

Frequencies of manual hazardous tasks and related workload in kilograms performed by Registered Nurses and Healthcare Assistants working in Residential Aged Care Facilities

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Abstract

Working in Residential Aged Care Facilities (RACFs) is associated with high physical and mental workload for Registered Nurses (RNs) and Healthcare Assistants (HCAs). In particular, workplace-related injuries often accompany manual hazardous tasks that include lifting, holding, carrying, pushing, and pulling. This research aimed to investigate the frequency of manual hazardous tasks and respective physical workloads in kilograms conducted by RNs and HCAs according to shifts and RACF providers to demonstrate the risk level for workplace-related injuries and overloading of the human musculoskeletal system.

Our research showed that RNs implemented 10 high-risk nursing actions and moved 546 kilograms of weight, whereas HCAs experienced a physical workload of 1,175 kilograms and 18 manual hazardous tasks per shift. HCAs are exposed to a 53 per cent higher physical workload and implement 80 per cent more manual hazardous tasks than RNs per shift. The most intense work demand for RNs was during the night shift, while for HCAs, it was the morning shift.

Keywords: Physical Workload, Manual Hazardous Tasks, Registered Nurses, Healthcare Assistants, Residential Aged Care Facilities

Introduction

Working in Residential Aged Care Facilities (RACFs) is associated with high physical and mental workload for Registered Nurses (RNs) and Healthcare Assistants (HCAs). Typically, demanding activities are manually handling residents, for instance, transferring residents from a wheelchair to bed and repositioning a resident in a wheelchair. These activities include bending movements, prolonged standing, cramped or unchanging positions, and hazardous manual tasks for nursing staff. Common manual hazardous tasks are lifting, (e.g., lifting a resident from the lower to the upper side of a bed), pushing (e.g., moving a resident

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Conflict of Interest

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into a wheelchair), pulling (e.g., pulling a resident from the left to the right bedside), holding (e.g., holding a resident in a standing position); all of which are considered high-risk activities which can lead to acute and long-term adverse health effects in the workplace. The exposure of nursing staff to these high-risk manual activities contributes significantly to workplace-related musculoskeletal disorders and injuries affecting the muscles, ligaments, bones, tendons, blood vessels, and nerves (Accident Compensation Corporation, 2023; Zhang et al., 2016; Ravenswood et al., 2021; WorkSafe New Zealand, 2018, 2022).

The global economic costs of work-related injuries and diseases are expected to average four per cent of the world's Gross Domestic Product (Dorman, 2012). The related costs for Australia are estimated at approximately \$29 billion per year (Safe Work Australia, 2023; Safe Work Australia & Deloitte Access Economics, 2022). In New Zealand, the annual estimated social and economic costs of work-related injuries and disease were about \$4.4 billion in 2022, with approximately 300,000 work-related injury claims and 59 fatalities reported in the same year (Accident Compensation Corporation, 2023; Business Leaders' Health & Safety Forum, 2023). The respective workplace-related injury costs of active claims were approximately \$1 billion, with almost 9,000 injury claims in the health sector. The most frequent cause for work-related injuries for nursing staff, specifically in the aged care sector, was while implementing manual hazardous tasks (lifting, pushing, pulling, and holding) (Ravenswood et al., 2021; WorkSafe New Zealand, 2023).

From a human perspective, the consequences of a workplace-related injury could seriously affect an individual's personality, family relationships, and involvement in social communities. The quantitative analysis of the healthcare costs regarding an injured worker is more straightforward to determine than the emerging psychological consequences. On an individual level, an injured person often takes the blame and responsibility for the workplace injury. They may not acknowledge the underlying root causes related to substandard workplace conditions and environment, which can also correspond with concerns and fears caused by uncertainty regarding whether it will be possible to return to the same job to continue with the career pathway. Detrimental changes to the personality can be experienced when living in a life situation that has suddenly been altered while, at the same time, suffering from the consequences of an injury. Relationships and friendships could be negatively affected by tension and challenges, such as financial concerns and uncertainty of future. The consequences of the injury might have adverse effects on maintaining leisure activities and networks due to possible physical limitations, lack of financial resources, and time constraints because of prioritisation of rehabilitation activities (Kim, 2013; Chin et al., 2017; Casey et al., 2021).

In the literature, the high physical and mental workload combined with an associated risk profile for obtaining an injury of nursing staff in RACFs is described extensively. However, few studies provide detailed frequencies on performing nursing high risk-activities and related workload in metric numbers in order to conduct a comprehensive workload risk assessment (Abd El-Fattah Mohamed Aly et al., 2021; Krishnan et al., 2021; National Institute for Occupational Safety and Health, 2023).

The first aim of this research was to investigate the frequency of manual hazardous tasks and respective physical workloads in kilograms implemented by nursing staff and RACF

providers according to morning, afternoon, and night shifts. The second objective was to demonstrate the risk level of RNs and HSCs obtaining a workplace-related injury using the “Key Indicator Method for Manual Handling Operations Assessment”.

Methods

The theoretical framework of this quantitative study emphasised a rigorous research process derived from the research objectives and implemented with physical measurement methods. The analysis was conducted with descriptive statistics. The research was conducted in 17 RACFs within the Greater Auckland Region, home to over a third of New Zealand’s population (Stats NZ, 2018). This study was approved by the University of Auckland Human Participants Ethics Committee in July 2016.

Globally known as nursing or care homes, RACFs are specialised facilities designed to support adults who require assistance beyond what is available at home. These centres provide comprehensive support, including help with daily activities, personal care, and moving, as well as intensive care and medical management for chronic health conditions. They play a crucial role in promoting both the physical and mental wellbeing of their residents, aiming to foster a sense of independence while offering the necessary care services (Hardy et al., 2020; Meulenbroeks et al., 2022).

In New Zealand, long-term residential care includes rest home care, continuing care (hospital), dementia care, and specialised hospital care (psychogeriatric care), which are provided in a rest home or hospital setting. Independent living in retirement villages is not considered residential aged care and, therefore, was not included in this study (Ministry of Health New Zealand, 2019).

For this study, RACFs were categorised as Stand-alone (S-RACF), Chain (C-RACF), and Religious and Charitable Trust (RC-RACF). In this context, Stand-alone RACFs is a facility operating as a single organisation, Chain RACFs represent more than one facility conducting business as a multiple organisation, while Religious and Charitable Trust RACFs are either single or multiple organisations with their mission and purposes being based on religious beliefs and charitable motives.

The managers of the RACFs in the designated research field received an invitation letter to participate voluntarily in the study based on a randomised list generated by a computer. The sample size of this study comprised a total of 17 RACFs (1,022 residential beds) out of 183 RACFs (9,777 residential beds) within the determined research field (Ministry of Health New Zealand, 2016). A total of 77 RNs and HCAs from a combination of seven S-RACFs, six C-RACFs, and four RC-RACFs participated in this study.

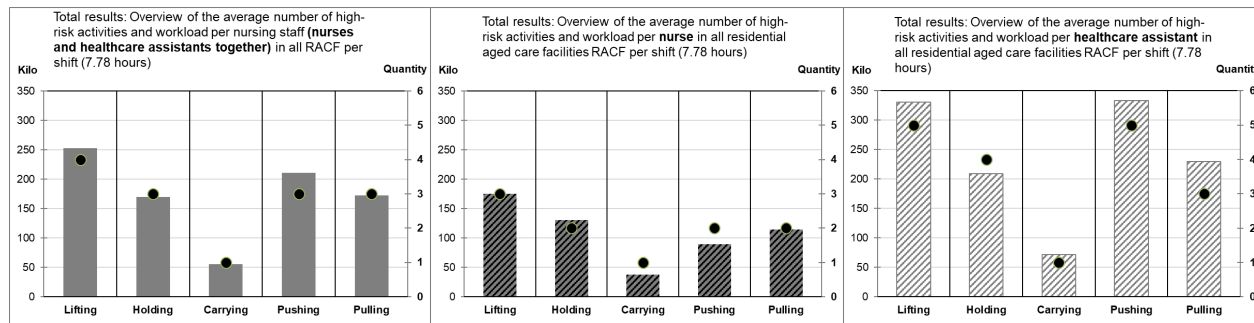
The participants recorded how often they performed one of the defined manual hazardous tasks that involved lifting, holding, carrying, pushing, and pulling, as well as the bodyweight of residents throughout all shifts of a full day. Each participating RN and HCA received instructions and a template from the researcher on documenting high-risk activities and

related workloads before their shift commenced. The researcher explained the template to each participant and highlighted examples of high-risk nursing actions. The researcher did not accompany the RNs and HCAs while working out of respect for the residents' privacy and to eliminate interference with the nursing staff' routines. However, the researcher remained on-site from 6:30am to 11:00pm to address any queries and collect the templates after each shift.

The workload analysis was based on summaries of the residents' bodyweights measured in kilograms and frequencies of the performed lifting, holding, carrying, pushing, and pulling activities. The "Key Indicator Method for Manual Handling Operations" assessment instrument was conducted to evaluate introduced nursing activities considered hazardous manual tasks in the workplace. The assessment was based on the frequencies of these implemented high-risk activities, the body weight of the residents, and the time and distance of conducting the risk action. The calculation formula accounts for factors, such as exposure time, mass to be moved, moving speed, ergonomic posture, and execution conditions. All points were then added together and multiplied with a time factor and a risk score resulting in a number between three and 100. Risk score numbers under 10 (Class 1) and up to 25 indicate a very low to moderate workload situation with less risk for health impacts (Class 2). Between 26 and 49 (Class 3) indicates an increased workload and a review of the workplace environment and working conditions is recommended. Risk score numbers above 50 (Class 4) highlight a high workload situation with possible worker health impacts. In the case of Class 4, there is a need for organisational change or a technical redesign of the workplace environment and conditions. The workload and number of high-risk activities investigated in this study are displayed in Figure 1 below. The "Key Indicator Method for Manual Handling Operations" assessment instrument was re-evaluated in 2011 by the developer and later evaluated in different studies. The validity and reliability (Cohen's kappa coefficient of 0,61-0,80) fulfilled scientific requirements (Klussmann et al, 2010; Steinberg et al., 2012).

Results

On average, RNs and HCAs carried a workload of 861 kilograms, including 14 high-risk activities, per shift. This total weight was 253 kilograms of lifting (four times each 63 kilograms), 211 kilograms of pushing (three times each 70 kilograms), 170 kilograms of pulling and 170 kilograms holding (three times each 57 kilograms), and 55 kilograms of carrying (once 55 kilograms). However, the workload division was not uniform between RNs and HCAs. For example, RNs handled, on average, 546 kilograms of weight and 10 manual hazardous tasks per shift compared to HCAs, handling over twice as much with 1,175 kilograms and 18 activities, potentially harmful from a health and safety perspective. Detailed results indicated that, on average, HCAs pushed 768 kilograms, lifted 404 kilograms, pulled 386 kilograms, held 266 kilograms, and carried 93 kilograms more than RNs per shift. The bar charts in Figure 1 highlights the average number of high-risk nursing activities and correlated workload of RNs and HCAs in all RACFs per shift.

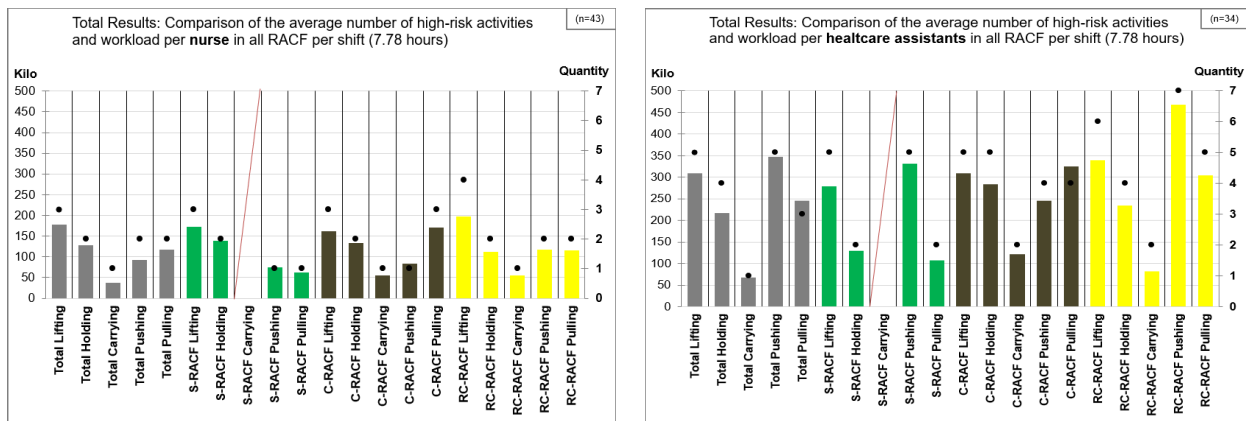
Figure 1: High-Risk Activities and Related Workload of Nursing Staff in all RACF Providers

Analysing the data according to shifts, the highest average workload for RNs was determined during the night shift with 823 kilograms and 16 high-risk measures. The afternoon shift included 488 kilograms and eight manual hazardous tasks, and the least work demand was during the morning shift with 337 kilograms, which included six high-risk activities. On average, HCAs were exposed to a work demand of 1,336 kilograms and 21 manual hazardous tasks in the afternoon shift and 1,014 kilograms and 15 high-risk activities in the morning shift.

Comparison by type of facility ownership of all investigated high-risk activities and related work demand showed that the C-RACFs and RC-RACFs nurses covered an average workload of approximately 605 kilograms per shift. Working at S-RACFs meant a lower total weight of 449 kilograms in the same amount of time. However, the action of carrying was excluded from this analysis for this category due to insufficient data to generate robust results. In RC-RACFs, RNs conducted, on average, 11 high-risk activities; in C-RACFs, there were 10 high-risk actions, and in S-RACFs, there were seven high-risk activities documented. The most commonly performed manual hazardous task by RNs was lifting, which was conducted in three out of 10 high-risk activity types. This was 36 per cent of all high-risk nursing activities performed. Next were holding and pulling, completed twice out of 10 times each and led to 42 per cent of the total percentage. Finally, pushing and carrying were the rarest, carried out once out of 10 times each, corresponding to 22 per cent.

It was found that HCAs were exposed to the most significant physical workload of 1,428 kilograms per shift in RC-RACFs. Although the recordings in C-RACFs were lower, the physical workload was still over a metric ton (1,285 kilograms) and 847 kilograms in S-RACFs per shift. The findings showed that, on average, 24 potential manual hazardous tasks were conducted in the RC-RACFs, 20 high-risk manual actions in C-RACFs, and 13 high-risk nursing activities in S-RACFs per shift. The most important types of hazardous manual tasks per shift performed by HCAs were pushing and lifting, conducted five out of 19 high-risk activities (56 per cent). Then, pulling and holding were performed in four out of 19 high-risk activities (39 per cent). Carrying was only recorded as one of 19 manual hazardous tasks (five per cent). Figure 2 below compares high-risk activities and related work demand for RNs and HCAs in all RACFs per shift.

Figure 2: Comparison of High-Risk Activities and Workload of Nursing Staff in all RACF Providers



The results transferred into the “Key Indicator Method for Manual Handling Operations Assessment” demonstrated that, for RNs, the manual hazardous task “pushing” was associated with the lowest risk class, followed by “pulling” in risk class two and “Lifting”, “holding”, and “carrying” next higher risk class. For HCAs, “pushing” and “pulling” were identified as class two risk categories while “lifting”, “holding”, and “carrying” were associated with the next higher risk class. Figure 3 provides the average number of high-risk activities and related work demands of RNs and HCAs in all RACFs per shift based on the “Key Indicator Method for Manual Handling Operations Assessment”.

Figure 3: Overview Key Indicator Method for Manual Handling Operations Assessment (n=77)

Risk Classification Class	Risk Score	Registered Nurses Implementation of hazardous manual tasks per shift (7.8 hours)					Healthcare Assistants Implementation of hazardous manual tasks per shift (7.8 hours)				
		Frequencies					Frequencies				
		3	2	1	2	2	5	4	1	5	3
4 High Workload High workload situation and workplace-related injury risk for all workers. Physical overload is likely to appear, and evaluation of the workplace environment and conditions is necessary.	>50										
3 Increased Workload Increased workload situation with a workplace-related injury risk for all workers. Redesign of the workplace environment and conditions is recommended.	25 to 50	✘	✘	✘			✘	✘	✘		
2 Moderate Workload Moderate workload situation with a workplace-related injury risk for workers with existing health conditions. For this group, redesign of the workplace environment and conditions is recommended.	10 to 25					✘				✘	✘
1 Low Workload Workplace-related risk for injury is low.	<10				✘						
		Lifting (Average)	Holding (Average)	Carrying (Average)	Pushing (Average)	Pulling (Average)	Lifting (Average)	Holding (Average)	Carrying (Average)	Pushing (Average)	Pulling (Average)

Discussion

This study investigated manual hazardous tasks conducted by nursing staff in different RACFs, which included lifting, holding, carrying, pushing, pulling, and related workloads per shift. The wider variety of nursing activities, such as medication, documentation, and replenishment of inventories, were not considered in workload calculations. In the

literature, few studies provide detailed numbers of workload measured in kilograms and related nursing high-risk activities. One of these studies showed that the total workload of an RN during a shift could reach between 3,000 and 5,000 kilograms. A New Zealand-based survey found that tools and equipment, such as hoists, were often available in RACFs, but workload increased when these were not used frequently and adequately (Swiger et al., 2016; Retsas & Pinikahana, 2000; Ravenswood et al., 2021).

The workload analysis of this study found that RNs performed, on average, a physical workload of 546 kilograms, and HCAs handled 1,175 kilograms per shift. This means that HCAs had a 53 per cent higher physical workload than RNs regarding these high-risk nursing activities. This result is supported by an Australian-based study which investigated RACF and found that RNs spent approximately half of the shift on communication-related tasks, followed by medication (18 per cent of the shift), documentation (17 per cent), and then direct care (seven per cent). On the contrary, HCAs spent most of their time per shift on direct care (40 per cent), followed by indirect care (nine per cent), and documentation (six per cent). These results imply that more direct nursing care time, such as 12-hour shifts, leads to more frequent manual hazardous tasks and consequently to a higher manual workload with potential increased adverse health impact on HCAs (Munyisia et al., 2011; Sagherian et al., 2017).

In total, RNs carried out, on average, fewer high-risk nursing activities than HCAs (10 compared to 18). The most commonly performed manual hazardous task by RNs was lifting (on average three times per shift), and for HCAs, it was lifting and pushing (on average five times per shift). For RNs, this was followed by pushing, pulling, and holding (on average, three times each per shift), while for HCAs, it was holding (on average, four times per shift) and pulling (on average, three times per shift). In both groups, carrying was the most infrequent action.

One study conducted in an Australian medical centre identified pushing or pulling as one of the most frequently performed manual hazardous tasks by nursing staff. Lifting was identified as one of the leading causes of manual handling-related injuries (approximately one-third out of 108 activities). A reason might be the inconsistent use of hoists or other safety equipment in performing lifting activities. For instance, nursing staff reported that the walking distances from the equipment storage depot to the resident rooms and proper use of safety lifting equipment are often too time-consuming. Therefore, lifting activities were often implemented without hoists or other equipment in order to save time (Retsas & Pinikahana, 2000; Noble & Sweeney, 2018).

In a comparison of the workload according to the type of RACF provider and nursing staff, it was found that the most extensive workload demand per shift for RNs was almost similar in C-RACFs (605 kilograms) and RC-RACFs (599 kilograms) followed by S-RACF (499 kilograms). For HCAs, the highest workload demand was in RC-RACFs (1,428 kilograms), followed by C-RACFs (1,285 kilograms) and S-RACFs (847 kilograms). No relevant research was found on workload and type of RACF provider for comparison and interpretation of this study results. Therefore, future research is needed to enhance knowledge about RACF providers' characteristics and related workload. However, research indicates that the workload experienced by nursing staff is linked to factors such as body weight of residents,

complexity of care required due to residents' health conditions, and the organisation of work; for example, a higher workload in an RACF that provides specialised care for highly dependent residents because of degenerative diseases, such as Multiple Sclerosis (Alghamdi, 2016).

A study by Nabe-Nielsen et al. (2009) found that nursing staff in RACFs are exposed to the highest physical and mental workload on the night shift (16 high-risk nursing activities), followed by eight high-risk nursing activities in the afternoon service and six manual hazardous tasks in the morning duties. This corresponds with our research which also identified night shift as the most physically demanding (823 kilograms), followed by the afternoon shift (488 kilograms) and then the morning shift (337 kilograms). This was the same for HCAs, who were exposed to a work demand of 1,336 kilograms in the afternoon and 1,014 kilograms in the morning shift.

The high number of manual hazardous tasks during the night shift could be related to reduced staffing levels, when a higher number of residents are assigned per nurse compared to the day shift; therefore, fewer nursing staff available to accomplish the physical work demands at night, which can vary depending on the number of residents with increased needs. For instance, residents who need assistance to walk from bed to the bathroom or need to be moved in bed to change incontinence products are more pronounced at night (Hägglund et al., 2017).

In this study, HCAs in RACFs performed the highest number of 21 high-risk activities in the afternoon shift, followed by 15 manual hazardous tasks in the morning shift. The large number of high-risk activities in the morning service might be related to the HCAs role, which is focused on providing direct nursing care. Particularly in the morning, there is a high demand for supporting residents while bathing, showering, and transfers. On the contrary, the reasons why RNs conducted fewer manual hazardous tasks than HCAs could be possibly related to the roles, duties, and designated tasks. RNs are involved in more indirect care activities, such as interacting with other healthcare professionals, documentation, supervising other HCAs, and controlling supplies. Therefore, they undertake less direct nursing care, including high-risk nursing activities. Consequently, the injury probabilities related to manual handling hazards are lower for RNs than for HCAs (Munyisia et al., 2011; Bergman & De Jesus, 2020).

Implications for Occupational Health Practice

One emerging theme from these findings is that RNs and HCAs are at risk for injuries because of the frequent practice of hazardous manual tasks and related high workloads. To reduce this risk, the design of workflow plans can support nursing staff to prevent unnecessary high-risk manual tasks. For example, lifting a resident for bed-making can be efficiently scheduled while the resident has already left the bed for breakfast. This approach leverages planned work tasks within the workflow to conduct manual handling more safely. On the other hand, to follow a resident-centred care model and to meet residents needs, manual hazardous tasks should follow safe practices, for example, the use of equipment,

safe handling techniques, or lifting a resident could be planned so nursing staff meet at defined times to conduct the high-risk activity in pairs.

While there is no specific “safe” weight limit that applies universally to all nursing staff the importance of safe lifting practices in the workplace is to apply a calculated approach that considers various factors to meet recommended weight limits. These factors include the weight of the resident, the frequency of lifting, the distance of the lift (both horizontally and vertically), the duration and twisting required, as well as the resident’s body posture during the lift. Further, they recommend assessing each lifting task individually, considering the unique characteristics of the lift and the capabilities of the person performing it. This approach ensures that the lifting activity is within safe limits and minimises the risk of injury. It would also reduce the workload for individual RNs and HCAs as it would balance the workload during peak times, especially when handling safety equipment in times when a hoist is unavailable or cannot be used due to limited space, etc. Moreover, a structured workflow plan allows nursing staff to collaborate and communicate effectively about their tasks and workloads. This is particularly useful for adapting quickly to sudden changes in routine during a shift, for example, preparing a resident for an unexpected admission to the emergency department (Canadian Centre for Occupational Health and Safety, 2023).

The presented study methods for identifying high-risk activities in nursing can be tailored to assess the frequency of manual hazardous tasks in different wards of an RACF. Based on this, specific workflow plans can be developed, and staffing levels can be adjusted for each shift. Implementing a dashboard that displays the workflow plans and schedules to team members per shift would offer a comprehensive view of the anticipated workload. This tool would guide RNs and HCAs on where and when specific tasks should be carried out. Additionally, the workflow plan overview could indicate whether the workload is evenly distributed among nursing staff during a shift. It could also include specific assignments for nursing staff considering residents’ body weight and level of dependency to ensure that the workload can be conducted in a healthy and safe manner.

From a rehabilitation perspective, the design of workflow plans could be beneficial for nursing staff with short-term musculoskeletal constraints, such as those recovering from a severe disease or injury. The introduced dashboard approach could display a specific workflow plan, distinct from others, with a reduced projected workload and be incorporated into a work return program. This feature would help safeguard vulnerable RNs and HCAs and allocate them lighter duties until they fully recuperate.

Limitations

While one of the few studies measuring high-risk nursing activities and associated workload in kilograms, this research encountered several limitations. One of the primary challenges was distinguishing between the different manual hazardous tasks. For instance, when a nursing staff member moved a resident from the lower to the upper end of the bed, it was unclear in some instances whether this should be categorised as pulling or carrying. This

ambiguity in defining activities could have impacted the accuracy of the measurements. Additionally, the study's approach might have been influenced when residents assisted in their transfers from a wheelchair to the toilet, thus affecting the perceived workload of the nursing staff. Such variations in resident participation were not consistently accounted for, which may have led to variations in the data. Another limitation was potential documentation errors by the participants, possibly due to stress and high workloads during their shifts. Furthermore, mathematical rounding to generate whole numbers for high-risk activities introduced minor discrepancies. This approach aimed to reflect realistic nursing scenarios but led to slight one-point deviations in the bar charts depicting the high-risk activities of RNs and HCAs.

Conclusion

This research investigated the frequency of manual hazardous tasks and respective physical workloads in kilograms performed by RNs and HCAs according to shifts and RACF providers. The results highlighted the high frequency of high-risk nursing activities and the significant physical workload of nursing staff in RACFs. Furthermore, the study found that HCAs experience a considerably higher physical workload than RNs, handling more hazardous manual tasks per shift. This disparity is possibly attributed to HCAs spending more time on direct care activities. Another interesting finding was that the most intense work demand for RNs occurs during the night shift, while for HCAs, it is the morning shift. The findings underscore the importance of effective workflow planning, the use of safety equipment, such as hoists and the implementation of safety practices to reduce the manual handling related risk of injuries and ensure the wellbeing of staff and residents in RACFs.

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