum Nurse–Patient Ratios
Veterans' Health Administration	System applies to all Veterans' Health Administration services, USA
RAFAELA®	Used by 90 % of individual institutions in Finland and across Nordic countries.

3.4. Search strategies

Following initial scoping searches, Griffiths et al.'s (2020) review of nurse staffing methodologies was selected as a point of entry into the literature. The reference list was used to identify studies which described nurse staffing methodologies. This was supplemented with further reference list tracking, cluster tracking (Booth et al., 2013) and citation tracking, Google/Google Scholar searches for grey literature and selected websites, and by drawing on the knowledge and expertise of advisory board members. Rather than an exhaustive review of all sources, the aim was to locate official accounts which enabled us to identify and describe the core components of nurse staffing systems and recent evaluation studies to understand users' implementation experiences and identify contextual influences. Searches and analysis progressed iteratively. Once the primary formal documents for the 10 nurse staffing systems had been identified, subsequent searches were designed to first, clarify issues or gaps in understanding through cross-checking and second, identify recent evaluations and reports. Documents were saved in separate files for each nurse staffing system.

3.5. Data sources

In Phase 1, the primary sources of data were formal accounts derived from policy and legislative documents, operational guidance, and official websites. Supplementary sources (grey literature and research papers) were used where information was unavailable or to clarify areas of uncertainty. As the only non-mandated system, we drew on research papers by the system developers to identify the core components of RAFAELA®.

In Phase 2, we consulted recent evaluation studies and reports which furnished evidence of users' experiences of system implementation. Research papers and/or reports were available for eight of the systems, searches for new materials concluded once we had sufficient understanding of common issues from which to draw policy-relevant conclusions.

3.6. Data extraction and analysis

Phase 1 followed the READ approach to document analysis in health policy research (Dalglish et al., 2020). This entails (1) preparing materials, (2) extracting data, (3) analysing data and (4) distilling findings. Materials were assembled for each staffing system and skimmed to get an overview of content. Data were then extracted into a provisional template designed around broad system components identified a priori: policy, workload measurement, quality indicators, professional judgement, human actors, committees. These categories were subsequently refined to inform the comparative analysis (Supplementary Table 1). The process was led by DA; HS, NJ and DA carried out data extraction. Within document triangulation, cross checking, and member checking (within team and the advisory group) were deployed to ensure the reliability and validity of the analysis (Maxwell, 2005).

In Phase 2, papers and reports of interest were skimmed to identify evidential fragments which contributed to an understanding of implementation experiences and core themes were identified inductively. Data extraction and quality appraisal was undertaken concurrently by DA and progressed through peer debriefing with AMR.

4. Results

This section is organised as follows: Phase 1 findings start with an overview of the 10 included systems, followed by a comparative analysis of their core components. Phase 2 findings are presented by individual system, to reflect how system components interact in practice within specific implementation contexts.

4.1. Phase 1

Forty-six documents were included in Phase 1 (Table 2). Summative comparative data is displayed in Table 3. Detailed system descriptors and core components are available in supplementary Table 1.

4.1.1. Overview of staffing systems

4.1.1.1. Policy context. The sample included 5 national-level systems (Wales, England, Scotland, New Zealand, Northern Ireland), 3 state-level systems (Australia, California, Nurse Staffing Committees) and 2 institutional-level systems (Veterans' Health Administration, RAFAELA®). Seven of the systems are mandated by law. In Northern Ireland and England, staffing systems are underpinned by national policies, and whilst deployed widely in Finland and Nordic countries, RAFAELA® is not mandated. Many systems were implemented in response to care quality concerns (Wales, England, Northern Ireland, Scotland, Veterans' Health Administration), or industrial unrest (Australia, New Zealand). California is distinctive in being proactively implemented following lobbying about an acute nursing shortage by the American Nurses Association (Van den Heede et al., 2020).

4.1.1.2. Scope. Most systems have been developed to inform staffing in acute inpatient care. Limited to acute medical and surgical services, England, Wales and Northern Ireland are the most restrictive in scope; others include a broader range of inpatient settings such as mental health and emergency care (Australia, New Zealand, Nurse Staffing Committees, California, Scotland, Veterans' Health Administration) and nursing and midwifery services (New Zealand and Australia). The Veterans' Health Administration and Scottish systems extend to residential care facilities and community care settings respectively.

4.1.1.3. Function. Ensuring safe nurse staffing involves strategic and operational sub-systems (Allen et al., 2023). The strategic sub-system refers to arrangements for determining the optimal staffing levels based on average unit requirements. The operational component refers to arrangements for managing daily fluctuations in capacity and demand. All systems were designed primarily for strategic purposes. While formal documents acknowledge the importance of the operational management of variation, in most cases, these arrangements are left to local determination. Only the RAFAELA®, New Zealand, and California systems include comprehensive operational processes.

4.1.1.4. Organising logics. The staffing systems are aligned with different organising logics, that is a set of material practices and normative assumptions that drive action (Thornton et al., 2013). We identified four distinctive approaches which we have conceptualised as: defined, deliberative, triangulated, and preconfigured.

In a defined approach unit staffing establishments are based on legally mandated minimum nurse–patient ratios which must be always applied. California is the only example of a defined approach included in the study. In a deliberative approach unit staffing levels are agreed by a formally constituted committee, which privilege the professional judgement of nurses. The Nurse Staffing Committees and RAFAELA® systems are deliberative approaches. The Veterans' Health Administration, Wales, Northern Ireland, Scotland, and England models are all triangulated approaches. Here, unit level staffing plans are informed by triangulating workload measurement data, outcome indicators and professional judgement. In preconfigured approaches, indicative staffing requirements have been agreed for local units of activity, but with flexibility to be revised according to demand. The New Zealand and Australian Models can be characterised as pre-configured approaches. In Australia, the minimum staffing establishment is based on the Nursing Hours per Patient Day associated with seven different categories of ward. The Care Capacity Demand Management system in New Zealand

Table 2
Phase 1: Documentary sources.

Index term	Documentary resources
England	1. National Institute for Health and Care Excellence (NICE). Safe staffing for nursing in adult inpatient wards in acute hospitals. NICE, 2014. 2. National Quality Board (NQB). Supporting NHS providers to deliver the right staff, with the right skills, in the right place at the right time: safe, sustainable and productive staffing. NQB, 2016 3. NHS Improvement (NHSI). Developing workforce safeguards: supporting providers to deliver high quality care through safe and effective staffing. NHSI, 2018. 4. National Quality Board (NQB). Safe, sustainable and productive staffing: an improvement resource for urgent and emergency care. NQB, 2018. 5. Griffiths P, Saville C, Ball JE, Chable R, Dimech A, Jones J, et al. The Safer Nursing Care Tool as a guide to nurse staffing requirements on hospital wards: observational and modelling study. Health Services and Delivery Research, 2020;8(16) 6. Smith, J., Forde, V., Goodman, M., Cannaby, A.M. and Radford, M., 2009. How to keep score of acuity and dependency. Nursing Management 16 (8), p.14. 7. Francis, R., 2013. Report of the Mid Staffordshire NHS Foundation Trust public inquiry: executive summary (Vol. 947). The Stationery Office.
Wales	1. Welsh Government. The Nurse Staffing Levels (Wales) Act 2016. Welsh Government, 2016. Available from: https://www.legislation.gov.uk/anaw/2016/5/data.pdf 2. Welsh Government. Nurse Staffing Levels (Wales) Act 2016: statutory guidance (version 2). Welsh Government, 2021. Available from: https://gov.wales/nurse-staffing-levels-wales-act-2016-statutory-guidance-version-2-html 3. Health Education and Innovation Wales (HEIW). Welsh Levels of Care (Edition 1). HEIW, 2017. Available from: https://heiw.nhs.wales/files/all-wales-nurse-staffing-programme/welsh-levels-of-care-edition-1/ 4. Health Education and Innovation Wales (HEIW). The Triangulated Approach. HEIW, 2024. Available from: https://heiw.nhs.wales/our-work/all-wales-nurse-staffing-programme/the-triangulated-approach/
Scotland	1. NHS Education for Scotland. Nursing and midwifery workload and workforce planning: Learning toolkit. The Scottish Government, 2013. 2. Scottish Government, Health and Care (Staffing) (Scotland) Act 2019. Scottish government, 2019. Available from: Welsh Government. The Nurse Staffing Levels (Wales) Act 2016. Welsh Government, 2016. Available from: https://www.legislation.gov.uk/anaw/2016/5/data.pdf 3. Healthcare Improvement Scotland. Professional Judgement Workload Tool User Guide and Frequently Asked Questions. NHS Scotland, 2020. 4. Healthcare Improvement Scotland. Adult Inpatient Workload Tool, User Guide and Frequently Asked Questions. NHS Scotland, 2021. 5. Scottish Government. Health and Social Care Standards: My support, my life. Scottish Government, 2017. Available from: https://www.gov.scot/publications/health-social-care-standards-support-life/.
Northern Ireland	1. Department of Health, Social Services and Public Safety. Delivering Care: Nurse Staffing in Northern Ireland Section 1: Strategic Direction and Rationale for general and specialist medical and surgical adult in-hospital care settings. Department of Health NI, 2014. Available from: https://www.health-ni.gov.uk/sites/default/files/publications/dhssps/normative-staffing-ranges-section1.pdf 2. Department of Health, Social Services and Public Safety. Delivering Care: Nurse Staffing in Northern Ireland Section 2: Using the Framework for general and specialist medical and surgical adult in-hospital care settings. Department of Health NI, 2014. Available from: https://www.health-ni.gov.uk/sites/default/files/publications/dhssps/normative-staffing-ranges-section2.pdf
New Zealand	1. New Zealand District Health Boards, Nurses Organisation and Ministry of Health. Safer Staffing and Care Capacity Demand Management: Effective Implementation Accord. Manatu Hauora/Ministry of Health. Available from: https://www.beehive.govt.nz/sites/default/files/2018-07/Safe%20Staffing%20Accord.pdf 2. Nursing Advisory Group. Nursing Safe Staffing Review and Report on the Review of the Care Capacity Demand Management (CCDM) Programme. Ministry of Health, 2022. Available from: https://www.health.govt.nz/system/files/documents/publications/nursing-safe-staffing-review-final_report-feb22.pdf 3. Safe Staffing Healthy Workplaces Unit. Care Capacity Demand Management Programme. Health New Zealand, 2024. Available from: https://sshw.health.nz/ccdm-programme 4. Safe Staffing Healthy Workplaces Unit. CCDM PROGRAMME: Safe Staffing Healthy Workplaces. Ministry of Health NZ, 2021. Available from: https://www.archive.ccdm.health.nz/
Australia	1. Government of Western Australia, Department of Health Nursing and Midwifery Office. NHpPD application manual Guiding principles: 2019 revised edition. Department of Health, 2019. Available from https://www.health.wa.gov.au/~/media/Files/Corporate/general-documents/nursing-and-midwifery/PDF/NHpPD-Guiding-Principles.PDF 2. Government of Western Australia, Department of Health Nursing and Midwifery office, Nursing Hours per Patient Day: an overview. Nursing and Midwifery office, WA Department of Health 2017. Available from: https://www.health.wa.gov.au/~/media/Files/Corporate/general-documents/nursing-and-midwifery/PDF/NHPPD_an_overview.docx 3. Department of Health and Human Services Tasmania. Safe Staffing User Manual Nursing Hours per Patient Day Model (NHPPD), Version 3. Department of Health and Human Services Tasmania, 2011, https://www.scribd.com/document/343969334/Safe-Staffing-User-Manual-NHPPD-Version-3-1-pdf, accessed 8/7/2024.
Nurse Staffing Committees	1. Oregon State Legislature. Oregon Revised Statutes Public Health, Housing, Environment Section 609.2 Chapter 441 - Health Care Facilities, 2021 EDITION. Oregon State Government, 2021. Available from: oregonlegislature.gov/bills_laws/ors/ors441.html 2. The Ohio General Assembly. Ohio Revised Code Title 37 Health-Safety-Morals Chapter 3727 – HOSPITALS, Section 3727.51. Ohio State Government, 2024. Available from: https://casetext.com/statute/ohio-revised-code/title-37-health-safety-morals/chapter-3727-hospitals/section-3727751-hospital-wide-nursing-care-committee 3. Washington State Legislature Revised code of Washington Title 70 Chapter 70.41 Section 70.41.420 Hospital staffing committee. Government of Washington State, 2023. Available from: https://app.leg.wa.gov/RCW/default.aspx?cite=70.41.420 4. Texas State Legislature. Health and Safety Code Title 4 Health facilities subtitle B licencing of health facilities chapter 257 Nurse Staffing. Texas State Government, 2009. Available from: https://statutes.capitol.texas.gov/Docs/HS/htm/HS.257.htm 5. Connecticut General Assembly. Statutes of Connecticut Volume 6 Title 19a Chapter 368a (Department of Public Health) section 19a-89e. Development of prospective nurse staffing plan by hospitals. Connecticut state government, 2017. Available from: https://www.cga.ct.gov/current/pub/chap_368a.htm#sec_19a-89e 6. Nevada Legislature. Nevada revised statutes Title 40 Chapter 449 Section 449.242 Establishment of staffing committee by certain hospitals in larger counties; membership; duty to develop documented staffing plan; duty to consider certain requests; quarterly meetings; reporting to Legislature. Nevada State Government, 2024. Available from: https://www.leg.state.nv.us/nrs/nrs-449.html#NRS449Sec242 7. Illinois General assembly. Illinois compiled statutes chapter Health Facilities and Regulation (210 ILCS 85/) hospital licensing act, Section 10.10 Nurse staffing by patient acuity. Illinois State government, 2009. Available from: https://ilga.gov/legislation/ILCS/ilcs3.asp?ActID=1234&ChapterID=21
California	1. California State Legislature. Assembly Bill No. 394: Health facilities: nursing staff. California State Government, 1999. Available from: http://leginfo.ca.gov/pub/99-00/bill/asm/ab_0351-0400/ab_394_bill_19991010_chaptered.html 2. United Nurses Associations of California. California nurse to patient ratios. California Nurses Association, 2004. Available from: https://unacuhcp.org/california-nurse-to-patient-ratios/

(*continued on next page*)

Table 2 (*continued*)

Index term	Documentary resources
	3. National Nurses United. RN Staffing ratios: A necessary solution to the Patient Safety Crisis in U.S. Hospitals (RN Staffing ratios whitepaper). National Nurses United, 2016. Available from: https://www.nationalnursesunited.org/sites/default/files/nnu/graphics/documents/NNU_Ratios_White_Paper.pdf 4. State of California. California Code of Regulations Title 22 - Social Security, Division 5 - Licensing and Certification of Health Facilities, Home Health Agencies, Clinics, and Referral Agencies, Chapter 1 - General Acute Care Hospitals, Article 3 - Basic Services 70,217 - Nursing Service Staff. State of California, 2013. Available from: https://www.law.cornell.edu/regulations/california/Cal-Code-Regs-Tit-22-SS-70217
Veterans' Health Administration	1. US Department of Veterans Affairs. VHA Directive 1351 Transmittal Sheet December 20, 2017. US Department of Veterans Affairs, 2017. Available from: https://www.navao.org/wp-content/uploads/2018/01/VHA-Directive-1351-Staffing-Methodology-for-VHA-Nursing-Personnel-12-20-17.pdf 2. US Department of Veterans Affairs. VHA directive 1351, staffing methodology for VHA nursing personnel, transmittal sheet January 18 2023. US Department of Veterans Affairs, 2023. Available from: https://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=10117 3. Taylor B, Yankey N, Robinson C, Annis A, Haddock KS, Alt-White A, Krein SL, Sales A. Evaluating the Veterans Health Administration's Staffing Methodology model: a reliable approach. Nursing Economics. 2015, 33(1):36. 4. Office of the Inspector General, department of Veterans Affairs (2004). Healthcare inspection: Evaluation of nurse staffing in Veterans Health administration facilities (no GAO-09-17). Washington, DC: Government Accountability Office.
RAFAELA®	1. Fagerström L, Lønning K, Andersen MH. The RAFAELA system: a workforce planning tool for nurse staffing and human resource management. Nursing management. 2014, 21(2). 2. Fagerström L, Rainio AK, Rauhala A, Nojonen K. Validation of a new method for patient classification, the Oulu Patient Classification. Journal of Advanced Nursing. 2000 Feb;31(2):481–90. 3. Hustad NB, Hellesø R, Andersen MH. A qualitative study of manager experiences using the RAFAELA system. Open Journal of Nursing. 2015;5:1224–32. 4. Fagerström, L., Rainio, A.-K. (1999) Professional assessment of optimal nursing care intensity level: a new method of assessing personnel resources for nursing care. J. Clin. Nurs., 8(4), 369–379. 5. Fagerström, L., Rauhala, A. (2007) Benchmarking in nursing care by the RAFAELA patient classification system – a possibility for nurse managers. J. Nurs. Manag., 15(7), 683–692. 6. Rauhala, A., Fagerström, L. (2004) Determining optimal nursing intensity: the RAFAELA method. Journal of Advanced Nursing, 45(4), 351–359.

includes a calculation tool which utilises 12 months of patient acuity and nurse staffing data to generate a recommended roster and required unit staffing level.

4.1.1.5. Intervention type. Complex interventions can be defined with different levels of specificity. A tight intervention has more granular and detailed information about the intervention. A loose intervention focuses less on the specific details of intervention components and more on the underlying goals, and on the capability of adopters to re-create their own version of the intervention in their own setting (Horton et al., 2018). Five of the staffing systems included in the review were 'tight' interventions, in which elements and implementation are precisely prescribed (Australia, New Zealand, Wales, Scotland, RAFAELA®). Three systems were loose interventions, where there is scope for local adaption (Nurse Staffing Committees, Veterans' Health Administration, Northern Ireland). California and England are tight-loose interventions; the former is based on mandated minimum nurse–patient ratios, but organisations can select their own acuity tool for operational purposes, the latter specifies the expectations required of health care organisations but does not prescribe how these should be achieved.

4.1.1.6. Digital infrastructures. The New Zealand and Australian systems are embedded in proprietary software and health service administrative platforms, in which workload management, rostering and quality improvement functions are integrated. Competent use of the digital infrastructure is a prerequisite for workforce planning. Whilst the Welsh and English systems are not aligned with a specific digital platform, there is widespread adoption of the SafeCare system from the commercial rostering system provider Allocate (Allocate Software, n.d.) and both systems use a national platform – DATIX – to log adverse events. The Scottish system is supported by a suite of web-based resources hosted by Health Care Improvement Scotland. Digital infrastructure information was unavailable for other systems.

4.1.2. Core components of nurse staffing systems

4.1.2.1. Ratio benchmarks. A nursing staff ratio benchmark refers to a standard or guideline for the number of patients assigned to each nurse in a healthcare setting. The Californian system is the only approach which mandates minimum nurse–patient ratios, but this includes registered and licenced vocational/practical nurses. The English, Scottish, and Northern Ireland systems utilise indicative staffing ranges (nurse–patient ratios and registrant-support worker skill mix) as a starting point for decision-making, but these are not mandated. Wales and the Veterans' Health Administration systems explicitly eschew ratio-based approaches, emphasising the importance of individualising staffing plans to specific clinical settings. There is no reference to skill-mix or ratios in documents reviewed for Australia, New Zealand, RAFAELA®, and Nurse Staffing Committees.

Several of the systems utilise benchmarking methods. This involves drawing on comparator units to inform local staffing decisions and includes historical and contemporaneous approaches. The unit categories that underpin the Australian system were agreed following a benchmarking exercise conducted across all sites in Western Australia Health during 2000–2001 to establish the initial targets. The RAFAELA® methodology suggests the data generated can be used for internal and external benchmarking, and in England, organisations must undertake calculations of Care Hours per Patient Day, which is uploaded monthly to a national data set to facilitate bench-marking. Bench-marking is also a central component of the Veterans' Health Administration staffing methodology, but it is unclear whether this is a contemporaneous or historical approach.

4.1.2.2. Workload measurement. A workload measurement tool is a system or method used to quantify, analyse, and manage the nursing workload. Workload can be measured at task, patient or unit level. Formal workload measurement was a core component of all systems included in the review. Four systems prescribe/recommend the measurement tool to be used (England, Wales, Scotland, RAFAELA®), but in the remaining systems, tool-selection is determined locally.

In nine systems the patient is the unit of analysis for workload measurement. The New Zealand system is pre-loaded with patient types which include standard acuity indicators and category timings for tasks associated with that type of care. Nurses are required to check the correct patient type is selected and confirm the care was delivered. All other patient-level workload measurement systems are bottom-up approaches. The Safer Nursing Care Tool (England) and the Welsh Levels of Care Tool (Wales) measure nursing workload by categorising each patient based on composite assessments of acuity and dependency. The Scottish Acuity-Quality Patient Dependency Tool and Oulu Patient

Table 3
Nurse staffing systems: Descriptors and core components.

Staffing system		England	Wales	Scotland	Northern Ireland	New Zealand	Australia	Nurse Staffing Committees	California	Veterans' Health Administration	RAFAELA®
System descriptors	Policy	National policy.	National legislation.	National legislation.	National policy.	National legislation.	State legislation.	State legislation.	State legislation.	Institutional level policy.	Institutional level policy.
	Scope	Acute adult medical and surgical units.	Acute adult and children's medical and surgical units.	Nursing and midwifery, includes adult acute, community, emergency department, mental health, paediatrics, neonatal care.	Acute adult medical and surgical unit.	Nursing and Midwifery services.	Nursing and midwifery inpatient settings.	Varies by state. All cover adult acute settings, some include paediatric and mental health services.	All areas of acute care including intensive/critical care, neonatal intensive care, paediatric, obstetric, emergency, medical, surgical, post anaesthetic, and specialty and psychiatric.	Acute, mental health and residential care settings.	Main components designed for use in acute settings; bespoke tools also provided for mental health, outpatients and emergency care, operating departments and recovery, and radiation therapy.
	Function	Strategic workforce planning.	Strategic workforce planning.	Strategic workforce planning.	Strategic workforce planning.	Strategic workforce planning + operational variance management.	Strategic workforce planning.	Strategic workforce planning.	Strategic workforce planning + operational variance management.	Strategic workforce planning.	Strategic workforce planning + operational variance management.
	Organising logic	Triangulated.	Triangulated.	Triangulated.	Triangulated.	Preconfigured.	Preconfigured.	Deliberative.	Defined.	Triangulated.	Deliberative.
	Intervention type	Loose-tight.	Tight.	Tight.	Loose.	Tight.	Tight.	Loose.	Loose-tight.	Loose.	Tight.
	Digital infrastructure	Use of commercial rostering system. Use of Datix – national register for adverse events.	Use of commercial rostering system. Use of Datix – national register for adverse events.	National web-based resources.	No information available.	Proprietary administrative system.	Proprietary administrative system.	No information available.	No information available.	No information available.	No information available.
Core components	Ratio benchmarks	Indicative staffing ranges. Care Hours per Patient Day calculated and uploaded to national data set to facilitate benchmarking	Rejects ratios.	Indicative staffing ranges.	Indicative staffing ranges.	No reference to ratios.	Unit categories based on bench-marking.	No reference to ratios.	Mandated minimum nurse–patient ratios.	Rejects ratios but emphasises benchmarking.	No reference to ratios but suggests internal and external bench-marking.
	Workload measurement	Safer Nursing Care Tool (patient level composite measure) designed for strategic workforce planning.	Wales Level of Care Tool (patient level composite measure) designed for strategic workforce planning.	Scottish Acuity-Quality Patient Dependency Tool (patient level indicator measure) used for strategic workforce planning. Quality Tool – used in clinical nurse specialist,	Patient level measure to be determined locally used for strategic workforce planning.	12 months of trend care data used for strategic workforce planning and operational purposes.	Unit level measure (Nursing Hours per Patient Day) used for strategic workforce planning.	Patient level measure to be determined locally used for strategic workforce planning.	Patient level measure to be determined locally and used for operational purposes.	Patient level measure to be determined locally used for strategic workforce planning.	Oulu Patient Classification (patient level indicator measure) – used daily. Professional Assessment of Optimal Nursing Care Intensity Level tool used periodically to

(*continued on next page*)

Table 3 (*continued*)

Staffing system		England	Wales	Scotland	Northern Ireland	New Zealand	Australia	Nurse Staffing Committees	California	Veterans' Health Administration	RAFAELA®
				community children's and specialist nurse and community nursing where indicative staffing ranges do not exist.							assess unit workload relative to staffing capacity.
	Staffing calculator	Included in Safer Nursing Care Tool.	Rejects approach.	Speciality tools.	No reference to calculators.	12 months of trend care data used for strategic workforce planning and operational purposes.	Seven ward categories (A-G) each assigned an average number of Nursing Hours per Patient Day level.	No reference to calculators.	N/A	Reference to 'specified calculator' but no further information available.	Regression approach.
	Outcome indicators	Indicative patient outcome indicators but not prescribed. Indicative staff outcomes: missed breaks, nursing overtime; compliance with mandatory training.	Prescribed patient outcome indicators: falls, pressure ulcers and medication errors + any other indicators deemed appropriate. Indicative staff outcomes: staff well-being, ability to take annual leave, compliance with mandatory training and performance development review.	Patient outcome indicators required but not specified.	Indicative patient outcome indicators but not prescribed. Indicative staff outcomes: absence rates, vacancy rates.	9 'quality patient care measures' in core data set: patient incidents, patient experience, care rationing, staff mix, patient acuity, bed utilisation, care hours variance, shifts below target, acute staffing shortage incidents. Indicative staff outcomes: roster gaps, overtime, staff incidents, unplanned leave, staff satisfaction/ engagement, professional development.	No reference to outcome indicators.	No reference to outcome indicators.	No reference to outcome indicators.	Indicative patient outcome indicators but not prescribed.	No reference to outcome indicators.
	Professional judgement	Explicit component of triangulated workforce planning.	Explicit component of triangulated workforce planning.	Explicit component of triangulated workforce planning. Includes Professional Judgement Tool.	Explicit component of triangulated workforce planning. Recommends use of Telford Tool.	No explicit reference to professional judgement.	'Accompanying descriptive detail' to inform unit categories; ward managers use for operational purposes.	Mandated requirements for staffing committees.	Mandated requirements for staffing committees.	Mandated requirements for staffing committees.	System founded on professional judgement.
	Governance	Focused on strategic workforce planning (biannual and ad hoc). Mechanism: Data driven decision-making informed by professional judgement; staffing plans	Focused on strategic workforce planning (biannual and ad hoc). Mechanism: decision making informed by data and professional judgement equally weighted;	Focused on strategic workforce planning (annual). Mechanism: Data driven decision-making informed by professional judgement; staffing plans reviewed by	Focused on strategic workforce planning (no information available on frequency). Mechanism: Principles based with range of factors considered in the	Focused on strategic workforce planning (annual). Mechanism: based on 12 months Tend Care data; reviewed by organisational boards, and representatives from professional associations and unions.	Focused on strategic workforce planning (annual). Mechanism: Unit category review and business case for recategorization; staffing plans reviewed by organisational boards, and representatives from	Focused on strategic workforce planning (annual). Mechanism: Professional Judgement; staffing plans reviewed by organisational boards and	Focused on operational management (annual). Mechanism: Review of workload tool.	Focused on strategic workforce planning – locally determined frequency. Mechanism: Data driven decision-making informed by professional judgement; staffing plans	Focused on strategic workforce planning (every 2nd or 3rd year). Non-mandated, and therefore not specified.

(*continued on next page*)

Table 3 (*continued*)

Staffing system	England	Wales	Scotland	Northern Ireland	New Zealand	Australia	Nurse Staffing Committees	California	Veterans' Health Administration	RAFAELA®
	reviewed by organisational boards and government report	staffing plans reviewed by organisational boards and government report.	organisational boards and government report.	round; staffing plans reviewed by organisational boards and government report.		professional associations and unions.	government report.		reviewed by organisational boards and government report.	

Classification (RAFAELA®) tools are indicator approaches in which patients are scored on a range of separate dimensions to reach a summative score. The Scottish tool considers both direct care and activities involving families. The RAFAELA® tool is distinctive in including assessment of planning and coordination as well as direct care.

Several systems measured workload at unit level. In the Australian system, unit-categories are assigned an average number of Nursing Hours per Patient Day, which reflects the total direct clinical care required for each patient in a 24-h period. Two systems include methods for assessing unit workload relative to staffing capacity (RAFAELA®, Scotland).

In five systems workload measurement is designed for strategic planning purposes with data typically generated over a defined census period (Wales, England, Scotland, Veterans' Health Administration, Nurse Staffing Committees), although in the UK as digital technologies have become available, they have been increasingly deployed as real-time assessments for variance management (Griffiths et al., 2020). In the New Zealand system establishment setting is based on 12-months of Trend Care data; these data are also deployed for variance management. The RAFAELA® Oulu Patient Classification Tool is designed for daily use. California is distinctive in requiring an 'acuity tool' to be used exclusively for operational decision-making to determine whether additional staff are required above the minimum mandated nurse–patient ratios.

4.1.2.3. Staffing calculators. A nurse staffing calculator is a tool designed to help healthcare administrators and nurse managers determine the appropriate number and mix of staff needed to provide safe patient care. It uses various inputs, including patient acuity levels, staff-to-patient ratios, shift requirements, and hospital policies, to calculate staffing needs.

Four systems include staffing establishment calculators. The English Safer Nursing Care Tool categories are associated with multipliers, used to estimate staffing requirements. The Scottish Common Staffing Method deploys online speciality tools to calculate indicative staffing requirements, and the New Zealand staffing methodology deploys 12 months of Trend Care data and staffing information to generate a recommended roster and overall staffing level. RAFAELA uses a regression-based approach to determine the staffing required to deliver an acceptable intensity of nursing work for patients in an individual ward/unit. There is reference to a 'specified calculator' in the Veterans' Health Administration system, but we were unable to locate further detail.

4.1.2.4. Outcome indicators. Outcome indicators are metrics used to evaluate the impacts of staffing levels on patient care, staff wellbeing, and overall system efficiency. Nurse-sensitive indicators specifically reflect aspects of patient care that are directly influenced by nursing actions, skills, and interventions (Blume et al., 2021). Six of the systems include outcome indicators as methodological components. The five triangulated approaches all involve consideration of outcomes for strategic workforce planning. In Wales, three 'nurse sensitive indicators' are prescribed (falls, pressure ulcers, medication errors), with scope for an organisation to use other indicators deemed appropriate. Indicative patient outcomes are listed in the English and Northern Ireland guidance but not prescribed, and the Veterans' Health Administration and Scottish staffing systems refer to 'nurse sensitive indicators' but do not specify candidate measures. The New Zealand system includes nine 'quality patient care measures' in the core data set. While three items have face validity as patient outcome indicators (patient incidents, patient experience, care rationing) the relationship of the other measures to patient outcomes is unclear.

Staff outcomes are also referred to, but not prescribed, in several methodologies (Wales, England, Northern Ireland, New Zealand). There is no reference to outcome indicators in the formal documentation reviewed in the Australian, Californian, RAFAELA®, and Nurse Staffing

Committees systems.

4.1.2.5. Professional judgement. Professional judgement refers to assessments of how features of clinical areas impact staffing need (Allen et al., 2023). It is an explicit component of many systems but takes different forms and its weight in decision-making varies. In three systems, professional judgement is inscribed in mandated requirements for key committees (Nurse Staffing Committees, Veterans' Health Administration, California). Professional judgement is an explicit component of the four 'triangulated' UK staffing systems. In Wales, England, and Northern Ireland, this refers to consideration of the local features of the clinical environment which impact staffing need and patient safety. Two UK systems also include formal 'professional judgement' tools. The Northern Ireland framework recommends use of the Telford professional judgement method (Telford, 1979), which provides a way of converting the shift-level staffing plan, decided using expert opinion, into the number of staff to employ. The Scottish Common Staffing Method includes a Professional Judgement Tool, completed on behalf of the team by a senior nurse, which documents the users' professional opinion on the staff and skill mix required to carry out the work on the ward during a defined period.

RAFAELA® does not explicitly refer to professional judgement, but the toolkit included in the methodology is framed primarily as a resource for making professional judgements about staffing. The Australian system refers to 'accompanying descriptive detail' in informing decision-making about ward categorisation, and ward managers can use calculated nursing hours flexibly for variance management to reflect capacity and acuity. There is no explicit reference to professional judgement in the New Zealand system, which uses data to generate rosters.

4.1.2.6. Governance arrangements. Governance arrangements refer to the formal processes and accountability mechanisms in nurse staffing systems. In all systems, except California, governance arrangements were primarily focused on strategic workforce planning. This included instructions on the frequency of reviews and also decision-making mechanisms.

The prescribed frequencies of strategic staffing reviews ranged from every second or third year (RAFAELA®) through annual (Nurse Staffing Committees; New Zealand, California, Australia, Scotland) to biannual (Wales, England). Frequency is locally-determined in the Veterans' Health Administration system. Several systems also make provision for ad hoc reviews of staffing.

Arrangements for determining staffing plans were diverse. The Nurse Staffing Committees is the only system founded almost exclusively on professional judgement. Within the triangulated approaches there are differences in the relative emphasis accorded to workload measurement, outcomes data and professional judgement in decision-making. The English, Scottish and Veterans' Health Administration systems emphasise data-driven decision making, mediated by professional judgement. The Northern Ireland system is 'principles-based' and oriented to a range of factors considered in the round. The Welsh system is unique within the triangulated approaches, as it explicitly gives equal weight to all three elements (workload data, quality data, professional judgement).

The Australian system entails an annual process of reviewing unit categories. This is achieved by examining 'six areas deemed to impact nursing workload'. A business case must be developed for unit recategorization. The New Zealand system requires 12 months of Trend Care data to determine staffing establishments and generate rosters.

In seven systems, unit-led staffing recommendations are reviewed by expert committees, comprising nurses, and representatives from finance, management, and human resources, with reports submitted to relevant state or government health authorities (Nurse Staffing Committees, Veterans' Health Administration, Wales, Northern Ireland, Scottish, England). The systems in Australia and New Zealand, are distinctive in requiring staffing establishments to be agreed with unions and professional associations. No governance processes are associated with the RAFAELA®, which is not formally mandated.

Very few formal documents specified governance arrangements for operational variance management, which whilst required, were left to local determination. RAFAELA® is designed for use in daily workload planning and staff deployment, but decision-making appears to be left largely to the professional judgements of nurses. The New Zealand Care Capacity Demand Management programme includes a variance management module.

4.1.3. Summary

Phase 1 deployed official accounts of nurse staffing systems to identify, describe and compare their core components. The systems analysed included one defined system based on mandated minimum nurse staffing ratios, two deliberative systems where staffing plans were primarily determined by professional judgement, five triangulated systems combining professional judgement with workload measurement and quality indicator data, and two preconfigured systems relying mainly on administrative data to generate staffing plans. Available documentation focused predominantly on strategic establishment setting, with limited guidance or resources for managing safe staffing at an operational level. Four systems used ratio benchmarks to inform staffing plans, but two explicitly rejected this approach, emphasising flexibility in meeting unit needs. All systems included workload measurement tools, and four systems included staffing calculators. Outcome indicators, although required components of six systems, were only loosely defined, with four systems omitting reference to them entirely. Professional judgement, a component of all systems, ranged from requirements for committee composition, to its formal integration into data-driven decision-making. Despite two systems including professional judgement tools, overall, it is a relatively unstructured system component in the systems included in the study. Most systems had formalised governance structures, requiring organisational boards to review nurse-led staffing recommendations, with union involvement in two cases.

4.2. Phase 2

Phase 2 aimed to understand implementation experiences and the mediating effects of context on nurse staffing systems' mechanisms of action. We drew on evidential fragments from research papers and reports, which were available for eight systems. No evaluations were available for the Northern Ireland and Scottish systems, which are in their infancy. Four outputs were published after 2020, others predated the Covid-19 pandemic. (See Table 4 for a summary and description of resources; see Supplementary Table 2 for extracted evidential fragments for each system.)

4.2.1. California

California is the only included system with mandated nurse–patient ratios. As the first model of its kind, it has been discussed widely in the professional literature. Spetz et al. (2009) carried out a mixed methods evaluation of how the implementation of ratios affected different types of hospitals (12 nonprofits, 4 public, and one for-profit). They found the legislation made it easier for nursing executives to secure funding, but meeting ratios increased costs. Some organisations were able to off-set costs with increased insurance premiums, others had to find savings elsewhere. Nursing leaders expressed concerns about the inflexibility of the system, with organisations required to create 'float pools' to cover meal breaks, increase the cross-training of staff, and Emergency Department bottlenecks arising if ratios could not be achieved. Whilst specified as a minimum requirement, ratio increases were rare and reductions in ancillary staff and the requirement for registered nurses to supervise licenced practical nurses, impacted the registrant role and increased workloads. Nevertheless, Californian hospital nurses cared for

Table 4
Phase 2 evidence sources.

Index term	Evidence sources	Type
California	Spetz et al. (2009)[1], Aiken et al. (2010)[2], Dierkes et al. (2022)[3]	[1]Mixed methods study examining the strategies used by hospitals to meet the staffing ratio requirements and their effects. [2]Survey of 22,336 hospital staff nurses in California, Pennsylvania and New Jersey in 2006 and analysis of state hospital discharge data bases. [3]A longitudinal study using hospital data from 1997 to 2016 to compare nurse staffing in California hospitals to hospitals in other states (not subject to staffing mandates) to identify staffing trends and differences pre- and post-mandate, as well as before, during, and after the 2008 economic recession.
Nurse Staffing Committees	Han et al. (2021)[4], Jones et al. (2015)[5]	[4]A difference-in-difference design using 16 years of hospital-level data from the American Hospital Association (AHA) annual survey, to compare changes in productive hours per patient day for registered nurses (RNs), licenced practical/vocational nurses (LPNs), and nursing assistive personnel (NAP) in the state that mandated staffing ratios, states that legislated staffing committees, and states that legislated public reporting, to changes in states that did not implement any nurse staffing legislation before and after the legislation was implemented. Multivariate linear regression models deployed to assess the effects with hospital and year fixed effects, controlling for hospital-level characteristics and state-level factors. [5]Secondary analysis of cross-sectional hospital administration survey data for Texas hospitals from the AHA annual survey data base.
Veterans' Health Administration	Taylor et al. (2015)[6]; Robinson et al. (2016)[7]	[6]Evaluation study commissioned by the Veterans' Administration Office of Nursing Services drawing on interviews with nurse executives and their teams at 21 facilities. [7]Evaluation study commissioned by the Veterans' Administration Office of Nursing Services: A qualitative multi-case evaluation approach assessed staffing methodology implementation drawing on routinely collected hospital data and structured interviews with nurse executives and teams at 21 facilities.
England	Allen et al. (2023)[8]	[8]Qualitative cross-case comparative study, informed by a practice approach and translational mobilisation theory: six case studies informed by stakeholder interviews, observations and document analysis, informed by a practice approach and translational mobilisation theory.
Wales	Allen et al. (2023)[9]	[9]Qualitative cross-case comparative study, informed by a practice approach and translational mobilisation theory: six case studies informed by stakeholder interviews, observations and document analysis, informed by a practice approach and translational mobilisation theory.
Australia	Buchan (2019)[10]	A stakeholder review prepared for the Chief Nursing and Midwifery Office, Department of Health, Western Australia, informed by focus groups and interviews with 90 staff and managers
New Zealand	Nursing Advisory Group (2022)[11]	Ministerial review of safe staffing and the Care Capacity Demand Management system, informed by interviews, focus groups, site visits and a national survey of front-line staff.
RAFAELA®	Hustad (2014)[12], Van Oostveen et al. (2016)[13], Lillehol et al. (2017)[14]	[12] Qualitative study of manager experiences using the RAFAELA system, drawing on 10 in-depth interviews. [13]Pre-implementation study to investigate the reliability, validity and feasibility of the RAFAELA workforce planning system, drawing on staff questionnaire. [14] Exploratory qualitative study drawing on two focus groups with 12 nurses.

one less patient on average than nurses in the other US states and two fewer patients on medical and surgical units (Aiken et al., 2010). The hospital nurse staffing ratios mandated in California are associated with lower mortality and nurse outcomes predictive of better nurse retention (Aiken et al., 2010) and during economic recession, ratios have a protective effect on staffing levels (Dierkes et al., 2022).

4.2.2. *Nurse Staffing Committees*

We were unable to locate studies of user experiences of Nurse Staffing Committees, however, Han et al. (2021) used multivariate linear regression models to evaluate the effects of alternative legislative approaches on nurse staffing in the US. Compared to California, the authors conclude that Nurse Staffing Committee's approach is not effective in increasing nurse staffing levels. They argue that this type of legislation does not give staffing committees control over the hospital budget, and if there are limited resources, committees may be forced to plan cuts, rather than increases. Variation in nurse staffing levels may also reflect nurses' power within hospitals (Jones et al., 2015). Jones et al. (2015) recommend qualitative research to explore the dynamics of nurse staffing committee functioning in different organisational contexts.

4.2.3. *Veterans' Health Administration*

A commissioned evaluation of the Veterans' Health Administration system found uneven implementation (Taylor et al., 2015; Robinson et al., 2016). Mediating factors include limitations in the knowledge required for data-driven decision making in organisations which had previously relied on historical levels to budget for staffing (Taylor et al., 2015); organisational boards' enrolment in the process and the integration of the staffing methodology with budgeting (Robinson et al., 2016); and the availability of funds and workforce to implement recommended staffing establishments. Many facilities were reallocating recommended staffing hours and adjusting skill-mix often to hire non-

registered nurses.

4.2.4. England and Wales

A cross-case qualitative study in England and Wales, found that staffing systems followed a common pattern (Allen et al., 2023, 2025). Nurses valued having access to formal workload measurement tools but acknowledged their limitations in capturing all aspects of nursing work. They also underlined the inadequacies of outcome data deployed in the study sites (pressure ulcers, falls, medication errors) as indicators of how care quality was impacted by staffing. Data generation was burdensome, with staff prioritising clinical care over data entry which impacted its accuracy. Professional judgement had attenuated authority in strategic workforce planning, which privileged quantitative data, even in Wales where professional judgement is weighted equally. Budgetary constraints and a nursing workforce shortage acted as powerful impulses towards skill-mix dilution. Owing to recruitment challenges, many areas were short-staffed and operational management centred on risk management. Healthcare organisations depended on the professional judgements of nurses for operational decision-making. Nurse staffing systems consumed significant nursing resources owing to immature digital infrastructures.

4.2.5. Australia

The Australian system is the only model included in the study in which ward categories are the unit of analysis for establishment-setting. A stakeholder review (Buchan, 2019) found the system could be used to justify staffing levels, had value for rostering, and could be used for bench-marking. However, it also identified the need to revise unit categories, developed in 2002, to take account of the increased complexity and acuity of patient populations, reduced length of stay, and increased patient throughput. The preconfigured staffing levels for ward types were found to be insufficiently flexible and did not consider local contextual features which impacted nursing workloads and the processes for developing business cases for unit recategorization were burdensome. The review also identified the necessity for improvements in the use of nurse-sensitive outcome measures, the requirement for greater clarity in relation to decisions about skill-mix, and the need for training in the digital system and data analytics support.

4.2.6. New Zealand

The New Zealand system, the only model using category-led patient need assessments, was reviewed in 2022 (Nursing Advisory Group, 2022). Where data were available, the system revealed the daily reality faced by front-line clinicians. Noting that the system has failed to achieve safe staffing levels, and that these challenges have been exacerbated by the global workforce shortages, the review highlights several concerns. First, the lack of a clear link between core quality indicators and patient outcomes, and the burdensome data collection process that impacts accuracy. Second, with many clinical areas understaffed, variance management was ineffective, with indicators of inadequate staffing routinely ignored. Third, executive enrolment has been uneven and executive nurses are not empowered to increase staffing establishments. The report also notes that the partnerships between organisations and nursing unions are not always achieved and in some case they are adversarial. The necessity for training in the digital infrastructures and data analytics support is underlined.

4.2.7. RAFAELA®

As a non-mandated methodology, RAFAELA® is used in 90 % of organisations in Finland and has spread across other Nordic countries, suggesting the system is attractive to senior nurses. Qualitative studies of nurse managers' experiences have found that it provides nurses with a common language, has value for daily workforce and strategic planning, and facilitates discussions between staff about the content and intensity of nursing work and the prioritisation of care (Lillehol et al., 2017; Hustad et al., 2015). Nevertheless, even in the face of broad staff support, one study notes that the system was considered complex and time-consuming (Hustad, 2014) and a pre-implementation study found that there was insufficient engagement with the measures of staffing adequacy required, and satisfactory reliability also proved hard to achieve (Van Oostveen et al., 2016). While the system has value for the daily management of care within available resources, we were unable to find reports on its use for strategic workforce planning.

4.2.8. Summary

Phase 2 analysed evidence from evaluations of nurses' experiences with staffing systems, highlighting implementation challenges and contextual influences (Table 5). Common issues included budget constraints (6 systems) and workforce shortages (4 systems, including 3 post-pandemic evaluations). In six systems the limited authority of nurses' professional judgement in governance structures was highlighted.

Concerns about outcome indicators were evident in five systems (England, Wales, Veterans' Health Administration, Australia, New Zealand). Composite workload measures in England and Wales were considered by nurses to be insufficiently sensitive, and while the indicator system in RAFAELA® received more positive feedback, concerns were also raised about its accuracy, and it was considered time-consuming. Reports emphasised the nursing workload created by staffing systems and the need for improved digital literacy and infrastructure.

A gap between staffing plans and recruitment was evident in six systems. Predefined staffing systems in Australia and California enabled senior nurses to justify staffing establishments. California's ratio-based system gave nurse executives more budget control, but without additional resources, the costs of meeting ratios impacted other services.

Operational risk management largely fell to nurses. RAFAELA® was the only tool noted as useful for unit-level management, while England and Wales rely on professional judgement. Defined (California) and preconfigured (New Zealand, Australia) systems lacked flexibility to adapt to changing needs. Persistent staff shortages in Wales, England, and New Zealand impacted care quality and variance management.

5. Discussion

This paper has presented findings from a document analysis of 10 widely used nurse staffing models and an interpretative review of contextual conditions and implementation experiences. Informed by Actor Network Theory (Latour, 2005), the study was designed to produce evidence and insights to aid decision-makers in optimising nurse staffing systems. While systems vary in their complexity, organising logics and core components, and nurses experience a range of implementation challenges, most are conditioned by financial constraints and/or workforce shortages. In this section of the paper, we integrate the insights from both phases, to consider their implications for system optimisation.

Benchmarks are core components of several staffing systems. Given the widespread financial constraints and workforce shortages in the post-pandemic world, and their impacts on staffing plans, our study suggests they should be used with caution. A review of nurse-sensitive value-based purchasing highlights how increases in nurse staffing are beneficial and cost effective for society but not to healthcare organisations who bear the labour costs (Kavanaugh et al., 2012). This creates a powerful normative impulse to depress staffing levels (Jones et al., 2015).

Workload measurement tools were components of most systems. Against the backdrop of a global nursing shortage, there is evidence that the caring division of labour will become more complex. A range of strategies – intermediate roles, new career pathways and caring technologies - are emerging to address the gap between capacity and demand. In this context, indicator models, as deployed in the RAFAELA® and Scottish systems, offer a greater level of detail about the content of

Table 5
Nurse staffing systems: Contextual conditions and implementation experiences.

Staffing system		California	Nurse Staffing Committee	Veterans' Health Administration	England and Wales	Australia	New Zealand	RAFAELA®
Contextual conditions	Budgetary constraints	Nurse–patient ratios protective against budgetary constraints.	Legislation does not give nurses control over budget.	Staffing methodology unevenly integrated into budgeting. Funding availability impacts implementation/ approval of staffing recommendations.	System implementation impacted by budgetary constraints.	Staffing system seen as linked to budget related staff constraints and financial reporting, rather than safe care. Unit recategorization has not led to staffing increases funded in a timely manner.	No evidence located.	No evidence located.
	Workforce shortages	Nurse–patient ratios implemented to address acute nursing shortages, which were resolved within 2 years.	No evidence located.	Recruitment challenges in local labour markets.	System implementation impacted by national workforce shortages.	No evidence located.	Nursing shortfall; 30 % internationally qualified, having major impacts on implementation.	No evidence located.
Implementation experience themes	Professional judgement	Minimum nurse–patient ratios legislation buttressed nursing authority for strategic workforce planning. Meal break and staffing regulations reduced nurses' ability to use professional judgement for operational purposes.	Senior nurses have variable authority for strategic workforce planning in different healthcare organisations.	Nurses have attenuated authority for strategic workforce planning. Committees involve considerable nursing investment of time and energy.	Professional judgement is necessary to interpret and make sense of workload and quality data. Nurses had attenuated authority for strategic workforce planning, which privileged data and management knowledge systems. Organisations depended on. nurses' professional judgement for operational purposes.	System buttressed professional authority for strategic workforce planning and in justifying staffing levels.	Nurses not empowered to increase staffing establishment.	Found to be useful for informing operational and strategic workforce planning and creating common language, no evidence of how unit level staffing level plans are mediated by organisational boards.
	Governance	Implementation of ratios perceived to increase tensions between managers and staff.	Impacts of normative forces in hospitals oriented to labour costs, which input from nurse staffing committees may not be sufficient to overcome. Unclear whether all organisations are compliant with the rules requiring nurse staffing committees.	Poor enrolment of organisational boards in process. Leadership turnover impacted implementation. Uneven integration with budget and resource allocation, which impacted attitudes towards methodology. Importance of nursing leadership buy-in.	Disconnect between clinicians and managers. Managers privileged safety and efficiency; nurses privileged quality.	Lack of transparency or understanding of the input and output aspects of the process. Concerns about transparency of skill-mix decisions.	Uneven board enrolment in system, and failure to act on recommended FTEs. Disconnect between clinicians and managers. CDDM methodology continues to be questioned by executive leadership. Uneasy partnerships between organisations and unions.	Attenuated authority of chief nurses who have been replaced by medical division managers.
	Outcome indicators	N/A	N/A	Not examined in the studies included in the review and acknowledged as a future priority.	Adverse event focused and considered inadequately sensitive to care quality.	More attention required to nurse sensitive indicators.	No clear link between quality indicators and patient outcomes, recommendations that these be simplified and standardised.	N/A
	Workload measurement	Not specifically mentioned, but ratios not increased in response to operational need, treated as maximum rather than minimum	N/A	Underlines importance of organisations selecting appropriate tools which align with the micro-systems in	Nurses valued having formal tools but acknowledged their limitations in capturing the full range of nursing work: turnover,	Preconfigured unit categories outdated and needed to be revised to reflect service changes. Distinctions between direct and indirect care are	CDDM - continues to be questioned by executive leadership.	Facilitated useful discussions between staff about nursing intensity and the prioritisation of care. Oulu Patient

(*continued on next page*)

Table 5 (*continued*)

Staffing system	California	Nurse Staffing Committee	Veterans' Health Administration	England and Wales	Australia	New Zealand	RAFAELA®
			which they provide care.	behavioural issues, indirect care and organisation.	unclear. Lack of clarity about how beds were used to calculate Nursing Hours per Patient Day. Sources of nursing work not included in calculations; concerns about impacts on ward layouts and work environments, patient slow and work fluency and impacts on staffing need, behavioural issues, mother and child workload in midwifery. Preconfigured unit categories insufficiently flexible to consider local contextual issues.		Classification not regarded as accurate. Nursing areas considered too abstract. Does not consider experience and skill-mix.
	Data generation burdens	No evidence located.	N/A	Limitations of knowledge and skills for data-driven decision making.	Data generation burdensome and impacts accuracy.	Developing business case for unit recategorization burdensome.	Data generation burdensome and impacts accuracy.	Time consuming and challenging to enrol front-line staff even though non-mandated system.
	Digital Infrastructures and literacy	No evidence located.	N/A	Limitations of knowledge and skills for data-driven decision making.	Immature digital systems consumed senior nursing time.	Digital literacy training and data analytics support required.	Digital literacy training and data analytics support required.	System is not integrated into hospital administrative systems.
	Impacts on staffing	Better ratios than other US systems, associated with lower mortality and nurse outcomes predictive of better nurse retention. Meeting nurse–patient ratios increased costs which had to be recovered elsewhere and increased RN supervisory burdens. Ratios not increased in response to operational need, treated as maximum rather than minimum. Reduction of auxiliary staff to save expenditure increased primary care duties for RNs.	Attenuated nursing authority impacted staffing plans, including staffing cuts in the context of budgetary constraints.	Implementation of staffing recommendations impacted by available funds. Recruitment challenges, created impetus for reallocation of FTEs and changes to staffing models, including skill-mix dilution.	Some examples of increased staffing, against a general trend in which workforce shortages and budgetary constraints led to skill mix dilution and routine requirement to functions with insufficient staff.	System had value for bench-marking and rostering. Concerns about transparency of skill-mix decisions. Hours treated as maximum, and it should be taken as indicating minimum.	The system has failed to achieve safe staffing levels. Variance management cannot function; 43 % of day shifts were below staffing target. Process often does not result in an agreement to recruit additional FTE.	No evidence located.
	Operational management	System inflexible, organisations required to increase cross training of staff, use of float pools to cover breaks, Emergency	No evidence located.	No evidence located.	Nurses responsible for mitigating risk for operational purposes, concerns for care quality.	System can be inflexible if bed occupancy changes quickly.	No evidence located.	System useful in supporting nurses to prioritise activity and manage daily workload. Value of system for

(*continued on next page*)

Table 5 (*continued*)

Staffing system	California	Nurse Staffing Committee	Veterans' Health Administration	England and Wales	Australia	New Zealand	RAFAELA®
	Department bottlenecks created if ratios not achieved.						strategic workforce planning, only recognised by managers, not clinical staff.

nursing work for workforce planning. The aim should be to capture the full range of direct and in-direct care work (Allen, 2015), as well as accounting for any impacts on the role of registrants arising from wider skill-mix changes, such as supervision. Given the work created for nurses by staffing systems, however, consideration should be given to the deployment of granular workload measurements tools for workforce planning, and simpler summative measures for operational purposes.

All systems were more focused on demand measurement than in assessing staffing adequacy as evidenced by patient and staff outcomes, with a number of evaluation reports identifying the need for improvement. There is a substantial literature on nurse-sensitive outcomes. In a review of reviews Blume et al. (2021) appraised the evidence for the association of staffing levels with 22 nurse-sensitive patient outcomes. The outcomes with the strongest evidence included patient satisfaction and poor quality of care. These are referred to in several methodologies included in the study but only prescribed in the formal systems of measurement in RAFAELA®. None of the systems included other outcomes for which Blume et al. identified strong evidence, namely length of stay and readmissions, despite the relative ease with which these data could be captured from hospital administrative systems. Furthermore, given the importance of clinical areas as learning environments and the challenges of undergraduate attrition, student feedback is a notable omission in the indicative outcome indicators specified in all systems included in the review. Given the dynamic nature of healthcare systems, and the multiple influences on skill-mix and staffing levels, identification of reliable outcome measures is an essential system component to assess the impacts of workforce planning and an urgent priority.

Professional judgement is a necessary component of all staffing systems because of the complex ways in which clinical environments impact workforce requirements and the fallibility of all systems of measurement. In many of the systems included in the study, however, professional judgement had attenuated authority in board level strategic decision making. This is in line with other research which has highlighted the challenges of clinical voices being crowded out by managerial perspectives (Waring and Bishop, 2013). Allen et al. (2023) have underlined the need to support nurses to articulate their professional judgement in nurse staffing systems and Saville et al. (2023) have recently published a framework designed for this purpose. More could be done to build on this work. The matters of concern typically subsumed in appeals to professional judgement are measurable features of the local clinical setting, and in the data-driven contexts of corporate decision making, there is a strong case for the development of tools to enable these to be systematically documented to strengthen the clinical perspective in workforce planning. In the longer term, a more systematic understanding of the contextual factors that impact staffing need could be incorporated into the modelling mechanisms deployed in pre-configured nurse staffing systems, like Australia, which have been criticised for their lack of adaptability to evolving healthcare systems.

The study has also highlighted the need to strengthen governance arrangements in nurse staffing systems. This is essential to prevent the descent into ceremonial compliance in which systems become an end in themselves rather than decision support mechanisms (Buchan, 2005). In many systems understaffing was being normalised, and while all systems underlined the importance of operational management, these processes were relatively opaque. Not only do staffing establishment decision-making mechanisms require improved transparency, there is a need for greater public accountability for their effects on patient outcomes and care quality, learning environments, and workforce well-being. Governance arrangements should also include the requirement for staffing systems to incorporate feedback mechanisms so they can evolve in response to dynamic healthcare contexts: changing patient populations, new technologies, and the redistribution of care between acute and community services. This depends on high quality accurate data, which requires investment in data literacy skills and adequate digital infrastructures.

In the context of international professional unrest with staffing levels

(Buchan and Catton, 2023), several nurses' organisations (US, Australia, England) have called for mandated minimum nurse–patient ratios. This is unsurprising given the costs and limitations of other systems. As the only ratio-based system included in the study California appeared to have a protective effect on nurse staffing in conditions of economic constraint. While ratios have been implemented with positive outcomes in select hospitals in Queensland, Australia (McHugh et al., 2021) and pilot sites in Ireland (Drennan et al., 2018), formal evaluations do not consider their wider system effects. Nursing shortages in California were resolved within two years of the legislation, in part by drawing in nurses from other states (Firth, 2023). In the context of global workforce shortages, the use of mandated ratios should be approached with care. Implementation in selected areas risks destabilising national and international provision, resulting in depleted nurse staffing levels in areas not subject to ratios perpetuating health inequalities.

In this section of the paper, we have integrated the findings from both phases of the study to consider their implications for optimising nurse staffing systems in the context of the global challenges faced by healthcare systems and the nursing profession. Because nurse staffing systems are complex interventions, prospective strategies must be tailored to system and context but to summarise the preceding discussion these include more granular workload measurement tools, improved data on patient, staff and learner outcomes, tools to augment the authority of professional judgement for strategic decision making, enhanced governance arrangements, strengthened digital infrastructures, and increased public accountability. Benchmarking approaches should be used with caution, given the normative impulse to depress staffing levels. In the context of a global workforce shortage, consideration should also be given to the impacts of nurse staffing models – such as ratio-based approaches - on equality of provision across the wider healthcare system.

5.1. Limitations

Our findings are limited to the ten widely used nurse staffing systems in high-income western healthcare systems, but there is scope for others to build on this approach to look inside the black box of other systems. We were unable to find evaluations for two systems included in the review, and not all evidence is reflective of the impact of the global impacts of COVID-19 pandemic on healthcare systems and the international nursing workforce.

6. Conclusion

This study has described and compared their core components, nurses' implementation experiences, and the contextual influences on their mechanisms of action. As global healthcare systems and nursing navigate an increasingly challenging landscape, ensuring that nurse staffing systems are effective and able to evolve in response to wider changes in the healthcare environment, is critical for advancing patient care and supporting the workforce. Previous studies of nurse staffing systems have focused on outcomes neglecting their inner dynamics. Conceptualising nurse staffing systems as complex interventions and drawing on Actor Network Theory, this study has introduced a robust framework to systematically analyse these socio-material relationships in future research, and in so doing has identified prospective strategies for system optimization.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnurstu.2025.105056.

CRediT authorship contribution statement

Davina Allen: Writing – original draft, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Heather Strange:** Writing – review & editing, Investigation, Formal analysis, Data curation. **Nina Jacob:** Writing – review & editing, Investigation, Data curation. **Anne Marie Rafferty:** Writing – review & editing, Funding acquisition.

Funding

This study was funded in part by the RCN Foundation. It represents the views of the authors and not the RCN Foundation.

Declaration of competing interest

None.

Acknowledgments

Rachel Hale contributed to the initial scoping exercise. Staffing systems selection was informed by the study advisory group: Mark Radford (Professor and Deputy Chief Nursing Office, England), Alison Leary (Professor Healthcare Modelling, London Southbank University), Jane Ball (Professor Nursing Workforce, University of Southampton), Walter Sermeus (Professor of Healthcare Management, Leuven Institute for Healthcare Policy), Charlotte McArdle (Professor, former Chief Nursing Officer, Northern Ireland), Helen Whyley (Executive Director for the Royal College of Nursing in Wales), Donna O'Boyle (Professor, Professional Adviser Healthcare Regulation, Scottish Government), Ruth Walker (Chair, All Wales Nurse Staffing Group).

References

Adebiyi, B.O., Mukumbang, F.C., Beytell, A.-M., 2019. To what extent is fetal alcohol spectrum disorder considered in policy-related documents in South Africa? A document review. Health Research Policy and Systems 17 (46). https://doi.org/10.1186/s12961-019-0447-9.

Aiken, L.H., Sloane, D.M., Cimiotti, J.P., Clarke, S.P., Flynn, L., Seago, J.A., Spetz, J., Smith, H.L., 2010. Implications of the California nurse staffing mandate for other states. Health Serv. Res. 45 (4), 904–921. https://doi.org/10.1111/j.1475-6773.2010.01114.x.

Allen, D., 2015. The Invisible Work of Nurses. Routledge, London.

Allen, D., Jacob, N., Strange, H., Jones, A., Burton, C., Rafferty, A.M., 2023. "It's not just about the numbers": inside the black box of nurses' professional judgement in nurse staffing Systems in England and Wales: insights from a qualitative cross-case comparative study. Int. J. Nurs. Stud. 147, 104586. https://doi.org/10.1016/j.ijnurstu.2023.104586.

Allen, D., Strange, H., Jacob, N., Zoccatelli, G., Desai, A., Rafferty, A.M., 2005. Understanding socio-material relations in nurse staffing systems: Insights from a qualitative study in England and Wales. Nurs. Inq. 32 (2), e70008.

Allocate software. https://www.allocatesoftware.co.uk/solutions/workforce-need/care/allocate-safecare/.

Blume, K.S., Dietermann, K., Kirchner-Heklau, U., Winter, V., Fleischer, S., Kreidly, L.M., Meyer, G., Schreyögg, J., 2021. Staffing levels and nurse-sensitive patient outcomes: umbrella review and qualitative study. Health Serv. Res. 56, 885–907.

Booth, A., Harris, J., Croot, E., Springett, F., Campbell, F., Wilkins, E., 2013. Towards a methodology for cluster searching to provide conceptual and contextual "richness" for systematic reviews of complex interventions: case study (CLUSTER). BMC Med. Res. Methodol. 13, 118. https://doi.org/10.1186/1471-2288-13-118.

Buchan, J., 2005. A certain ratio? The policy implications of minimum staffing ratios in nursing. J. Health Serv. Res. Policy 10 (4), 239–244.

Buchan, J., 2019. Nursing hours per patient day (NHpPD) in Western Australia: stakeholder views and the evidence base: background review for the Chief Nursing and Midwifery Office, Department of Health, Western Australia. https://www.health.wa.gov.au/~/media/Files/Corporate/general-documents/nursing-and-midwifery/PDF/NHpPD-stakeholder-view-and-evidence-base.pdf. (Accessed 8 July 2024).

Buchan, J., Catton, H., 2023. Recover to Rebuild: Investing in the Nursing Workforce for System Effectiveness. International Council of Nurses, Switzerland.

Dalglish, S.L., Khalid, H., McMahon, S.A., 2020. Document analysis in health policy research: the READ approach. Health Policy Plan. 35 (10), 1424–1431. https://doi.org/10.1093/heapol/czaa064.

Dierkes, A., Do, D., Morin, H., Rochman, M., Sloane, D., McHugh, M., 2022. The impact of California's staffing mandate and the economic recession on registered nurse staffing levels: a longitudinal analysis. Nurs. Outlook 70 (2), 219–227. https://doi.org/10.1016/j.outlook.2021.09.007.

Drennan, J., Savage, E., Hegarty, J., Muurphy, A., Brady, N., Howson, V., Gilligan, D., Dahly, D., Griffiths, P., Ball, J., Duffield, C., Scott, A., 2018. Evaluation of the 'Pilot Implementation of the Framework for Safe Staffing and Skill Mix, Report 3'. University College Cork, Ireland. https://assets.gov.ie/10014/4aa5216641734b8dafecbbdadcfa418e.pdf.

Firth, S., 2023. Nurse-to-patient staffing ratios win some hard fought ground, Medpage Today. https://www.medpagetoday.com/special-reports/features/106770.

Griffiths, P., Saville, C., Ball, J., Jones, J., Pattison, N., Monks, T., 2020. Nursing workload, nurse staffing methodologies and tools: a systematic scoping review and discussion. Int. J. Nurs. Stud. 103. https://doi.org/10.1016/j.ijnurstu.2019.103487.

Han, X., Pittman, P., Barnow, B., 2021. Alternative approaches to ensuring adequate nurse staffing, the effect of state legislation on hospital nurse staffing. Med. Care 59 (Suppl. 5), 10. www.lww-medicalcare.com (S463).

Horton, T., Illingworth, J., Warburton, S., 2018. The Spread Challenge. The Health Foundation, London. https://www.health.org.uk/sites/default/files/upload/publications/2018/The-spread-challenge.pdf.

Hustad, N.B., 2014. Patient Classification Systems: A Qualitative Study of Manager Experiences with the RAFAELA System and a Literature Review of Different Systems. University of Oslo (Masters Thesis).

Hustad, N.B., Hellesø, R., Andersen, M.A., 2015. A qualitative study of manager experiences using the RAFAELA system. Open J. Nurs. 5, 1024–1032. https://doi.org/10.4236/ojn.2015.511109.

Jones, T., Heui Bae, S., Murry, N., Hamilton, P., 2015. Texas nurse staffing trends before and after mandated nurse staffing committees. Policy Polit. Nurs. Pract. 16, 79–96.

Katchmarchi, A.B., Taliaferro, A.R., Kipfer, H.J., 2018. A document analysis of drowning prevention education resources in the United States. Int. J. Inj. Control Saf. Promot. 25, 78–84.

Kavanaugh, K.T., Cimiotti, J.P., Abusalem, S., Coty, M., 2012. Moving healthcare quality forward with nursing-sensitive value-based purchasing. J. Nurs. Scholarsh. 44 (4), 385–395. https://doi.org/10.1111/j.1547- 5069.2012.01469.x.

Latour, B., 2005. Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford University Press, Oxford, UK.

Lillehol, B.M., Lønning, K., Andersen, M.H., 2017. Exploring nurse managers' perception of using the RAFAELA system as a management tool in a Norwegian hospital setting. Nurs. Open 5, 77–83. https://doi.org/10.1002/nop2.115.

Maxwell, J.A., 2005. Qualitative Research Design: An Interactive Approach, 2nd edn. Sage Publications, Thousand Oaks, CA.

McHugh, D., Aiken, L., Sloane, DM., Windsor, C., Douglas, C. Yates, P. (2021) Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: a prospective study in a panel of hospitals, Lancet, 397, (10288), 1905-1913,:doi:https://doi.org/10.1016/S0140-6736(21)00768-6.

Nursing Advisory Group, 2022. Nurse Safe Staffing Review: Report on the Review of the Care Capacity Demand Management (CDDM) Programme. Ministry of Health, Wellington. https://www.health.govt.nz/publication/nursing-safe-staffing-review-and-report-review-care-capacity-demand-management-ccdm-programme.

Robinson, C.H., Annis, A.M., Forman, J., Krine, S.L., Yankey, N., Duffy, S.A., Taylor, B., Sales, A.E., 2016. Factors that affect implementation of a nurse staffing directive: results from a qualitative multi-case evaluation. J. Adv. Nurs. 72 (8), 1886–1898. https://doi.org/10.1111/han.12961.

Saville, C., Griffiths, P., Casey, A., Chable, R., Chapman, H., Radford, M., Watts, N., 2023. https://shelfordgroup.org/wp-content/uploads/2024/01/2024-Professional-Judgement-Framework.pdf.

Skivington, K., Matthews, L., Simpson, S.A., Craig, P., Baird, J., Blazeby, J.M., et al., 2021. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. BMJ 374 (2061). https://doi.org/10.1136/bmj.n2061.

Spetz, J., Chapman, S., Herrera, C., Kaiser, J., Seago, J.A., Dower, J.D., 2009. Assessing the impact of California's staffing ratios on hospitals and patient care, California Healthcare Foundation. https://www.chcf.org/wp-content/uploads/2017/12/PDF-AssessingCANurseStaffingRatios.pdf.

Taylor, B., Yankey, N., Robinson, C., Annis, A., Haddock, K.S., Alt-White, A., Krein, S.L., Sales, A., 2015. Evaluating the Veterans Health Administration's staffing methodology model: a reliable approach. Nurs. Econ. 33 (1), 36–66.

Telford, W., 1979. Determining nursing establishments. Health Serv. Manpow. Rev. 5 (4), 11–17.

Thornton, P.H., Ocasio, W., Lounsbury, M., 2013. The Institutional Logics Perspective: A New Approach to Culture, Structure and Process, online edn. Oxford Academic. https://doi.org/10.1093/acprof:oso/9780199601936.001.0001 (Oxford, 2012, accessed 12 Nov. 2024, 23 May 2013).

Twigg, D.E., Whitehead, L., Doleman, G., El-Zaemey, S., 2021. The impact of nurse staffing methodologies on nurse and patient outcomes: a systematic review. J. Adv. Nurs. 77 (12), 4599–4611. https://doi.org/10.1111/jan.14909.

Van den Heede, K., Cornelis, J., Bouckaert, N., Bruyneel, L., Van de Voorde, C., Sermeus, W., 2020. Safe nurse staffing policies for hospitals in England, Ireland, California, Victoria and Queensland: a discussion paper. Health Policy 124 (10), 1064–1073. https://doi.org/10.1016/j.healthpol.2020.08.003.

Van Oostveen, C.J., Mathijssen, E., Vermeulen, H., 2016. Nurse staffing issues are just the tip of the iceberg: a qualitative study about nurses' perceptions of nurse staffing. Int. J. Nurs. Stud. 52, 1300–1309.

Waring, J., Bishop, S., 2013. McDonaldization or commercial re-stratification: corporatization and the multimodal organization of English doctors. Soc. Sci. Med. 82, 147–155. https://doi.org/10.1016/j. socscimed.2012.12.023.