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More than just staffing? Assessing evidence on the complex interplay among nurse staffing, other features of organisational context and resident outcomes in long-term care: a systematic review protocol

Katharina Choroschun [iD],[1] Megan Kennedy,[2] Matthias Hoben [iD] [3]

¹School of Public Health, Bielefeld University, Bielefeld, Germany
²John W. Scott Health Sciences Library, University of Alberta, Edmonton, Alberta, Canada
³Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

Correspondence to
Mrs Katharina Choroschun;
k.choroschun@uni-bielefeld.de

ABSTRACT

Introduction Especially in acute care, evidence points to an association between care staffing and resident outcomes. However, this evidence is more limited in residential long-term care (LTC). Due to fundamental differences in the population of care recipients, organisational processes and staffing models, studies in acute care may not be applicable to LTC settings. We especially lack evidence on the complex interplay among nurse staffing and organisational context factors such as leadership, work culture or communication, and how these complex interactions influence resident outcomes. Our systematic review will identify and synthesise the available evidence on how nurse staffing and organisational context in residential LTC interact and how this impacts resident outcomes.

Methods and analysis We will systematically search the databases MEDLINE, EMBASE, CINAHL, Scopus and PsycINFO from inception for quantitative research studies and systematically conducted reviews that statistically modelled interactions among nurse staffing and organisational context variables. We will include original studies that included nurse staffing and organisational context in LTC as independent variables, modelled interactions between these variables and described associations of these interactions with resident outcomes. Two reviewers will independently screen titles/abstracts and full texts for inclusion. They will also screen contents of key journals, publications of key authors and reference lists of all included studies. Discrepancies at any stage of the process will be resolved by consensus. Data extraction will be performed by one research team member and checked by a second team member. Two reviewers will independently assess the methodological quality of included studies using four validated checklists appropriate for different research designs. We will conduct a meta-analysis if pooling is possible. Otherwise, we will synthesise results using thematic analysis and vote counting.

Ethics and dissemination Ethical approval is not required as this project does not involve primary data collection. The results of this study will be disseminated via peer-reviewed publications and conference presentation.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study protocol is informed by the Cochrane Collaboration systematic review methods and adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols.
⇒ Study selection, data extraction and quality assessment will be performed independently by two researchers, which will ensure that all relevant studies are included without personal biases.
⇒ The number of high-quality studies on this topic may be small, possibly limiting the strength of the conclusions we can draw.

INTRODUCTION

Demographic changes such as decreasing fertility and population ageing have increased the pressure on residential long-term care (LTC) settings.[1 2] Residential LTC is defined as 24-hour functional support and care for individuals who require assistance with activities of daily living (ADL) and often have complex health needs and increased vulnerability. Services may also include palliative/hospice and end-of-life care.[3] Due to demographic trends, demand for LTC has increased, and older adults have entered LTC with increasingly complex care needs and closer to the end of life than ever before.[4 5] However, staffing levels have not kept up with these increasing demands.[2] In almost all Organization for Economic Co-operation and Development (OECD) countries, the number of LTC workers per population has remained consistent or decreased since 2011—and

more than half of OECD countries report a shortage of LTC caregivers.[2] Media and researchers have increasingly expressed concerns about LTC staffing levels being too low, affecting quality of resident care and safety.[6–9]

In acute care, multiple studies have demonstrated that better nurse staffing (ie, more care hours per client and day and more qualified care teams) is associated with better client outcomes.[10–15] For example, Driscroll et al[16] found in their meta-analysis that higher nurse staffing levels decreased the mortality risk by 14% (OR=0.86, 95% CI 0.79 to 0.94). Similarly, a systematic review by Kane et al[17] demonstrated that on intensive care units one registered nurse (RN) more per client day decreased the odds of hospital acquired pneumonia (OR=0.70; 95% CI 0.56 to 0.88), unplanned extubation (OR=0.49; 95% CI 0.36 to 0.67), respiratory failure (OR=0.40; 95% CI 0.27 to 0.59) and cardiac arrest (OR=0.72; 95% CI 0.62 to 0.84). However, the results of these studies may not be directly applicable to LTC. LTC facilities serve different populations than acute care, are organised differently and staffing models differ significantly from those in acute care (more nursing assistants, less regulated staff). In addition, the care provided is less medically focused, emphasising the management of multiple chronic conditions and related symptoms, and supporting people with physical and cognitive impairment, over curing a disease.[18]

In LTC the evidence is more heterogeneous and not as conclusive. Most of the studies on staffing in LTC are based out of the USA.[19 20] Older systematic reviews suggested an association between higher total staffing levels and improved quality of care.[21] Bostick et al[21] found that staffing levels most strongly influenced residents' functional ability, pressure ulcers and weight loss. Yet, more recent reviews do not support these conclusions. In a systematic review published in 2020, Armijo-Olivo et al[22] pointed out that total nurse staffing hours were not associated with urinary catheter use, use of physical restraint and development of infections. Three of the studies included in this review reported a positive association of total nurse staffing hours with overall quality of care, whereas two of the included studies indicated no association. Overall, the included studies were of poor methodological quality, failed to adequately and consistently define measures of staffing and quality, and reported contradictory study findings, clearly not permitting any strong conclusions.[22–24]

The reason for the abovementioned complexities may be that the relationship between nurse staffing and quality of care could be moderated by other factors. Backhaus et al[25] point to organisational context factors as one of the possible reasons for the inconclusive evidence—and these factors and their interaction with care staffing have received little attention in the literature on nurse staffing and quality of LTC. Better organisational context, such as supportive leadership, a collaborative work culture, or supportive care teams may interact with LTC staffing and mitigate the negative effects of lower nurse staffing in LTC.[25] However, only a small number of studies have

included both, nurse staffing and organisational context characteristics, as independent variables to assess their influence on quality of care in nursing homes.[26–28] These studies suggest a positive association between organisational factors and quality of care, but no association between staffing and quality of care.

The current body of literature on organisational context lacks adequate definitions too, and it is characterised by considerable variability in how contextual factors are measured across studies.[29] Squires et al[30] created a framework of domains, attributes and features of organisational context. The authors defined organisational context *'as characteristics of: the providers and users of healthcare, internal organisational arrangements, infrastructures and networks, responsiveness to change, and the broader healthcare system'*.[30] Organisational context refers to facility or unit characteristics that are created by the interactions and relationships of those living and working in these organisations, such as leadership, culture, connections among care teams, and so on. Organisational context differs from structural variables such as facility size, ownership model, and so on, in that it is dynamic in nature and potentially modifiable—which are critical characteristics when change is the aim. Staffing can be considered an element of organisational context, but focusing solely on staffing without including other contextual factors is not adequate.[31]

Recent studies in acute care settings have demonstrated that organisational context is associated with quality of client care and nurse outcomes.[32–34] In their systematic review, Kaplan et al[35] identified leadership from top management, organisational culture, data infrastructure and information systems as important contextual factors influencing quality improvement success in healthcare. Ten (21%) of the included studies were conducted in LTC. In their systematic review, Braithwaite et al[36] found that across multiple studies, settings and countries, positive organisational and workplace cultures were consistently associated with a wide range of patient outcomes, such as reduced mortality rates, falls, hospital acquired infections and increased patient satisfaction. Four studies (6.5%) were conducted in aged care settings. Temkin-Greener et al[37] demonstrated that residents in LTC facilities with lower staff cohesion had significantly greater odds of pressure ulcers (OR=0.957; p=0.016) and incontinence (OR=0.924; p<0.001). Residents in facilities with more self-managed care teams had a lower risk of pressure ulcers (OR=0.977; p=0.028). van Beek et al[38] found that organisational culture was related to perceived and observed quality of care in LTC dementia units.

The fact that various studies in LTC fail to identify a relationship between staffing levels and quality of care may indicate that more or better-educated staff will not automatically lead to better quality of care, but that the quality of the organisational context may play a significant additional role.[19 27] However, to the best of our knowledge no review has synthesised available evidence on the interactions between organisational context factors,

nurse staffing and the association of these interactions with resident outcomes.

Aim

This systematic review aims to identify, analyse and synthesise quantitative research evidence on statistical interactions between nurse staffing and organisational context in LTC homes, and the effects of these interactions on LTC resident outcomes. To this end, the proposed systematic review will answer the following research questions:

▶ Which interactions between elements of organisational context and nurse staffing in LTC have been described in the literature?

▶ What LTC resident outcomes are influenced by these staffing-context interactions?

METHODS AND ANALYSIS

Our systematic review will follow the Cochrane Handbook of Systematic Reviews of Interventions[39] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[40] guidelines. This protocol followed the PRISMA-P reporting guidelines for systematic review protocols.[41] We started the review in January 2021. Currently, we are screening the full texts. The review is scheduled to be completed by June 2022.

Inclusion and exclusion criteria

We will include empirical studies that (1) Used nurse staffing and organisational context in LTC as independent variables, (2) Statistically modelled interactions among staffing and contextual variables, and (3) Described any association of these interactions with resident outcomes in LTC facilities. We are especially interested in statistical interaction effects and their associations with other outcomes. Therefore, we define interactions, according to Lavrakas,[42] as the simultaneous effect of two or more independent variables on at least one dependent variable in which their joint effect is significantly greater (or significantly less) than the sum of the parts. We will include original quantitative studies of any design or systematically conducted reviews (ie, reviews that used a comprehensive search strategy, and systematically described their inclusion/exclusion criteria, process of eligibility screening, data extraction and analysis/synthesis of the included studies). If the search identifies non-peer-reviewed references (grey literature, such as dissertations, theses, technical reports, etc), we will include these references if they meet our inclusion criteria. We will include studies regardless of the year of publication, country of origin and publication language. Languages spoken among members of our study team include: Chinese, English, French, German, Nepalese and Urdu. Our networks include colleagues who speak Danish, Dutch, Farsi, Italian, Norwegian, Portuguese, Spanish and Swedish, who will help us to assess eligibility of studies in these languages. Should we encounter studies with no English abstract in languages other than those listed, we will further leverage our networks to find a

colleague who speaks this language. We have successfully applied this approach in previous literature reviews.[43–45] We will exclude qualitative studies, non-empirical work, non-systematic (selective) reviews and studies with a focus on the psychometrical testing of instruments. We will also exclude studies that are conducted in residential facilities providing care for residents with less complex care needs (assisted living, supportive living, retirement homes, senior housing), day care or night care facilities, hospitals, home care, primary care, care housing or studies that focus on LTC homes that admit primarily younger people. We will exclude studies that only include either one of nurse staffing or organisational context, and studies that do not focus on nurses, but on social workers, students or other healthcare professionals instead. We will exclude studies that do not measure associations with resident outcomes and studies reporting associations with nurse outcomes such as nurse satisfaction, and so on.

Search strategy

A research science librarian with expertise in systematic reviews in healthcare developed our search strategy (online supplemental file). This search strategy combines database-specific subject headings and keywords related to the concepts of LTC, organisational context, nurse staffing and resident outcomes. We will systematically search the databases of Medline, EMBASE, CINAHL, PsycINFO and Scopus from database inception to the date the final search will be carried out (summer 2022). We will complement the electronic database search by searching for trial protocols through meta register (http://www.controlled-trials.com/mrct/). We will retrieve all findings available in the respective database without limiting by language, country of origin and year of publication.

To ensure literature saturation, we will review the reference lists of included studies or relevant reviews identified through the search. Also, for study protocols, we will search authors' names to identify results that are published in peer-reviewed journals or 'grey literature'. In addition, we will search contents of key journals (ie, *Journal of Clinical Nursing*, *Journal of Aging & Health*, *International Journal of Nursing Studies*) and publications of key authors by hand. Key authors will emerge during the screening process (ie, those who published particularly substantial research papers or who published a large number of research papers relevant to our research question).

Management and screening of identified references

Following the search, all identified citations will be collated and uploaded into Covidence systematic review online software (Veritas Health Information, Melbourne, Australia. Available at http://www.covidence.org). All review team members will receive training in using Covidence prior to the screening, and we will conduct calibration exercises as well as regular team meetings to discuss issues to improve the application of the inclusion and exclusion criteria. After duplicates are removed, two

review team members will independently screen titles and abstracts of 50 randomly selected papers to test, and if needed refine and clarify inclusion criteria. Level of agreement among reviewers will be assessed for each pair of reviewers by calculating weighted κ statistics.[46] All reviewers will discuss and clarify discrepancies until consensus is reached. Titles and abstracts of the remaining papers will also be screened by two independent reviewers and discrepancies will be resolved by consensus. We will obtain full texts of all included studies based on title/abstract screening and for those with insufficient information in titles or abstracts to decide on inclusion. Two review team members will screen full texts independently for inclusion. One review team member will carry out a hand search of key journals, and a second team member will independently check the included studies. Two team members will independently screen the reference lists of all included studies for any additional relevant studies. The results of the screening process will be reported in full and presented in a PRISMA flow diagram.

Data items
We will focus on three major outcomes: (1) Nurse staffing, (2) Organisational context, and (3) Resident outcomes—all of which we define in the following sections.

The most common operationalisations of nurse staffing include nurse staffing levels (ie, care hours per resident day) and professional staff mix (ie, the proportions of different care providers with various qualifications and skills).[47] Examples of staffing variables include staffing levels (numbers of persons, full-time equivalents, care hours per resident day) and the proportion of different provider groups such as RNs, licensed practical nurses (LPNs), and care aides (also called nurse assistants or personal care workers) among care teams.[19] While non-nursing care staff, such as recreational therapists, social workers and so on, play a critical role in LTC, their role is not bedside care. Therefore, we will limit our focus to nurse staffing (ie, RNs, LPNs and care aides).

Organisational context is the environment or setting in which people receive healthcare services, or getting research evidence into practice.[48] Organisational context is influenced by various factors on social, political and economic levels. Organisational context includes more than the structural and not easily changeable characteristics such as size, ownership model and so on. Organisational context also refers to characteristics of facilities or units that are more dynamic, more modifiable and that are brought about by the relationships and interactions of those who work and live in these settings, such as leadership, culture, connections among care teams and so on.[49] Squires *et al*[30] categorised six domains of organisational context: (1) Users of context, as the patient population, (2) Providers/workers in context, as clinician and provider groups, (3) Internal arrangements of context, like leadership or culture, (4) Internal infrastructures/networks, like support or communication, (5) Responsiveness to change, meaning organisational change

processes, and (6) Broader system related to context, like politics, and market. In our review, we will assess structural and contextual factors.

The dependent variable is defined as resident outcomes. The Donabedian Model[50] is a widely accepted method to design the main dimensions of healthcare quality and is used for determining quality in healthcare. Donabedian has specified three levels of quality outcomes: structural outcomes, process outcomes and care outcomes. Our review focuses on care outcomes only since those are the direct measures of a resident's health and well-being. Organisational context and structural variables are what Donabedian considers structural quality outcomes, so they are accounted for—as the independent variables of interest.

Resident outcomes will include variables such as established and agreed on LTC quality indicators based on the Resident Assessment Instrument-Minimum Data Set 2.0, which are validated measures of LTC quality[51 52] or comparable outcomes. We will include:
► Indicators of quality of care such as individual resident-level measures or unit/facility aggregated rates of outcomes such as pain, falls, pressure ulcers, physical restraint use, antipsychotics use without a diagnosis of psychosis, hospitalisations, depression, social isolation/loneliness, weight loss, infectious disease, injuries and so on.
► Summary measures of functional status such as ADL or cognition scores.
► Global measures such as mortality rates and rehospitalisation rates.

Quality appraisal
Two members of the review team will independently assess the methodological quality of the studies. They will discuss discrepancies until consensus is reached. The whole research team will discuss results for each study in detail. To evaluate study quality, we will use four validated checklists as appropriate to each study's design, all of which were used and described in detail in previous systematic reviews:
► Systematic reviews and meta-analyses—Assessment of Multiple Systematic Reviews (AMSTAR) tool.[53] AMSTAR is a reliable and valid instrument[54] that assesses study quality in the categories of definition of an a priori design, study selection and data extraction, literature search, inclusion and exclusion criteria, list of studies included and excluded, characteristics and scientific quality of studies included, appropriateness of conclusions and methods used to combine findings, publication bias and conflict of interest.
► For intervention studies, we will use the Quality Assessment Tool for Quantitative Studies,[55] which has established validity and reliability.[56] This tool assesses eight domains: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity and analysis. An

overall rating of strong, moderate or weak is assigned based on scores of each domain.

► For cohort studies and case-control studies, we will use the Newcastle-Ottawa Scale. This tool assesses three broad perspectives: the selection of the study groups; the comparability of the groups; and the ascertainment of either the exposure or outcome of interest for case-control or cohort studies, respectively.[57]

► For cross-sectional studies, we will use the rigorously developed AXIS critical appraisal tool.[58] This tool contains 20 guiding questions relating to the quality of reporting, study design quality and possible introduction of biases. The reviewer will assign to each guiding question one of three options: yes, no, do not know.

We will rate the overall quality of each study included with a scoring method developed by de Vet *et al*.[59] We will calculate the ratio of the obtained score to the maximum possible score, which varies with the checklist used and the number of checklist items applicable. Based on this quality score with a possible range of 0–1, we will rank studies as weak (≤0.50), low moderate (0.51–0.66), high moderate (0.67–0.79) or strong (≥0.80).

Data extraction

We will use an Excel spreadsheet data extraction form to guide our data extraction. We will test the data extraction process by having each team member extracting data from the same five included studies. The extracted data will then be compared and any discrepancies will be discussed as a team prior to moving on to extract data from the remainder of the studies. One team member will extract study details into the template, and a second team member will double-check the extracted information. Any arising disagreements will be resolved through discussion, or with a third reviewer. The categories of extracted data, based on previous successful literature reviews,[60 61] include specific details on:

► Study author(s)
► Year of publication
► Title
► Journal (or type of reference if not a journal paper)
► Country of origin (ie, the country in which included LTC homes are located)
► Research question(s) or objective(s)
► Study design
► Study setting and sample
► Staffing variables assessed and tool/measures used to assess staffing variables
► Organisational context variables measured, and tools/methods used to measure organisational context variables
► Types of interactions between staffing and organisational context assessed
► Resident outcomes and tools/methods used to assess resident outcomes (dependent variable(s))
► Statistical analyses methods used
► Main study findings.

Analyses

We will first conduct a thematic analysis of all studies included.[62] In this step, we will identify and categorise the types of interactions between organisational context and nurse staffing identified in each study (research question 1). We will then identify and categorise the effects of these interactions on quality of resident care (research question 2). In addition, we will summarise the available quantitative evidence (ie, effect sizes of correlations, regression parameters, relative risks). We will report the range of scores, and the number and proportion of studies reporting statistically significant positive associations, statistically negative associations, and statistically non-significant associations for a certain study outcome (vote counting).

If possible, we will statistically pool results of quantitative studies, using random-effects meta-analysis. We will conduct these analyses separately for longitudinal and cross-sectional studies. Statistical pooling is possible if three or more longitudinal studies or three or more cross-sectional studies (a) Report the same influencing organisational context and staffing factors on resident outcomes, (b) Measure organisational context and staffing in a comparable way (eg, all studies used a comparable measurement tool and report the outcome in the same way), (c) Report the same resident outcomes and (d) Report the same type of statistical outcome. Pooling a minimum of two studies can be performed statistically.[63]

However, at least three studies are needed to estimate measures of heterogeneity in addition to estimating the pooled effect for random-effects meta-analysis.[64] Where possible, we will contact authors of included studies to obtain missing information. We will use STATA V.15 (StataCorp, College Station, Texas, USA) to run random-effects models, which are more appropriate than fixed-effects models if we identify heterogeneity and small numbers of included studies.[65 66] We will report pooled effect sizes and their 95% CIs. To verify non-significant statistical heterogeneity among included studies, we will use the I^2 [67 68] and H[69] statistics (including their 95% CIs) and inconsistency of study results.[68] If we are not able to identify a sufficient number of comparable studies or studies are too heterogeneous (eg, different designs, settings, outcomes), we will report the thematic analyses and vote counting results described above.[70]

Meta-bias(es)

To assess reporting bias, we will determine whether for intervention studies a study protocol was published before recruitment of patients had started. We will compare those study protocols to the published studies. In case we are able to include 10 or more comparable studies (eg, similar designs, settings, outcomes), we will use funnel plots to assess publication bias.[71]

We will compare a fixed-effects estimate against the random-effects model to assess the possible presence of small sample bias in the published literature (ie, in which the intervention effect is more beneficial in

smaller studies). In the presence of small sample bias, the random-effects estimate of the intervention is more beneficial than the fixed-effects estimate. The potential for reporting bias will be further explored by funnel plots if ≥10 studies are available.

The overall quality of the body of evidence will be judged using the Grading of Recommendations Assessment, Development and Evaluation guidelines.[31 72] The quality of evidence will be assessed based the following details: risk of bias, consistency, directness, precision and publication bias. Additional domains may be considered where appropriate. Quality will be adjudicated as high (further research is very unlikely to change our confidence in the estimate of effect), moderate (further research is likely to have an important impact on our confidence in the estimate of effect, and may change the estimate), low (further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate) or very low (very uncertain about the estimate of effect).

Patient and public involvement

We will discuss the findings of the review and its implications with our Citizen Advisory Board, which includes five older adults in need of ongoing care and their family/friend care partners.

ETHICS AND DISSEMINATION

We did not seek ethics approval for this study, as we will not collect primary data and data from studies included cannot be linked to individuals or organisations. The results of this study will be disseminated via peer-reviewed publications and conference presentation.

ORCID iDs
Katharina Choroschun http://orcid.org/0000-0002-6400-3863
Matthias Hoben http://orcid.org/0000-0003-3465-315X

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