

2015

## Nursing work activities in Australian residential aged care homes

Siyu Qian  
*University of Wollongong*

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**School of Computing and Information Technology**

**Faculty of Engineering and Information Sciences**

# **Nursing Work Activities in Australian Residential Aged Care Homes**

**Siyu Qian**

**"This thesis is presented as part of the requirements for the award of the  
Degree of Doctor of Philosophy of the  
University of Wollongong"**

**March 2015**

## **Certification**

I, Siyu Qian, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Computing and Information Technology, University of Wollongong, is entirely my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Siyu Qian  
March 2015

## **Abstract**

### **Background**

Australian residential aged care (RAC) homes are facing challenges of an increasing number of older people with complex care needs and a chronic shortage of skilled nursing staff to provide quality and efficient aged care services to these older people. Strategies like task re-allocation, process management and introduction of electronic information systems can be promising to overcome these challenges; however development of these strategies requires knowledge of nursing work activities and associated problems. Two important aged care services provided by nursing staff are personal care and nursing care. To date, there is little research on nursing work activities of providing these two types of care services and the challenges in the delivery of these services in RAC homes.

### **Aims**

This research aimed to explore and describe nursing work activities of providing personal care and nursing care, identify the associated problems and explain the causes of these problems and their potential impacts in Australian RAC homes.

### **Methods**

This research used time-motion observation method as the predominant data collection method. Structured and unstructured field notes, review of organisational documents and informal conversation with study participants were also used. Two types of data were collected. One was personal care activities collected in two high-care units in two separate RAC homes in two cities. The other was nursing care activities collected in another two high-care units in one RAC home in a third city. Cultural-historical activity theory was used to conceptualise nursing work activities and the identified problems. Both quantitative and qualitative data analyses were performed.

### **Results**

There were common work patterns of nursing staff in conducting personal care or nursing care activities in terms of their work processes and time usage. For personal care provision,

no significant difference was found between the two units in 70% of the nursing staff's time. Significant differences between the two units were found in the time nursing staff spent on verbal communication, documentation and transit. For nursing care provision, no significant difference was found between the two units in all of the nursing staff's time.

Problems in nursing work activities were conceptualised into three levels of contradictions: primary, secondary and quaternary levels through the lens of the cultural-historical activity theory. Primary contradictions were caused by the tools used by the nursing staff, for example the electronic information system that did not fully support nursing documentation at the point-of-care.

Secondary contradictions were observed between the nursing staff and the organisational guidelines about medication management and documentation. It was also observed in the unavailability of a portable device that nurses could use for data entry and retrieval when they were providing wound care to residents.

Quaternary contradictions were found between the activity system of medication administration and the activity system of assisting residents' with ADL, and between the activity system of medication administration in the RAC home and the activity system of adding a new resident's medication profile in the pharmacy.

Possible causes of these contradictions were related to the nursing staff, the physical tools and the management of RAC homes, the activity system outside the homes and the design of the electronic information system. Potential impacts of these contradictions included inadequate verbal communication among care team members, interrupted medication administration process, medication errors and inefficient documentation.

## **Conclusion**

Providing quality and efficient aged care services requires solutions to the contradictions in the nursing activity system both within and outside RAC homes. This requires collaboration among RAC homes, pharmacies and IT companies in nursing work redesign, organisational process change and introduction of innovative information technology

solutions that really support aged care services. These are the future directions of research with high potential to improve RAC services in Australia and over the world.

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## **Statements**

This thesis is prepared in the style of Thesis by Compilation by the University of Wollongong. Seven articles are included in this thesis: two articles have been published in peer-reviewed journals. Two articles are in revision as requested by journals. Another two articles are under review by journals. The last article has been published in the proceeding of a peer-reviewed conference.

I am the first author of all these papers. I contributed to the study design, data collection and analysis and preparation of the manuscripts. Six co-authors are involved in the publications. They are Ping Yu, David Hailey, Ning Wang, Zhenyu Zhang, Pamela Davy, Mark Nelson. Their contributions are outlined in the co-author contribution declaration forms attached to this thesis.

## **List of Publications**

### **Published peer-reviewed journal articles:**

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.  
*The journal is an open-access journal. Copyright rests with the authors.*
2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time–motion study. Australian Health Review 2014, 38(2):230-237.  
*As per Licence to Publish of the Australian Health Review, the authors retain the right to include the work in part or in full in a thesis provided it is not published for commercial gain.*
3. Siyu Qian, Ping Yu, David Hailey. The impact of electronic medication administration records in a residential aged care home. International Journal of Medical Informatics. (in press)

### **Article in 2<sup>nd</sup> round revision as requested by the peer-reviewed journal:**

4. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Nurses' time spent on administering each type of medication in a residential aged care home. Journal of Nursing Management.

### **Articles under review by peer-reviewed journals:**

5. Siyu Qian, Ping Yu, David Hailey. Nursing staff work patterns in a residential aged care home: A time-motion study. Australian Health Review.
6. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Medication administration process and procedural problems in a residential aged care home: An observational study. Australian Health Review.

### **Published peer-reviewed conference paper:**

7. Siyu Qian, Ping Yu. Fitting clinical workflow: The case for wound care in a residential aged care home. Published on Australian Health Informatics Conference 2014. Collected by Studies in Health Technology and Informatics; Melbourne, Australia. Edited by Grain H, Martin-Sanchez F, Schaper LK. IOS press; 2014:130-136.  
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## Table of Contents

Certification.....	2
Abstract .....	3
Acknowledgements .....	6
Statements .....	7
List of Publications .....	8
Table of Contents .....	9
List of Tables.....	18
List of Figures .....	19
List of Abbreviations.....	20
Chapter 1.           General Introduction .....	21
1.1    Research background .....	22
1.1.1.       Residential aged care services.....	22
1.1.2.       Aged care funding instrument.....	22
1.1.3.       Common types of frontline nursing staff .....	22
1.1.4.       Challenges to RAC homes .....	23
1.2    The research project .....	24
1.2.1.       Personal care activities.....	24
1.2.2.       Nursing care activities.....	25
1.3    Organisation of the thesis .....	27
References .....	28
Chapter 2.           Literature Review.....	31
2.1    Cultural-historical activity theory.....	31
2.1.1.       The evolution of the cultural-historical activity theory .....	31

2.1.2.	The concept of activity and contradictions .....	35
2.2	Previous studies on nursing work activities in RAC homes .....	38
2.2.1.	Previous studies on personal care activities in RAC homes .....	38
2.2.2.	Previous studies on nursing care activities in RAC homes.....	40
2.2.3.	Previous studies on impacts of an electronic information system in RAC homes	43
2.2.4.	Gaps in the literature .....	47
2.3	Methods for studying nursing work activities .....	48
2.3.1.	Focus group discussion .....	48
2.3.2.	Work sampling and time-motion observational methods .....	49
2.3.3.	Document review .....	51
2.3.4.	Structured and unstructured field notes.....	51
2.3.5.	Work process visualisation methods.....	52
2.3.6.	Measurements of nursing work activities .....	52
2.3.7.	Justification of data collection and analysis methods .....	53
2.4	Conclusion.....	54
	References .....	55
Chapter 3.	The Work Pattern of Personal Care Workers in Two Australian Residential Aged Care Homes: A Time-Motion Study .....	62
3.1.	Introduction .....	63
3.2.	Methods .....	65
3.2.1.	Settings.....	65
3.2.2.	Classification of personal care activities.....	65
3.2.3.	Ethical approval .....	67

3.2.4.	Inter-rater reliability .....	68
3.2.5.	Data collection .....	68
3.2.6.	Data analysis .....	69
3.3.	Results .....	69
3.3.1.	Activity time .....	70
3.3.2.	Activity frequency.....	72
3.3.3.	Activity duration .....	72
3.3.4.	Switch between two consecutive activities .....	72
3.4.	Discussion .....	75
3.5.	Limitations.....	77
3.6.	Conclusion.....	77
	References .....	78

Chapter 4.	Time Spent on Daytime Direct Care Activities by Personal Care Workers in Two Australian Residential Aged Care Homes: A Time-Motion Study .....	81
4.1	Introduction .....	81
4.2	Methods .....	83
4.2.1.	Classification of activities .....	83
4.2.2.	Settings.....	83
4.2.3.	Ethics approval.....	85
4.2.4.	Training of the observer .....	85
4.2.5.	Selection of participants .....	85
4.2.6.	Data collection .....	86
4.2.7.	Data analysis .....	86
4.3	Results .....	87

4.3.1.	Time spent with each resident.....	87
4.3.2.	Comparison of activity time.....	87
4.3.3.	Comparison of activity duration.....	88
4.3.4.	Concurrent communication with a resident .....	88
4.3.5.	Distribution of activities over hours.....	88
4.4	Discussion .....	94
4.4.1.	The common findings at both RAC homes.....	94
4.4.2.	The differences in toileting and mobility activities.....	95
4.4.3.	Communication with residents.....	95
4.5	Limitations.....	96
4.6	Conclusion.....	97
	References .....	97
Chapter 5.	The Work Pattern of Nursing Care Staff in a Residential Aged Care Home: A Time-Motion Study .....	101
5.1	Introduction .....	102
5.2	Methods .....	103
5.2.1.	The preliminary study .....	103
5.2.2.	The pilot study .....	108
5.2.3.	Empirical data collection.....	109
5.2.4.	Data analysis .....	109
5.3	Results .....	110
5.3.1.	A common work process of nursing care staff in morning shifts ...	110
5.3.2.	Activity time .....	111
5.3.3.	Activity duration .....	111

5.3.4.	Activity frequency.....	111
5.3.5.	Activity pattern.....	113
5.4	Discussion .....	116
5.5	Limitations.....	118
5.6	Conclusion.....	118
	References .....	119
Chapter 6.	Medication Administration Process and Problems in a Residential Aged Care Home: An Observational Study .....	122
6.1	Introduction .....	122
6.2	Methods .....	123
6.2.1.	Settings.....	123
6.2.2.	Participants .....	124
6.2.3.	Data collection .....	124
6.2.4.	Ethical considerations .....	124
6.2.5.	Data analysis .....	124
6.3	Results .....	125
6.3.1.	The organisation of medication to be administered .....	125
6.3.2.	The common process of the morning medication round.....	125
6.3.3.	Differences in individual nurses' work process .....	127
6.3.4.	Problems.....	127
6.4	Discussion .....	129
6.5	Limitations.....	130
6.6	Conclusion.....	130
	References .....	131

Chapter 7.	Nursing Time Spent on Administering Each Type of Medication in a Residential Aged Care Home.....	134
7.1	Introduction .....	134
7.2	Methods .....	135
7.2.1.	Settings.....	135
7.2.2.	Participants.....	136
7.2.3.	Data collection .....	136
7.2.4.	Data analysis .....	137
7.2.5.	Ethical considerations .....	138
7.3	Results .....	138
7.3.1.	Average time spent on each type of medication .....	139
7.3.2.	Time spent on a resident .....	140
7.4	Discussion .....	142
7.5	Conclusion.....	143
	References .....	143
Chapter 8.	The Impacts of an Electronic Medication Administration Record System in a Residential Aged Care Home .....	145
8.1	Introduction .....	146
8.2	Methods .....	147
8.2.1.	Settings and the participants .....	147
8.2.2.	The eMAR system .....	148
8.2.3.	The paper-based records .....	149
8.2.4.	Data collection methods.....	150
8.2.5.	Data collection .....	151

8.2.6.	Data analysis .....	151
8.2.7.	Ethics approval.....	151
8.3	Results .....	151
8.3.1.	Time nurses spent on documentation activities in a medication round 151	
8.3.2.	Medication administration process for a resident using the eMAR system or the paper-based records .....	152
8.3.3.	The impacts of the eMAR system.....	156
8.4	Discussion .....	159
8.4.1.	Impact on nurses' time spent on documentation.....	159
8.4.2.	Impact on the medication administration process for a resident.....	159
8.4.3.	Benefits and unintended adverse consequences of introducing the eMAR system 160	
8.5	Conclusion.....	161
	References .....	161
Chapter 9.	Fitting Clinical Workflow: The Case for Wound Care in a Residential Aged Care Home 164	
9.1.	Introduction .....	164
9.2.	Methods .....	166
9.3.	Results .....	167
9.3.1.	Wound care process .....	167
9.3.2.	Documentation of wound care .....	167
9.3.3.	Problems in the use of the EHR system .....	168
9.4.	Discussion .....	170
9.5.	Conclusion.....	171

References .....	171
Chapter 10. General Discussion: Nursing Work Activities through the Lens of Cultural-Historical Activity Theory .....	173
10.1. A reflection on using CHAT in an observational study .....	173
10.1.1. Study setting .....	173
10.1.2. Participants .....	174
10.1.3. Content of observation .....	174
10.2. The interaction between personal care and nursing care activity systems .....	176
10.3. Personal care activity system in an RAC home .....	178
10.3.1. The contradiction in personal care activity system, possible cause, potential impact and implications .....	182
10.4. Nursing care activity system in an RAC home .....	183
10.4.1. Medication administration activity system .....	186
10.4.2. Wound care and physical review activity systems .....	187
10.4.3. Documentation activity system .....	187
10.4.4. Infection control activity system .....	188
10.4.5. Contradictions in nursing care activity system, possible causes, potential impacts and implications .....	188
10.5. Conclusion .....	200
References .....	201
Chapter 11. General Conclusion .....	204
11.1. Summary of key findings .....	204
11.1.1. The personal care activity system .....	204
11.1.2. Time spent on direct care activities by personal care workers .....	205

11.1.3.	The nursing care activity system.....	205
11.1.4.	The medication administration and associated problems.....	206
11.1.5.	Time spent on medication administration .....	206
11.1.6.	The impacts of an eMAR system .....	207
11.1.7.	Wound care and its documentation .....	207
11.1.8.	Nursing work activities and associated problems through the lens of cultural-historical activity theory .....	208
11.2.	Research limitations .....	210
11.3.	Research contributions .....	211
11.4.	Implications for practice .....	211
11.4.1.	Implications for nursing management.....	212
11.4.2.	Implications for investment in an electronic information system...	212
11.4.3.	Implications for the design of an electronic information system for use in RAC	213
11.5.	Recommendations for future research .....	213
	References .....	214
	Appendix A .....	215
Supplementary Table 1.	The time, frequency and duration of personal care activities at Unit 1.	215
Supplementary Table 2.	The time, frequency and duration of personal care activities at Unit 2.	220
Supplementary Table 3.	The total number of observations of each nursing care activity and its duration.	225
	Statement of Contribution of Others .....	230

## List of Tables

Table 3.1 Classification of personal care activities.....	66
Table 3.2 Time spent on each category of activities, combining the two units. ....	70
Table 3.3 Time, frequency and duration by activity category at Unit 1 and Unit 2. ....	71
Table 3.4 Direction and number of the most frequently observed switches between two consecutive activities. ....	73
Table 4.1 The classification system of direct care activities.....	84
Table 4.2 Time, frequency and duration of each direct care activity at the two units. ....	88
Table 4.3 The direct care activities that happened concurrently with communication with a resident. ....	91
Table 5.1 Classification of nursing care staff activities. ....	105
Table 5.2 Nursing care staff's time spent on each category of activities.....	112
Table 7.1 Methods used by nurses to prepare and provide tablets. ....	137
Table 7.2 Percentage of time nurses spent on activities and corresponding time in a three-hour morning medication round.....	138
Table 7.3 Percentage of residents needing each type of medication and average time spent on preparing for and providing to a resident. ....	139
Table 7.4 The average time a nurse spent on a resident and on preparing and providing tablets to this resident.....	141
Table 8.1 Documentation activities during a medication round .....	150
Table 8.2 The percentage of time nurses spent on each documentation activity in a medication round at the two units. ....	153
Table 8.3 The impacts of the eMAR system.....	156
Table 10.1 Four sub-activity systems in personal care. ....	181
Table 10.2 Five sub-activity systems in the nursing care activity. ....	184
Table 10.3 Contradictions in nursing work activity systems, their possible causes, potential impacts and implications.....	193

## List of Figures

Figure 1.1 Organisation of the thesis. ....	28
Figure 2.1 First generation CHAT: reformulated Vygotsky's triangle.....	32
Figure 2.2 Second generation CHAT: Engeström's triangle .....	32
Figure 2.3 Third generation CHAT: minimum two interacting activity systems in a model. .....	34
Figure 2.4 Four levels of contradictions. ....	36
Figure 3.1 Distribution of duration at Unit 1 and Unit 2. ....	74
Figure 4.1 Percent of instances of direct care distributed in different hours over the observation periods at Unit 1 and Unit 2. ....	92
Figure 4.2 The percent of instances of each category of activities distributed in different hours over the observation periods. ....	93
Figure 5.1 A common work process of nursing care staff in morning shifts.....	110
Figure 5.2 The number of occurrences of main activity category in each hour in a morning shift.....	114
Figure 5.3 Activity pattern of each observational shift.....	115
Figure 6.1 A common process of the morning medication round and the process of medication administration for a resident.....	126
Figure 8.1 Two ways of using the eMAR system during a medication administration process for a resident.....	154
Figure 8.2 Two ways of using the paper-based medication administration records during a medication administration process for a resident.....	155
Figure 9.1 Wound care processes.....	168
Figure 9.2 Transcribing data from paper to the EHR system. ....	169
Figure 10.1 The interaction between personal care and nursing care activity systems in an RAC home.....	177

## **List of Abbreviations**

ACFI	Aged Care Funding Instrument
CHAT	Cultural-Historical Activity Theory
EHR	Electronic Health Record
eMAR	Electronic Medication Administration Record
EEN	Endorsed Enrolled Nurse
EN	Enrolled Nurse
PCW	Personal Care Worker
RAC	Residential Aged Care
RN	Registered Nurse
TAFE	Technical and Further Education

## **Chapter 1. General Introduction**

With an increasing number of older people seeking aged care services and a shortage of frontline nursing staff [1, 2], Australian residential aged care (RAC) homes are facing challenges to provide quality, safe and efficient care services and contain the costs. Strategies like task re-allocation, process management and introduction of health information technologies are promising to help RAC homes to overcome these challenges. However, to develop such strategies, there is a need for a good understanding about how frontline nursing staff conduct their work activities.

In healthcare settings, understanding how staff conduct their work activities is important, because inefficient processes may lead to delays in critical resources for care delivery [3]. Faulty processes are one of the major causes leading healthcare staff to make technical mistakes [4] and non-value-adding activities may increase healthcare costs. Within RAC homes, nursing work activities play a significant role in meeting residents' various needs.

Residents' day-to-day core care needs such as activities of daily living (ADL), medication management and wound management are assessed by the aged care funding instrument (ACFI) for government subsidy [5]. These care needs are met by personal care and nursing care provided by nursing staff in RAC homes. Personal care service aims at assisting residents with their ADL such as showering, dressing and toileting. Nursing care service aims at managing residents' health conditions. It includes activities such as medication administration, wound care and catheter care. Currently, there is a lack of research on nursing work activities in providing these two types of aged care services in Australian RAC homes. Therefore, this study aimed to:

1. Explore and describe nursing work activities in providing personal care and nursing care in Australian RAC homes.
2. Identify problems associated with these activities.
3. Explain the possible causes of these problems and their potential impacts.

## **Research background**

### **1.1.1. Residential aged care services**

In Australia, RAC homes provide aged care services to older people who can no longer live by themselves at home. Residential aged care services are available on either a permanent or a respite basis and are provided at two levels: low care and high care. Low-care homes provided accommodation, laundry, meals, cleaning services and personal care. High-care homes provide 24-hour nursing care in addition to low-care services.

Providers of aged care services included government, not-for-profit and private organisations. The latter two are the main providers, accounting in 2011 for 60% and 30% of the RAC homes, respectively [1].

### **1.1.2. Aged care funding instrument**

Residential aged care homes are funded based on the care needs of their residents. The funding instrument ACFI classifies residents' core care needs into three categories: ADL, cognitive and behaviour, and complex health care [5]. It assesses residents' level of care needs. The ADL needs are rated using four scales: independent, supervision, physical assistance and use of mechanical lifting equipment. Cognitive skills are measured as none, mild, moderate and severe. Medication needs are measured by complexity, frequency and assistance time. The assessment only includes residents requiring permanent care and is not used for residents requiring respite care [1]. The outcomes of assessment are used for calculating the funding to be paid to the RAC homes.

### **1.1.3. Common types of frontline nursing staff**

In Australian RAC homes, common types of frontline nursing staff include personal care workers (PCWs), enrolled nurses (ENs), endorsed enrolled nurses (EENs) and registered nurses (RNs). Personal care workers, also known as assistants in nursing, perform personal care activities. They undertake a 5-month full-time course to achieve a qualification of Certificate III in Aged Care awarded by the Technical and Further Education (TAFE)

college system in Australia [6]. Those PCWs with Certificate IV Level II in medication management are eligible to conduct medication management activities.

Enrolled nurses undertake an 18-month or two-year course to achieve a Diploma in Enrolled Nursing at a TAFE college. Generally speaking, they maintain residents' healthcare by observing, measuring and recording residents' temperature, pulse, respiration and blood pressure and by assisting with personal care. Endorsed enrolled nurses complete more comprehensive medication management training than ENs at a TAFE college [6].

Registered nurses have a three-year Bachelor of Nursing or a Bachelor Degree in Health Science. They perform team leader or unit manager duties, medication administration, assessment and management of complex or specialised nursing care. They are registered and licensed under the appropriate Nursing Act to practise nursing [6].

#### **1.1.4. Challenges to RAC homes**

The growing ageing population has resulted in an increasing number of residents, especially the very old and frail, who need residential aged care services [1]. The number of older people receiving aged care services is projected to increase to over 2.5 million or almost 8% of the population by 2050 [7]. The number of Australians aged 85 years or over, the major users of aged care services, is projected to increase from around 0.4 million in 2010 to 1.8 million by 2050, a more than four-fold increase. This will require an increase in the volume and intensity of aged care services [8].

The situation has been deteriorating and will continue to do so with a chronic shortage in the direct care workforce, on whom the residents rely [2, 9]. The Aged Care Workforce report [2] showed that, from 2003 to 2012, the number of RNs has been decreasing both numerically and proportionally from 24,019 (21% of the direct care workforce) to 21,916 (14.9%). Enrolled nurses were increasing in number but decreasing in proportion from 15,604 (13.1%) to 16,915 (11.5%). In contrast, PCWs increased in both number and proportion from 67,143 (58.5%) to 100,312 (68.2%). Although the total number of the

major direct care workforce increased in 2012, two thirds of the RAC homes reported a shortage of RNs and one half reported a shortage of PCWs [2].

### **The research project**

Three aged care organisations participated in this research. Ethics approval was obtained from the Human Research Ethics Committee of the University of Wollongong. Agreements from the aged care organisations were also obtained. The timeframe of the project was from 2010 to 2015.

To accord with the division of labour in RAC homes, nursing staff were classified into two types: personal care staff and nursing care staff. Personal care staff were staff who provided personal care services to residents. They were all PCWs. Nursing care staff were those who provided nursing care to residents. They were an RN, EENs and PCWs with Certificate IV Level II in medication management.

#### **1.2.1. Personal care activities**

To investigate personal care activities, time-motion observations were conducted in two high-care units belonging to two aged care organisations in 2010. One unit had 32 beds. Eleven PCWs were observed over 14 days, one per day. The other unit had 25 beds. Twenty-seven PCWs were observed over 16 days, two per day. A classification system of personal care activities was developed, with 58 activities grouped into eight categories: direct care, indirect care, infection control, documentation, transit, staff break, verbal communication and other activities (see Table 3.1). Quantitative analysis was performed.

The results are presented in Chapters 3 and 4 which had been published in *BMC Health Services Research* and *Australian Health Review*, respectively. Chapter 3 presents an overview of the personal care activities and the work pattern of PCWs in conducting these activities. Each category of activities was measured by time, frequency and duration, and the number of switches between two consecutive activities.

As direct care activities require PCWs to directly interact with residents, analysing direct care activities will provide insights for promoting person-centred care. Therefore, the study described in Chapter 4 drilled down to direct care activities and measured the time, frequency and duration of conducting each of them. The major insight was that verbal communication with residents was most time consuming and it often occurred concurrently with another activity. The direct care activities that were concurrently performed by PCWs when verbally communicating with residents were identified.

### **1.2.2. Nursing care activities**

To investigate nursing care activities, time-motion observations were conducted in another two high-care units belonging to a third aged care organisation in 2013. Three additional data collection methods—structured and unstructured field notes, document review and informal conversation with study participants — were also used. Data were collected over 12 days, six days in each unit. Seven nursing care staff members who routinely worked in the two units were observed, one per day.

A classification system of nursing care activities was developed. It contained 116 activities grouped into ten categories: medication administration, wound care, physical review, infection control, verbal communication (pure and concurrent), documentation (electronic and paper-based), print and fax, transit, staff breaks and other. Quantitative and qualitative data analysis methods were used to analyse the data.

The results are presented in Chapters 5 to 9. Chapter 5 presents an overview of the nursing care activities and the work pattern of nursing care staff in conducting these activities in a morning shift. A common work process followed by staff was graphically presented. Each activity was measured by time, frequency and duration. Individual staff activity patterns were plotted over time to examine differences among them. A manuscript of this chapter is currently in revision as requested by *Geriatric Nursing*.

As medication administration is a nursing care activity that is prone to error [10], investigating its processes will reveal potentially harmful problems and provide

opportunities for improvements. Therefore, Chapter 6 specifically reports the findings about the medication administration process. It graphically described a common process of morning medication rounds and the process of medication administration for an individual resident. Then, it identified problems that were potentially harmful. A manuscript of Chapter 6 is currently under review by the *Journal of Nursing Administration*.

The literature reports that the occurrence of medication administration error is partly due to high staff workload and time pressure [11-13]. Therefore, Chapter 7 presents a study which quantified the time spent on administering each type of medication and determined whether administration time for residents differed by individual medication needs. A manuscript of Chapter 7 is currently in revision as requested by the *Journal of Nursing Management*.

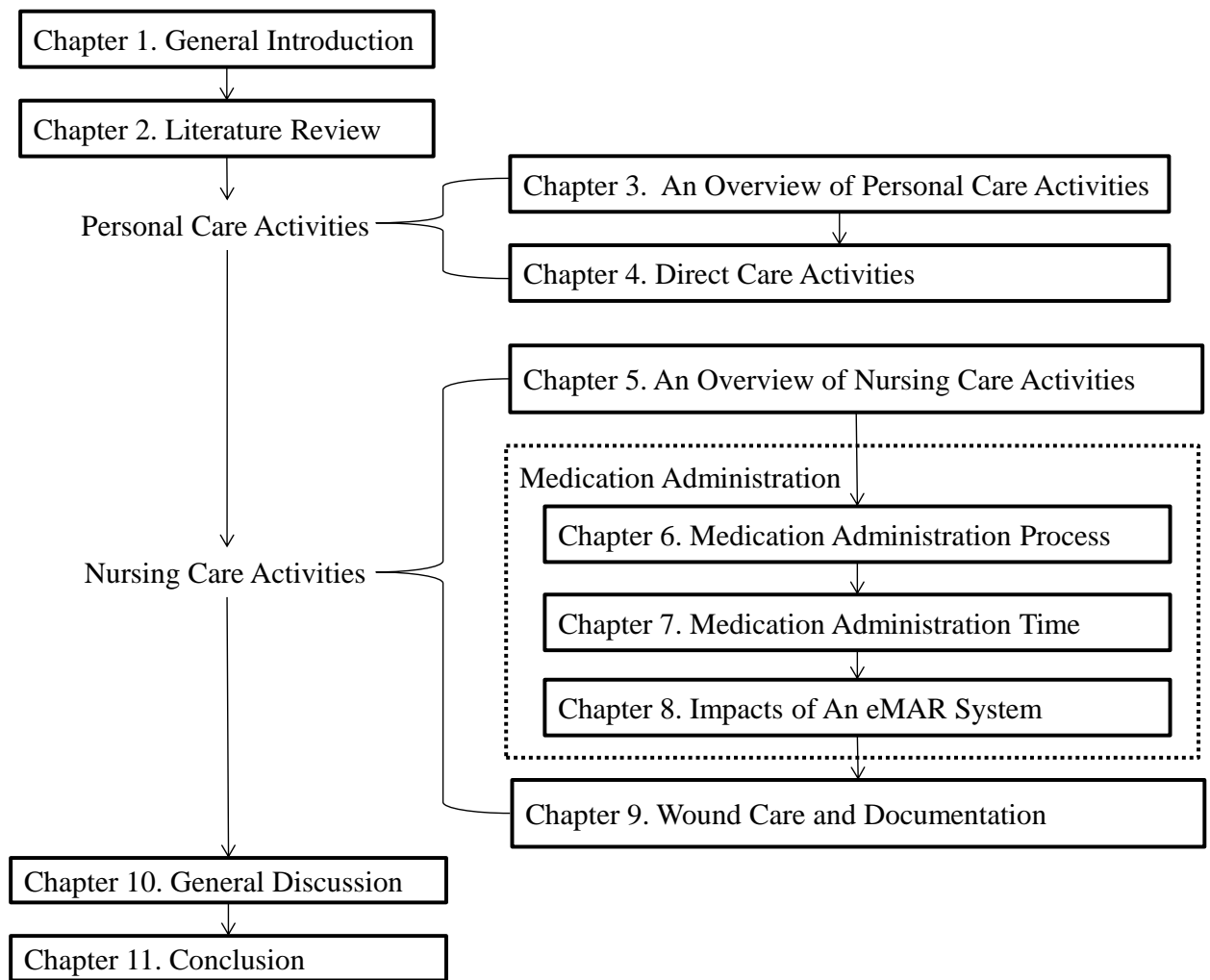
With the expectation of reducing medication error and improving efficiency, RAC homes are introducing an electronic medication administration record (eMAR) system. However, there is a lack of empirical evidence to suggest whether and how an eMAR system can meet the stated expectations. Therefore, Chapter 8 presents a study which examined and compared the documentation time with the use of an eMAR system with that of the equivalent paper-based records. The documentation processes for the eMAR system and the paper-based records were graphically depicted. It also identified benefits and unintended adverse consequences of using the eMAR system. A manuscript of Chapter 8 is currently under review by the *International Journal of Medical Informatics*.

Alongside medication administration, wound care is another routinely conducted activity. Documentation of wound care is essential for the management and healing of wounds. Therefore, Chapter 9 presents a study which examined and graphically depicted wound care and its documentation processes. Problems in these processes were identified. This chapter has been published as a peer-reviewed conference paper which can be found in *Studies in Health Technology and Informatics*.

## **Organisation of the thesis**

This thesis consists of 11 chapters. Following this introduction, Chapter 2 presents a literature review which briefly introduces the cultural-historical activity theory (CHAT). CHAT is a general theory and framework about human activities. Using the framework, an activity is viewed as a system which can be broken down into subject (who conducts the activity), object (what is done), tools (what are used), rules (what are the conditions), community (where the activity is conducted) and division of labour (roles and responsibilities in the community) [14]. This provides a systematic way to conceptualise nursing work activities. Chapter 2 then reviews previous studies on nursing work activities in RAC homes, and identifies gaps in the literature. It also reviews methods that could be used to investigate and measure work activities.

Chapters 3 to 9 present findings from the two time-motion observational studies. Chapter 10 gives a general discussion about research findings and conceptualises nursing work activities and the associated problems through the lens of CHAT. Chapter 11 summarises the key findings of this research and acknowledges research limitations. It also highlights the research contribution and implications for practice. The thesis concludes by pointing out future research directions. The organisation of the thesis is shown in Figure 1.1.



**Figure 1.1 Organisation of the thesis.**

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## **Chapter 2. Literature Review**

The literature review in this chapter is in four sections. The first three sections cover topic areas that this research has drawn upon. The first section describes the cultural-historical activity theory (CHAT) which serves as a conceptual framework to understand nursing work activities. The second section reviews the previous studies on nursing work activities in RAC homes and identifies gaps in the literature. The third section reviews methods used by previous studies to investigate nursing work activities. The last section concludes this chapter.

### **Cultural-historical activity theory**

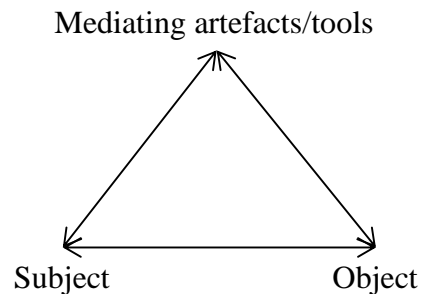
Cultural-historical activity theory is “a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, both individual and social levels interlinked at the same time” [1]. In other words, it can be used to understand who is doing what, why they are doing it, what is the object, what tools they use, what rules they follow, what the division of labour is and how it is embedded in the environment and the community.

The theory is rooted in the work of the Soviet psychologist Lev Vygotsky in the 1920s and early 1930s and was expanded by Alexei Leontiev [2]. The theory remained unknown outside the Soviet Union until the 1980s [3]. It was further developed in the mid-1990s when it attracted a growing interest among academics globally.

#### **2.1.1. The evolution of the cultural-historical activity theory**

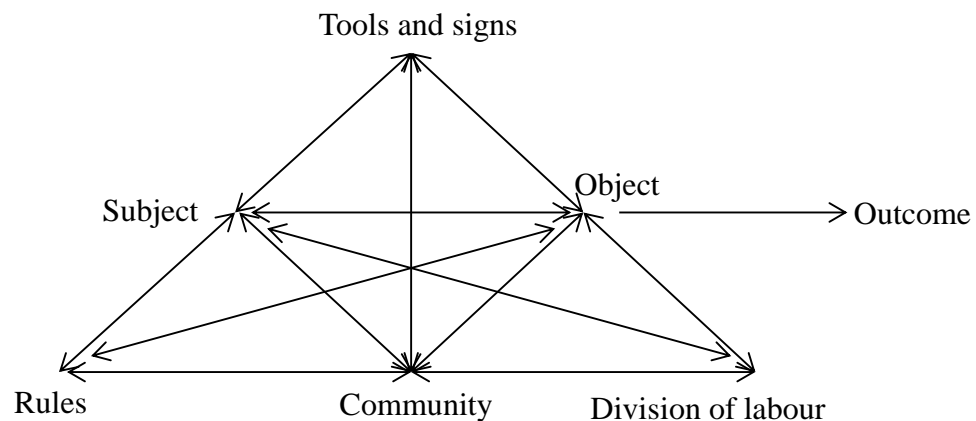
According to Engeström [2], CHAT evolved through three generations. The first generation centred around Vygotsky who argued that the relationship between the subject and the object was never direct, but mediated by artefacts or tools (Figure 2.1). For example, a nurse’s documentation activity in using paper-based records may be different from the practice in using an electronic information system [4]. The relationship between the nurse

(subject) and the documentation (object) is mediated by the documentation tools, either paper or electronic media.



**Figure 2.1 First generation CHAT: reformulated Vygotsky's triangle.**

The limitation of the first generation CHAT was that it was individually-focused. This means the unit of analysis was individual. This limitation was overcome by the second generation CHAT centring around Leontiev who explicated the difference between an individual action and a collective activity in his 'primeval collective hunt' example [5]. Leontiev's extension was graphically depicted by the Finnish researcher Yrjö Engeström in the 1980s (Figure 2.2).



**Figure 2.2 Second generation CHAT: Engeström's triangle**

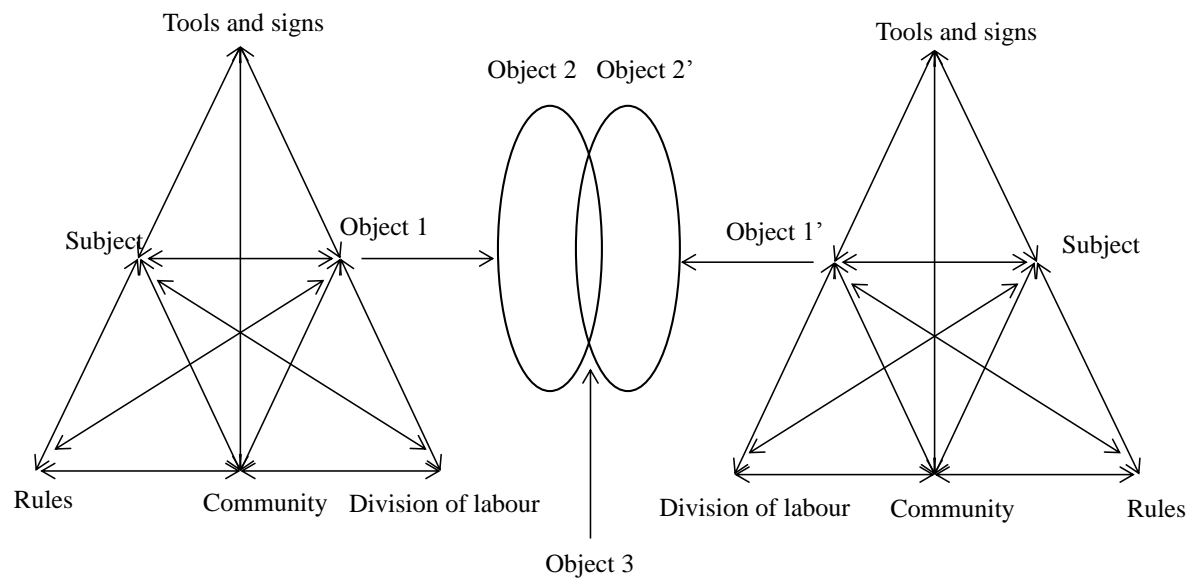
Engeström calls this triangle the structure of a human activity system. The subject is a person or a group of people performing the activity and the object is the thing that the subject works on. The object can be tangible (e.g. documentation forms) or intangible (e.g. ideas).

The mediating tools can be primary, secondary and tertiary [6, 7]. Primary tools are material or physical tools, such as artefacts, instruments, machines and computers. Secondary tools are psychological tools, such as language, signs, ideas and models. Tertiary tools are socio-cultural tools, such as cultural systems, environment, context and virtual space. The capability and availability of tools mediate what needs to be done. In turn, what needs to be done may lead to the modification of tools. Thus, tools carry the historical knowledge of how people work or how work activities are organised [1]. For example, traditional paper-based documentation records may not be easy to use for RAC homes to provide evidence for government funding. This hindered (mediated) the funding application process. To improve accessibility to funding, RAC homes modified their documentation tools by introducing an electronic information system, which has demonstrated its capability of helping the homes to obtain more funding [8].

Rules, such as nursing guidelines for medication management, are the conditions that determine how the subject carries out the object of medication management for residents. Community (e.g. RAC homes) consists of people who share with the subject an interest in the object but do not engage in that specific action carried out by the subject. Division of labour (e.g. PCWs, RNs, kitchen staff, cleaners) represents the roles and responsibilities allocated within the community of an RAC home.

Outcomes are the results of carrying out the activity, e.g. the quality of care for residents. Outcomes can be anticipated or unanticipated, positive or negative. For example, nursing staff use an electronic information system as a tool to document care. The anticipated outcomes are improved quality of care, improved documentation efficiency and reduced cost [8]. However, there can be unanticipated negative outcomes such as reduction of communication, increased difficulties in care delivery and workarounds to the system [4, 9].

The limitation of the second generation CHAT was that it was insensitive toward cultural diversity. Since the 1970s and 1980s, CHAT was introduced to the western world and attracted interests in a wider international audience. “Questions of the diversity and dialogue between different traditions or perspectives became increasingly serious challenges” [2] to understand interactions among two or more activity systems. This triggered the emergence of the third generation CHAT which focused on the interacting activity systems (Figure 2.3).



**Figure 2.3 Third generation CHAT: minimum two interacting activity systems in a model.**

The model of the third generation CHAT is expanded to include at least two interacting activity systems (Figure 2.3). Object 1 and Object 1' are both at the individual level. For example, Object 1 can be monitoring blood sugar level of a specific diabetic resident. Object 1' can be administering insulin to this resident based on the monitoring results.

Object 2 and Object 2' are at the group level. They are “a collectively meaningful object constructed by the activity system” [2] of Object 1 or Object 1'. For example, Object 2 is

monitoring all the diabetic residents in an RAC home. Object 2' is administering insulin to all the diabetic residents based on the monitoring results.

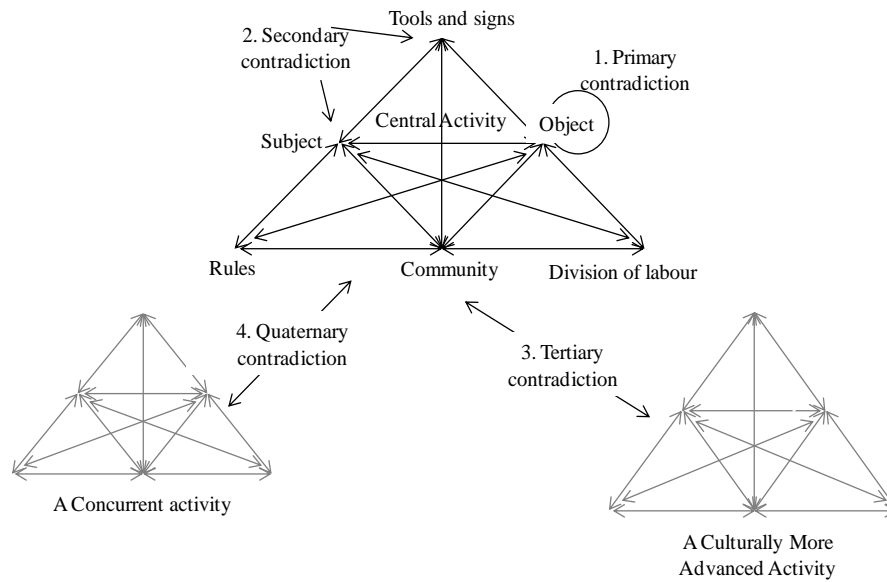
Object 3 is indicated by the overlapped part of Object 2 and Object 2'. It is a shared or jointly conducted object- diabetic care. There are other activity systems which also shared this object, for example, monitoring the food intake of diabetic residents.

Engeström summarised five principles of CHAT [2]. The first principle is that the unit of analysis is a collective, tool-mediated and object-oriented activity system. The second principle is that an activity system is always multi-voiced. That means there are multiple viewpoints, traditions and interests in an activity system. The third principle is the historicity of an activity system. In other words, the formation and transformation of an activity system take a lengthy period of time. The problems and potentials of the system can only be understood in consideration of the history of the system- the history of the activity, its objects and tools and local community. The fourth principle is that contradictions take the central role in the change and development of an activity system. The fifth principle proclaims the possibility of expansive transformation in an activity system as its contradictions are aggravated.

### **2.1.2. The concept of activity and contradictions**

Engeström's triangle indicates that activity is a broader concept rather than an individual action of a subject. It is purposeful, tool mediated, socially situated, rule governed and under continuous change or development. It is a meaningful context or system that can be broken down into six components: subject, object, tools, rules, community and division of labour.

Contradictions constitute a key concept in CHAT. They drive motivation for improvement efforts, changes, developments and innovations in people's work [10, 11]. Engeström [12] proposed four levels of contradictions (Figure 2.4):



**Figure 2.4 Four levels of contradictions [12].**

1) *primary contradictions that appear within a component of an activity system.* For example, computer system break down is a primary contradiction within the component of tools in the activity system of electronic documentation.

2) *secondary contradictions that appear between components of an activity system.* For example, nursing staff's low computer literacy may hinder their activity of using an electronic documentation system. This contradiction happens between the object of electronic documentation done by the nursing staff (subject) and their capability of using the electronic documentation tool- computer literacy (secondary tool). This contradiction may lead to nursing staff resistance to using a new electronic information system.

3) *tertiary contradictions that appear between the object of the dominant form of an activity system and the object of a culturally more advanced form of the activity system.* In other words, a new object is introduced to an activity system usually with the aims of relieving one or more secondary contradictions [13]. For example, in the traditional documentation activity system, nursing staff record nursing observations and activities on paper-based charts. The subject is the nursing staff. The object is the paper-based charts. The tools are pens, the handwriting capability of the nursing staff (legibility) and their

ability to formulate written statements. Rules include the documentation requirements of the RAC home. Community is the care team. Division of labour includes RNs, EENs, ENs and PCWs. A secondary contradiction in this paper-based documentation activity system is between the nursing staff's handwriting capability and ability to formulate written statements (the tools) and documenting on the paper-based charts (the object). Poor legibility and unclear handwriting may reduce the quality of documentation, which places further negative impact on quality and safety of care. It can even lead to serious adverse consequence such as a medication error.

A culturally more advanced tool of documentation is electronic documentation. The advantage for a nurse subject in using this tool is substantial improvement in legibility of records, the object. Therefore, in this new documentation activity system, changes are in the object and the tools used to achieve the object. The object is changed from paper-based charts to electronic charts. The tools change from a pen to a computer, a keyboard and nursing staff's typing skill in addition to their capability of formulating written statements. The tertiary contradictions, such as resistance to use of electronic charts, appear between the paper-based charts (the object of the original, dominant form of nursing documentation activity system) and electronic charts (the object of a culturally more advanced form of this activity system).

*4) quaternary contradictions that appear between the central activity system and its neighbouring or interacting activity system.* For example, in the provision of the activity system of care, rules require nursing staff to provide quality care and complete all the care activities in time. This requires adequate staffing and an appropriate skill mix in the care team. The staffing level and skill mix are determined by the activity system of the management of the RAC home. When adequate staffing and an appropriate skill mix cannot be met, contradictions like nursing staff not conducting certain care activities (e.g. brushing residents' teeth) will arise.

Identifying the contradictions in nursing work activity system and understanding the nature and extent of the contradictions will help nursing managers to identify weak points in

nursing work and can introduce innovative methods to improve care services. Therefore, the four levels of contradictions introduced above provide a conceptual framework to guide the identification and conceptualisation of contradictions in nursing work activities in RAC homes.

### **Previous studies on nursing work activities in RAC homes**

This section reviews previous studies on nursing work activities in RAC homes and identifies gaps in the literature. As mentioned in Chapter 1, nursing work activities in RAC homes include personal care activities and nursing care activities. Therefore, this literature review first covers studies on personal care activities. It then reviews studies on nursing care activities with a focus on medication management which is critical to resident safety. This is followed by a review of studies on the impacts of electronic information systems on nursing work activities, as many RAC homes in Australia have or are in the process of introducing electronic information systems to their nursing activity systems, such as an electronic health record (EHR) system. The literature review concludes with a summary of the gaps in the literature that were identified.

#### **2.2.1. Previous studies on personal care activities in RAC homes**

Studies about personal care activities in RAC homes were mostly focused on specific individual activities, such as bathing, feeding and oral care [14-16]. Kobayashi and Yamamoto examined personal care staff time needed for bathing dementia residents in various stages in a Japanese RAC home [14]. They found that the stage of dementia affected the amount of time required for guiding a resident to the bathroom, but did not affect the time required for dressing or undressing the person. This indicated that personal care staff required varied amounts of time for showering dementia residents in various stages, but relatively consistent amount of time for dressing or undressing the residents..

Simmons and Schnelle conducted an observational study to investigate feeding activity in six American RAC homes [15]. They measured personal care staff time spent on providing feeding assistance to residents and the oral food and fluid consumption of residents, before

and during a two-day trial in which staff were trained to assist residents with eating in order to increase their oral intake of food. The study found that the personal care staff needed an average of 35 to 40 minutes to assist a resident who was responsive to their assistance to take an adequate amount of food, regardless of the person's physical dependency. This indicated that when residents responded to personal care staff assistance, the level of care needs of the residents did not make a difference to the amount of time the staff took to complete the feeding activity.

Coleman and Watson investigated an oral care activity conducted by 47 personal care staff to 67 dentate residents in five RAC homes in the USA [16]. Their study found that personal care staff adherence to oral care standards was low. Personal care staff were observed brushing residents' teeth and rinsing their mouths with water in only 16% of observations on residents, indicating inadequate oral care provided to the residents. This was probably associated with inadequate supplies provided by RAC homes, as the study found that only 26% of residents had a toothbrush and toothpaste visibly present. However, personal care staff only provided oral care to 60% of those residents who had the necessary supplies. Personal staff never met standards like brushing a resident's teeth for at least 2 minutes, indicating that time constraints could be a reason for the low oral care provision rate. The result of this study raises the question of the actual time spent on oral care by personal care staff in Australia.

Munyisia et al. conducted a work sampling study which determined the time that personal care staff allocated to various work activities including bathing, feeding and oral care activities in a 53-bed high-care unit in an Australian RAC home [17]. However, the study results were estimated and these activities were presented as a bigger category of direct care, which limited the understanding of how much time was actually spent on each activity.

To date, there is a lack of accurate examination of the time personal care staff spend on each personal care activity and the pattern of conducting these activities in a work shift in RAC homes.

### **2.2.2. Previous studies on nursing care activities in RAC homes**

A number of studies in RAC homes have investigated nursing care activities including wound care [18-20], pain management [21-24], catheter care [25], and medication management [26-28], to name a few. For example, Rondas et al. measured the prevalence of infected chronic wounds and explored signs and symptoms used by nursing staff to diagnose infected chronic wounds in a Dutch RAC home [18]. Their study found that 22% of the chronic wounds were considered infected. The signs and symptoms used for diagnosis included the increase of exudate, erythema, pain and wound recalcitrance. Husebo et al. examined the response of agitated behaviours of dementia residents to individualised pain management intervention [29]. Their study found that verbal agitation behaviours had the largest significant difference between the controlled group and the intervention group. This indicated that verbal agitation behaviours such as constant requests for attention, complaining and negativism, could be an indicator of the need for a pain assessment and treatment.

Among the many nursing care activities, medication management is critical to resident safety and is related to other nursing care activities (e.g. pain management). Error rates in medication administration have been found to range from 28% to 40% [30, 31]. Therefore, the following two sections will focus on studies on medication management.

#### ***Medication management process***

Medication management in Australian RAC homes is an interdisciplinary collaborative work process which spans five stages: prescribing, documenting, dispensing, administering and monitoring. Physicians prescribe medications. Pharmacists dispense medications. Physicians and pharmacists are both located offsite. Nursing care staff in RAC homes document medication orders and medication administration, administer medication and assess the effects of medication. Understanding the medication management process lays the foundation for further studies to investigate existing problems.

Verrue et al. conducted structured interviews in Belgian RAC homes to explore the medication management process [27]. They found that medications were mainly delivered by community pharmacies in 83% of 76 RAC homes. Nursing care staff were not the only medication administrators, personal care staff also participated in this nursing activity. A common problem identified was postscription i.e. a medication was dispensed by the pharmacist before the doctor prescribed it. Medication administration is the process where medication errors are most likely to occur [32]. There is a need to investigate whether there are other problems within this process in addition to that found by Verrue et al.

Ellis et al. conducted focus group discussions to investigate nursing care staff work processes of medication management in two RAC homes in Canada [26]. They found that nurses had to “race against time” in their process of preparation, administration, assessment and documentation. The preparation phase was an information collection process which included gathering information about residents and medication through reviewing medication charts, talking to residents’ family members and collaborating with other care team members. This information collection process is essential for ensuring safe medication administration.

In the medication administration phase, nursing care staff administered medication to residents in a “flexible” and “quick” manner (e.g. hiding medication in food) in order to successfully complete this activity. In the last phase, nursing care staff assessed the effectiveness of the medication taken by the residents and documented it. Barriers to safe medication management included time constraints, knowledge limitations, interruptions and poor communication.

Although this study conceptualised the medication management process in three phases and provided narrative descriptions of each, it did not illustrate how various activities were organised. Also fewer than five studies reported this process to a certain extent, none of them conducted in Australia. Therefore, there is a need for understanding medication management activity in Australian RAC homes.

### ***Medication administration time***

Dellefield et al. examined RN time utilisation by a work sampling study in a 174-bed RAC home in the USA [33]. They estimated that 31% of RN time was spent on direct care activities, including medication administration.

In the work sampling study conducted by Munyisia et al. [17], not only PCWs were observed, RNs and EENs were also observed. The study estimated that both RNs and EENs spent 18% of their time collectively on medication preparation, provision and documentation activities. However, it did not provide further details about time spent on each of these three activities.

Thomson et al. defined seven steps in the medication administration process: preparing the medication trolley, locating and identifying the resident, preparing medication, preparing a resident to receive medication, providing medication to the person, observing the person's response in case of any immediate adverse event, and travelling back to the medication trolley [28]. They then conducted a time-motion observational study to accurately measure the time nursing care staff spent on each step in different types of care units within an RAC home in Canada. They found that, in different types of care units, nursing time per resident ranged from four minutes to 13 minutes in a morning medication round and two to seven minutes in a noon medication round. Medication preparation took 75 to 100 seconds per resident, longer than medication provision (40 to 70 seconds). The study did not examine medication-related documentation activity.

In the study by Ellis et al. in two RAC homes in Canada [26], a nurse participating in the focus group discussion mentioned that one nurse medicated 40-50 residents, each taking seven to ten medications per day and how a resident took medication (e.g. one pill at a time) affected the amount of nursing time spent with each resident. Thus, nursing care staff adopted various techniques (e.g. diverting a resident's attention) so as to be able to complete this activity in reasonable amount of time. This indicated that the number of

medications and the methods used by nurses to provide medication to residents were factors impacting on medication administration time.

The literature has not documented how much time nursing care staff spent on each type of medication in RAC homes or determined whether the administration time for residents differs by individual medication needs such as the number of medications taken by a resident and the medication provision methods. This information will be useful for nursing managers to make informed decisions on staffing and task re-allocation. Therefore, there is a need to focus more closely on this activity to fill in the gaps in the literature.

### **2.2.3. Previous studies on impacts of an electronic information system in RAC homes**

The move from paper-based documentation to electronic documentation has been a significant trend in healthcare settings worldwide [4, 9, 34-40]. This change in documentation tools is driven by a number of contradictions in the traditional paper-based documentation environment, for example, the excessive daily paper work which takes nursing staff away from their caring duties and the difficulties in managing information, retrieving data and documenting consistent, detailed and accurate care information [9, 41]. The expected outcomes of moving to electronic documentation are improved quality of care [42, 43], improved work efficiency [44, 45] and reduced costs [42, 46].

Documentation is vital to the management of residents' health, care provision, funding applications and care service accreditation in Australian RAC homes. An analysis of the aged care accreditation reports published in 2013 shows that 37% of the homes were using an electronic information system for documentation in their daily activities.

Although the purpose of introducing an electronic information system is to relieve contradictions, this intentional change not only produces benefits but also spurs new contradictions. This section reviews studies that either quantitatively or qualitatively evaluated the impacts of introducing an electronic information system on nursing work activities in RAC homes.

***Quantitative evaluation of the impacts of introducing an electronic information system on nursing work activities***

There is limited research on this topic in RAC homes. Munyisia et al. conducted longitudinal work sampling observations to quantify the impact of an EHR system on nursing staff time allocation in a high-care unit of an Australian RAC home [47]. Observations were carried out at five time points: three months before and three, six, 12 and 23 months after the implementation of an EHR system. Registered nurses, EENs and PCWs were observed. Over the course of the study, the system provided functions such as progress notes, care plan and funding of care, but did not include medication management. Documentation of medication management remained paper-based.

The study results of Munyisia et al. suggested that the introduction of the system did not change the time RNs allocated to medication management, direct care, in-transit and staff break activities. Their time spent on documentation and verbal communication activity did not change significantly 12 months after the introduction of the system. But at 23 months, their documentation time substantially increased and verbal communication time substantially dropped.

Similarly, the introduction of the EHR system did not change much of the EENs' time allocation. The EENs' time allocated to medication management, verbal communication, in-transit and staff break activities did not change significantly. The EENs did not conduct direct care activities. Their time spent on documentation activity substantially dropped at 12 months after the introduction of the system.

Personal care worker changed their time allocation to a greater extent during the course of the study. Their documentation time increased significantly at three and six months, but settled back at 12 months after the use of the system. Their time spent on verbal communication activity increased significantly at three, six and 12 months, but settled back at 23 months after the use of the system. They spent a similar amount of time on in-transit activity, except that the amount of time increased significantly at 6 months after using the

system. No significant changes occurred to PCWs' time spent on direct care, indirect care and staff breaks.

This longitudinal study filled a gap because no study had been conducted in RAC homes to evaluate the impacts of an electronic information system on nursing staff time allocation. However, as the electronic system examined did not support any medication management activity, the impact of an electronic information system on the time spent on the medication management activity is yet to be investigated.

Munyisia et al. also conducted a survey study to investigate nursing staff perceptions about the impacts of the EHR system [48]. The study results showed that the benefits to nursing work activities were accurate, legible and complete information and reduced repetition in data entry.

Florczak et al. evaluated a point-of-care wound documentation and reporting system in an American RAC home using the survey method [49]. The survey findings showed that the electronic system improved documentation consistency, nursing staff ability to determine a resident's risk level, management of treatment of existing wounds, communication with other health professionals, recognition of changes in wound status, and care plan revisions. The biggest gain was in recognition of changes in wound status. The quantitative survey results may be understood better with qualitative observational data, such as the wound care process and its documentation activity conducted by nursing staff. However, the study was conducted in a single home and there is still a lack of research on the work processes of wound care and its documentation activity.

### ***Qualitative evaluation of the impacts of introducing an electronic information system on nursing work activities***

Qualitative interview studies of nursing staff perceptions about the impacts of an electronic information system found some benefits to their work activities, but also identified unintended adverse consequences which disturbed nursing work activities [8, 9]. A systematic investigation on the benefits and unintended adverse consequences of using

EHR systems in nine Australian RAC homes was conducted by Zhang et al. [8] and Yu et al. [9] using an interview method. The benefits to nursing work activities included convenient and efficient data entry, distribution and storage, more information for nursing staff to understand the residents and care services, and improved communication among nursing staff and with outside health professionals [8].

The unintended adverse consequences of introducing the EHR system was the disruption of nursing staff in completing work activities. These included inability or difficulty in data entry and information retrieval, increased complexity of information management, inadequate numbers of computers due to a lack of space to place them, an increased documentation burden, reduced face-to-face verbal communication, and increased difficulties in care activities [9].

Although these qualitative studies reflect the subjective view of nursing staff, objective observation is needed to paint a fuller picture of the topic. Vogelsmeier et al. used observation, process mapping, key informant interviews and field notes to explore nursing staff documentation activity and the use of an eMAR system in five American RAC homes [50]. They observed 43 nursing staff before the implementation of the eMAR system and 45 nursing staff six months after the implementation to determine how medication administration practices had changed. The study found that nursing work processes were adversely impacted by the eMAR system. Nursing staff worked around significant safety features intentionally designed in the system, for example double signings- one after medication preparation and the other after medication provision- to ensure that the medication provided was actually the one prepared. As mentioned early in this literature review, nursing staff were always “racing against time” [26]. They wanted to successfully complete their activities within the time frame. Therefore, some nursing staff worked around this safety feature by completing both signings before the actual medication provision.

As a type of electronic information system, an eMAR system is particularly focused on medication management, an essential nursing care activity in RAC homes. However, the

number of studies which have investigated the impact of an eMAR system in RAC homes is still limited. More evidence is needed to provide insights into the impacts of an eMAR system so that managers can make informed decisions on investing in this technology and introducing changes to nursing activity systems.

#### **2.2.4. Gaps in the literature**

Only a handful of studies have been conducted in RAC homes, prompting the need for more evidence about nursing work activities. This review of previous studies on nursing work activities in RAC homes had three themes: 1. personal care activities, 2. nursing care activities and 3. the impacts of an electronic information system. Gaps in the three themes were identified.

*Gaps in Theme 1.* Previous studies on personal care activities mostly focused on a specific activity [14-16], which missed the whole picture of personal care. One study estimated the time personal care staff spent on an extensive category of direct care which included all types of personal care activities, such as showering, dressing, feeding and toileting [17], thus losing the details about each activity. To date, there is a lack of studies to accurately examine the work pattern of personal care.

*Gaps in Theme 2.* Previous studies investigated nursing work processes of, and time spent on, medication management activities [17, 26-28, 33]. However, there is a lack of visualisation of the actual work processes followed by nursing care staff, identification of associated problems, examination of the time spent on each type of medication and whether the time nursing care staff spend on medication administration differs by individual medication needs. Therefore, the work pattern of nursing care is yet to be investigated.

*Gaps in Theme 3.* Review of both quantitative and qualitative studies on the impacts of an electronic information system on nursing work activities [8, 9, 47-50] showed that the electronic information system generated both benefits and unintended adverse consequences for nursing work activities. However, there is a lack of research on the impacts of an eMAR system on medication management. As medication management is

essential for resident safety, there is a need to understand the benefits and unintended adverse consequences of introducing an eMAR system. Wound care processes and their documentation have not been investigated by previous studies either. As it is a common type of nursing care conducted by nursing staff everyday in RAC homes, knowledge about wound care processes is essential for improving nursing care services in RAC homes.

To fill these knowledge gaps, this research aimed to:

4. Explore and describe nursing work activities in providing personal care and nursing care in Australian RAC homes.
5. Identify problems associated with these activities.
6. Explain possible causes of these problems and their potential impacts.

### **Methods for studying nursing work activities**

To achieve the aims of this research, both quantitative and qualitative data collection methods are needed. This section reviews data collection methods and work process visualisation methods and measurements of nursing work activities. It also outlines the justification for the methods used in this research.

#### **2.3.1. Focus group discussion**

Focus group discussion brings in a small group of subjects at one meeting to discuss a phenomenon of interest for about two hours [51]. The discussion is facilitated by a trained person and follows a set agenda. The final outcome is a holistic understanding of the proposed discussion topic. A limitation of this method is that the discussion is sometimes unduly dominated by one or two participants [52], thus the accuracy of the outcome could be limited. However, focus group discussion can gather information quickly with a relatively low cost.

### **2.3.2. Work sampling and time-motion observational methods**

Observational methods can compensate for the limitations of the focus group discussion. There are two observational methods applicable to this research: work sampling and time-motion methods. The work sampling method requires an observer to walk around in the RAC home to record each individual staff's activity from a distance at a certain time interval [17]. The advantage of this method is that it allows a single observer to record all the activities conducted by all the participants within the time interval. However, the disadvantages are that the resulting time expenditure is estimated and the detailed work processes of nursing staff carrying out their activities cannot be captured. The observer cannot hear the verbal communication among participants from a distance, thus is not able to capture some useful information (e.g. what is going on among nursing staff).

Time-motion observation requires an observer to continuously observe one participant at a time and record each action the participant undertakes. It can collect very detailed information about work processes (e.g. sequence and duration of activities), however it is labour-intensive and costly if conducted on a large scale [53]. The time-motion observation method collects both quantitative data (time expenditure on activities) and qualitative data (work processes). This method is suitable for use in this research, because it can provide accurate examination of each activity and at the same time record the work processes of nursing staff in conducting activities. The observer is exposed to details in nursing staff work and can obtain useful contextual information for interpreting research findings.

A limitation of observational methods is that study participants may change their behaviour in response to their awareness of being observed. This phenomenon is called the "Hawthorne effect"[54]. This effect can be reduced in two ways [55]: First, the observer can spend some time with the participants to allow them to become familiar with the observer and the nature of the study, before the actual observations commence. The other factor is that the busy nature of work in a care setting reduces the ability of the participants to sustain significant change in their work activities.

### *Classification systems of nursing work activities in RAC homes*

Both work sampling and time-motion observation methods require a pre-defined classification system of the participants' activities. In the review of previous studies on nursing work activities in RAC homes, only two activity classification systems were found. One was developed in the longitudinal work sampling study conducted by Munyisia et al. [56, 57]. The classification system contains 48 directly observable activities which are grouped into seven main categories: direct care, indirect care, documentation, verbal communication, in-transit, staff breaks and others.

This activity classification system covers both personal care and nursing care activities. It designates a good number of personal care activities, but doesn't differentiate infection control activities such as washing hands, using gloves and putting on an apron which are often conducted by personal care staff. A major limitation of this classification system is that the nursing care activities are described at a very high level, such as medication preparation, provision and documentation. This level of activity granularity is not suitable for this research to fill in the knowledge gaps, for example how much nursing time is spent on each type of medication. Although this classification system cannot be used to observe nursing care activities, it can be used for observation of personal care activities with further development.

To date, there is a shortage of classification systems of nursing care activities in RAC homes, except the seven steps of medication administration process defined by Thomson et al. [28]. The seven steps are preparing the medication trolley, locating and identifying the resident, preparing medication, preparing a resident to receive medication, providing medication to the person, observing the person's response in case of any immediate adverse event, and travelling back to the medication trolley. Since their study was focused on medication administration, a lot of other activities conducted by nursing care staff were not considered, such as documentation activity, wound care activity and infection control activity. Therefore, a classification system of nursing care activities needs to be developed from scratch in this research.

In summary, classification systems of nursing work activities found in the existing literature could not assist the collection of adequate data to achieve the research aims to fill the knowledge gaps. Therefore, two activity classification systems were developed in this research: one for personal care (see Chapter 3) and the other for nursing care (see Chapter 5).

### **2.3.3. Document review**

Document review is a qualitative data collection method. It often serves as a complement to other research methods [58]. Document review has five functions [58]: 1) to understand background information about the context in which the research is conducted; 2) to identify questions to be asked or situations to be observed in the research; 3) to collect supplementary research data; 4) to understand changes and development of an organisation or program; and 5) to verify findings or corroborate evidence from other sources.

Document review is more efficient and cost-effective than observational method. It is also stable, because the presence of the investigator will not alter what is being studied. However, documents may not always be retrievable and provide sufficient details.

### **2.3.4. Structured and unstructured field notes**

In field observation, it is important to use both our eyes and ears [59]. To understand nursing work activities, we need to understand the community or the context in which they are carried out. Structured and unstructured field notes are particularly useful for recording and understanding the context. They are taken during direct observations of participants.

Structured and unstructured field notes can provide additional data that cannot be collected by the time-motion observations. Also, they can provide insight into the interaction between people, illustrate the whole picture, capture context and process, and inform the influence of the physical environment [59]. However, what is written into the field notes are affected by a researcher's view about what he or she sees and hears.

### **2.3.5. Work process visualisation methods**

The purpose of visualising or graphically representing nursing work processes is to document the current work processes and communicate it with the intended audience such as nursing staff, managers, electronic information system designers and the general audience. This requires a simple and easy representation of nursing work processes. The outcomes of the visualisation are process diagrams that represent nursing work processes.

Jun et al. evaluated several process representation methods and how each was perceived by healthcare workers [60]. Their study found that the flowchart was widely used and was considered particularly helpful in describing and understanding the overall sequence of care processes, because many healthcare workers were quite familiar with the flowchart used in their work. However, the flowchart uses a long list of symbols which can increase the cognitive load of the busy working nursing staff who will review and validate the process diagrams. A simpler method was needed.

Kmetz proposed a representation method which uses only five visually distinctive symbols adopted from the flowchart [61]. No more symbols are used. The symbols are rectangle, diamond, circle, arrow and document. Rectangle represents processes and activities, diamond represents two mutually exclusive decisions, circle represents start and stop, single direction arrow represents material or information flow and document represents paper input or output. They have the same meanings as used in the flowchart. Because these symbols are also used by flowcharts technique, the participating nursing staff will be able to understand them. Another feature of this technique is the distinctiveness of the symbols, which enables the process diagram viewers to understand the meaning of the diagram quickly.

### **2.3.6. Measurements of nursing work activities**

To study nursing work activities and identify work patterns, previous studies in hospital settings or RAC homes have used various measurements, including activity time, frequency, duration and switch between two consecutive activities [17, 28, 62-65]. Activity time is the

total amount of time spent on an activity during a set period of time (usually in an eight-hour work shift). It is expressed by two parameters: 1) the actual time and 2) the percentage of time used to complete an activity in relation to the total amount of time for all the nursing work activities.

Activity frequency is the number of occurrences of an activity during a set period of time. Activity duration is the amount of time, usually assessed in seconds, consecutively spent on an activity. The switch between two consecutive activities include the number of occurrences of the switch and the direction of the switch (e.g. from a direct care activity to an indirect care activity). This research adopted these measurements of nursing work activities in order to compare the results with previous study findings.

### **2.3.7. Justification of data collection and analysis methods**

#### ***Justification of data collection methods***

This research used time-motion observation, focus group discussion, structured and unstructured field notes and document review at different stages of the study procedure. To achieve the first aim of this research i.e. to explore and describe nursing work activities in providing personal care and nursing care in Australian RAC homes, time-motion observation method was the predominant data collection method.

To conduct time-motion observation, a predefined classification system of personal care or nursing care activities was needed. As mentioned before, the activity classification system developed by Munyisia et al. [17] could be used for observation of personal care activities, but it needed further development. Therefore, focus group discussions were conducted with researchers and nursing staff who had extensive experience working in aged care to further develop the activity classification system.

The classification system of nursing care activities had to be developed from scratch, because there was no existing activity classification system that could be used to achieve the aims of this research. A quick way to identify what activities nursing care staff do in

RAC homes was direct observation with unstructured field notes, which recorded everything a nurse did. Therefore, direct observation with unstructured field notes was chosen for this purpose.

One of the gaps identified in the literature is a lack of research determining whether the time nursing care staff spend on medication administration differs by individual medication needs. To fill in this gap and to achieve the first aim of this research, an instrument for taking structured field notes was developed to specifically record an individual resident's medication needs (e.g. crushing tablet medication) during time-motion observation.

To achieve the second aim of this research i.e. to identify problems associated with nursing work activities, a document review method was used. This was because reviewing organisational policies and guidelines on nursing work activities can gather background information and standards for benchmarking to identify problems in nursing work activities.

Therefore, multiple methods, including time-motion observation, focus group discussion, structured and unstructured field notes and document review, were used in this research.

### ***Justification of work process visualisation method***

In this research, process diagrams were developed based on observations of nursing staff's work. The developed diagrams were then to be validated by the nursing staff participants and revised according to their feedback. Therefore, it was important that the diagrams were easy and quick for the busy working participants to understand. The method proposed by Kmetz [61] with only five symbols was suitable for this purpose. Therefore, it was used in this research to represent nursing work processes.

### **Conclusion**

This chapter has introduced activity theory as a conceptual framework for the researcher to study nursing work activities, the relationships and contradictions associated with the activities and the cultural-historical environment of the RAC homes. It reviewed the previous studies on nursing work activities in RAC homes and identified several gaps in the

literature. These gaps included a lack of research on nursing work activities to accurately examine the time spent on each activity, to visualise work processes, to identify patterns and problems, and a lack of research on nursing work activities with the use of an eMAR system and the impact of the system. This chapter also reviewed data collection methods, work process visualisation methods and measurements of nursing work activities, and indicated which of these methods were selected for use in this research.

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### **Chapter 3. The Work Pattern of Personal Care Workers in Two Australian Residential Aged Care Homes: A Time-Motion Study**

#### **Abstract**

The aim of the study is to describe the work pattern of PCWs in RAC homes. This knowledge is important for staff performance appraisal, task allocation and scheduling. It will also support funding allocation based on activities.

A time-motion study was conducted in 2010 at two Australian RAC homes. The observation at Unit 1 was between the hours of 7:00 and 14:00 or 15:00 for 14 days. One PCW was observed on each day. The observation at Unit 2 was from 10:00 to 17:00 for 16 days. One PCW working on a morning shift and another one working on an afternoon shift were observed on each day. 58 work activities done by PCWs were grouped into eight categories. Activity time, frequency, duration and the switch between two consecutive activities were used as measurements to describe the work pattern.

Personal care workers spent about 70.0% of their time on four types of activities consistently at both units: direct care (30.7%), indirect care (17.6%), infection control (6.4%) and staff breaks (15.2%). Verbal communication was the most frequently observed activity. It could occur independently or concurrently with other activities. More than half of the verbal communication time was spent on concurrent verbal communication. At Unit 2, PCWs spent significantly more time than their counterparts at Unit 1 on verbal communication (Unit 1: 47.3% vs. Unit 2: 63.5%,  $P = 0.003$ ), transit (Unit 1: 3.4% vs. Unit 2: 5.5%,  $P < 0.001$ ) and others (Unit 1: 0.5% vs. Unit 2: 1.8%,  $P < 0.001$ ). They spent less time on documentation (Unit 1: 4.1% vs. Unit 2: 2.3%,  $P < 0.001$ ). The PCWs usually did documentation at the end of the shift. More than two-thirds of the observed activities had a very short duration (1 minute or less). Personal care workers frequently switched within or between verbal communication, direct and indirect care activities.

At both RAC homes, direct care, indirect care, infection control and staff breaks occupied the major part of a PCW's work, however verbal communication was the most time

consuming activity. Personal care workers frequently switched between activities, suggesting that looking after the elderly in RAC homes is a busy and demanding job.

### **3.1. Introduction**

The growing ageing population has resulted in an increasing number of residents, especially the very old and frail, in RAC homes [1]. This requires an increase in the number and intensity of the aged care services. The situation is worsened by a chronic shortage of direct care workers, on whom these people rely to live [2]. All of this represents a big challenge to the delivery of aged care services in RAC homes.

An important strategy to address this challenge is to effectively design work activities to optimally deliver aged care services. This requires a basic knowledge about which work activities are currently undertaken by direct care workers and how much time each activity actually takes to meet a resident's care needs.

Personal care workers make up the largest proportion (70%) of the direct care workers in RAC homes. Because of the challenge of attracting RNs, the number of PCWs is increasing steadily in Australia [3]. Personal care workers have a minimum qualification of Certificate III in Aged Care awarded by the TAFE college system in Australia. They are the major providers of personal care to residents, especially the ADL which are one of the important care needs supported by the ACFI [4]. The ACFI assesses the day-to-day core care needs of a resident to determine the level of subsidy.

Work sampling and time-motion techniques have been applied extensively to measure the work pattern in healthcare settings [5-12]. The former has a relatively small cost, but is not able to capture some important information such as the duration of an activity because the observation is not continuous [13]. The latter allows precise time to be recorded for each activity, but this is labour-intensive and costly [14].

Previous studies have investigated the work pattern in hospital settings [6-8, 10, 11]. For example, Cornell *et al.* [7] inspected nurses' workflow and their computer use in two acute care medical-surgical units in a general hospital in the USA. They found that nurses

frequently switched between activities and the duration of most of the activities was very short and highly variable. A recent study described the work activities of bedside intensive care unit nurses in a private hospital in Australia [11]. Nurses spent most of their time on direct care and indirect care and they undertook two activities simultaneously for almost half of their time.

Although there has been much research on work patterns in hospital settings, few such studies have been undertaken in RAC homes. Among the studies undertaken in RAC homes, some only focused on particular activities (e.g. bathing-related care) [5, 12, 15]. Munyisia *et al.* [9] examined the time expenditure on different types of activities performed by direct care workers by conducting a work sampling study in a high-care unit and a low-care unit of an RAC home. They found that in both units, verbal communication was the most time-consuming activity (32.4%-51.9%). This study provides a comprehensive overview of what the direct care workers do and how they spend their working time, however it was confined to a single RAC home and because it is a work sampling study, the duration of each activity or the switches which occur between activities could not be determined.

This study aims to accurately describe the work pattern of PCWs in two high-care RAC homes. Previous studies used different measurements to describe work patterns [7, 10, 11, 16, 17]. The commonly used measurements are activity time, frequency, duration and the switch between two consecutive activities.

Activity time is expressed by two parameters: (1) the time an activity takes over an eight-hour shift and (2) the percentage of time used to complete an activity in relation to the total amount of time for all activities. Activity frequency is the number of occurrences of an activity during a set period of time (e.g. an hour). Activity duration, usually assessed in seconds, is the length of time continuously spent on an activity. It is presented as a mean with standard deviation to indicate its variability. The switch between two consecutive activities includes the number of occurrence of a switch and the direction of this switch. These four measurements were used in this study to describe a PCW's work pattern.

## **3.2. Methods**

### **3.2.1. Settings**

A time-motion observational study was conducted at two RAC homes. The first RAC home was located in Sydney and was owned by a not-for-profit organisation which operates 23 RAC homes. The observation was conducted in a 32-bed high-care wing (Unit 1) staffed by one half-time and four full-time PCWs and one RN. The other RAC home was a stand-alone, not-for-profit home in Newcastle with 108 beds. The observation was conducted in a 25-bed high-care wing (Unit 2) in which three PCWs and one RN took care of 23 residents (two beds were empty at the time of the study).

### **3.2.2. Classification of personal care activities**

The observational study requires a predefined classification of activities. Our research team has developed and applied a classification system of nursing work activities in a longitudinal work sampling study conducted in an Australian RAC home [9, 18-20]. This work activity classification system was further developed and revised through three focus group discussions with three researchers (including the researchers who developed it) and three RNs who had extensive experience working in aged care.

The final classification system contains 58 activities grouped into eight categories: direct care, indirect care, infection control, documentation, transit, staff breaks, verbal communication and other activities not included in the previous categories. The activities in each category are presented in Table 3.1.

**Table 3.1 Classification of personal care activities.**

Category	Activities
Direct care	Physical Assessment.
	Routine hygiene (e.g. daily shower or wash).
	Continence related hygiene (e.g. shower or wash following pad change).
	Oral Care.
	Shave or grooming.
	Toileting - prompted by a resident.
	Toileting - prompted by a personal care worker.
	Pad check.
	Pad change.
	Scheduled toileting.
	Dressing a resident.
	Resident mobility; passive & active exercises; turning a resident in bed.
	Medication administration.
	Specimen collection; urine collection.
	Assisting a resident with eating and drinking (include feeding systems).
	Assisting a resident with food (e.g. cutting up food, uncovering food or delivery of food).
	Care of the deceased; laying out.
	Assisting a resident with hand washing following the use of toilet.
	Assisting a resident with transfer to and from a bed, a chair, etc.
	Transferring a resident to or from dining room or board room.
	Weighing a resident.
	Assisting a resident to receive a phone call.
	Attending to a resident call for assistance.
Indirect care	Equipment set up (e.g. sling set up, shower chair set up).
	Resident shower set up (e.g. preparing shampoo, towel or body lotion).
	Bed making routine.
	Changing a bed following an incontinent episode.
	Cleaning up spills following an incontinent episode.
	Re-stocking supplies to a trolley.
	Re-stocking supplies to a resident's cupboard.
	Transporting linen to and from laundry.

	Transporting clinical waste for disposal.
	Using or cleaning up bed pans.
	Emptying a resident's meal plate.
	Collecting pads from a storage cupboard.
	Collecting a resident's clothes from his or her cupboard; putting clothes back to the cupboard.
	Sorting and putting a resident's clothes to his or her room.
Infection control	Putting on personal protective equipment.
	Taking off personal protective equipment.
	Alcohol hand washing (related to toileting or pad change).
	Alcohol hand washing (unrelated to toileting or pad change).
	Water hand washing (related to toileting or pad change).
	Water hand washing (unrelated to toileting or pad change).
Documentation	Locating or collecting a resident's records.
	Taking a photo of a resident.
	Reviewing or writing resident's clinical information; reading notes; viewing results.
	Putting records back to filing area.
Transit	Standing or walking in the corridor between activities.
Staff breaks	Personal errands (off unit chores; meal break; making personal telephone call).
Verbal communication	Asking for assistance from another personal care worker.
	Assisting another personal care worker to do his or her work.
	Participating in-service training.
	Communication of information about a resident (external).
	Communication of information about a resident (internal).
	Communicating with a resident.
	Communicating with a resident's family.
	Receiving a phone call; making a phone call.
Others	Other tasks not included

### 3.2.3. Ethical approval

Ethical approval was granted by the Human Research Ethics Committee of the University of Wollongong based on written approval given by the two participant aged care organisations which run the two RAC homes.

#### **3.2.4. Inter-rater reliability**

Our observation was conducted by a single observer. To ensure the reliability of the observation process, our observer and a second observer, who has extensive experience in conducting observational studies, independently observed and recorded the same activities of four PCWs for a period of four hours. Then a comparison of two hours of their records was conducted and discussed. A minimum agreement of more than 95% was achieved in the two records, suggesting the inter-rater reliability is adequate according to Pelletier and Duffield [21].

#### **3.2.5. Data collection**

The observation was performed in 2010. Before the observation, the nursing manager at each unit introduced the observer to the RNs and the PCWs. On each observational day, the observer arrived at the unit 15 minutes before the start of the observation to identify one of the PCWs for observation, using convenience sampling. The observer tried to observe different PCWs on different days to maximise the number of participants. At the start, the observer explained the purpose and procedure of the observation to the PCW. Only after written consent was given by the participant, was the observation conducted. A clinical handheld was used to record the observational data on an Excel spreadsheet.

For the first seven days of data collection at Unit 1 only the start time was recorded for the observed activities. Because the start time of the current activity is the end time of the previous activity, it was not necessary to record the end time. The observer noticed that a PC might only be speaking or might be performing some other activity concurrently. In order to correctly record verbal communication time, the data collection protocol was modified to include both the start time and end time of a verbal communication activity. At Unit 2, both start and end times of verbal communication activities were recorded from the beginning.

At Unit 1, a total of 11 PCWs were observed over a period of 14 days (three of the PCWs were observed twice). The observation was between the hours of 7:00 am and 14:00 or 15:00 pm on each day, depending on the observed PCW's finishing time.

At Unit 2, a total of 27 PCWs were observed over 16 days (five were observed twice). The observation was from 10:00 am to 17:00 pm. On each day, a morning shift PCW was observed first. After this individual finished work at 14:00 or 15:00 pm, an afternoon shift PCW was observed.

### **3.2.6. Data analysis**

The data were analysed in Microsoft Excel 2007, SPSS version 18.0 (SPSS inc., Chicago, IL, USA) and R version 2.12.1 [22]. The duration of each activity was calculated in Excel. Analysis concerning verbal communication at Unit 1 was based on the last seven days of observation since the end time was not recorded during the first seven observational days. A Z test was used to compare the percentage of time spent on each category of activities between the two units. A Pearson's chi square test was used to determine the difference between the two units in the number of activities which fell into different duration groups. Statistical significance was assumed when  $P < 0.05$ .

### **3.3. Results**

Fifty-one of the designated 58 activities were observed at Unit 1. The seven activities which were not observed are: 'care of the deceased or laying out', 'assisting a resident to receive a phone call', 're-stocking supplies to a resident's cupboard', 'using or cleaning up bed pans', 'sorting and putting a resident's clothes to his or her room', 'participating in-service training' and 'taking a photo of a resident'. Fifty-five of the designated activities were observed at Unit 2. The three activities which were not observed are: 'cleaning up spills following an incontinent episode', 're-stocking supplies to a resident's cupboard', and 'taking a photo of a resident'.

A total of 173 hours of observation and 11,283 events were recorded. Personal care workers usually worked in pairs to provide care to a resident. Throughout a shift, PCWs were

constantly conducting direct care, indirect care, infection control, verbal communication and transit activities. They did documentation at the end of the shift.

Table 3.2 shows the time spent on each category of activities, combining data from the two units. The percentages do not sum to 100% because verbal communication may occur either by itself or simultaneously with an activity from one of the other seven categories. This means that the percentage of time spent on verbal communication has overlaps with the other categories.

**Table 3.2 Time spent on each category of activities, combining the two units.**

Categories	Time (%)	95% Confidence intervals	
Direct care	30.7	28.7	32.8
Indirect care	17.6	16.3	18.8
Infection control	6.4	5.8	7.1
Documentation	3.1	2.5	3.7
Transit	4.6	3.9	5.2
Staff breaks	15.2	11.8	18.6
Verbal communication	59.2	53.7	64.6
Others	1.2	0.8	1.6

### 3.3.1. Activity time

At Unit 1, 81 hours of observation were recorded and at Unit 2, 92 hours were recorded. Table 3.3 presents the time, frequency and duration by activity category at each unit.

No statistically significant difference between the two units was found in the time spent on direct care, indirect care, infection control or staff breaks, and these activities took approximately 70.0% of the working time (Unit 1: 68.1%, Unit 2: 71.6%). As shown in Table 3.3, PCWs at Unit 2 spent significantly more time than their counterparts at Unit 1 on verbal communication (Unit 1: 47.3% vs. Unit 2: 63.5%,  $P = 0.003$ ), transit (Unit 1: 3.4% vs. Unit 2: 5.5%,  $P < 0.001$ ) and others (Unit 1: 0.5% vs. Unit 2: 1.8%,  $P < 0.001$ ). They spent less time, however, on documentation (Unit 1: 4.1% vs. Unit 2: 2.3%,  $P < 0.001$ ).

**Table 3.3 Time, frequency and duration by activity category at Unit 1 and Unit 2.**

Category	Unit	Time				Frequency per hour	Duration (seconds)			
		%	95% Confidence intervals		8-hour shift (h:m:s)		Mean	Standard deviation	95% Confidence intervals	
Direct care	1	30.9	28.7	33.0	2:28:05	14.5	75.6	143.5	67.4	83.8
	2	30.7	28.1	33.2	2:27:07	19.6	56.5	56.7	53.8	59.1
Indirect care	1	16.7	15.5	17.9	1:19:55	10.6	56.1	54.5	52.5	59.8
	2	18.4	16.7	20.2	1:28:22	13.2	50.5	46.8	47.9	53.2
Infection control	1	5.9	5.2	6.6	0:28:25	5.3	40.2	61.5	34.3	46.1
	2	6.8	6.1	7.6	0:32:46	8.8	28.2	24.5	26.5	29.9
Documentation	1	4.1 <sup>a</sup>	3.4	4.8	0:19:31	3.2	45.5	82.4	35.4	55.6
	2	2.3 <sup>b</sup>	1.7	3.0	0:11:13	1.4	58.8	80.7	44.9	72.7
Transit	1	3.4 <sup>a</sup>	3.0	3.9	0:16:29	3.0	41.3	46.7	35.4	47.2
	2	5.5 <sup>b</sup>	4.5	6.6	0:26:34	3.0	67.1	84.4	57.0	77.1
Staff breaks	1	14.6	10.9	18.4	1:10:17	0.6	880.1	817.5	642.7	1117.5
	2	15.7	11.0	20.4	1:15:24	0.7	815.0	845.4	603.8	1026.2
Verbal communication	1	47.3 <sup>a</sup>	39.3	55.3	3:47:00	18.8	90.7	140.9	80.0	101.5
	2	63.5 <sup>b</sup>	56.6	70.4	5:04:40	25.8	88.9	173.4	81.9	95.8
Others	1	0.5 <sup>a</sup>	0.3	0.7	0:02:24	0.2	96.3	70.0	57.6	135.1
	2	1.8 <sup>b</sup>	1.1	2.5	0:08:46	0.6	110.3	118.5	78.3	142.3

<sup>a,b</sup>Indicate significant difference between the two units in the percentage of time spent on this category of activities ( $P < 0.05$ ).

At Unit 1, the most time-consuming direct care activity was ‘assisting a resident with eating and drinking (include feeding systems)’ at 35 minutes over an eight-hour shift (see Appendix A supplementary table 1). At Unit 2, however ‘assisting a resident with transfer to and from a bed, a chair, etc.’ was the most time-consuming direct care activity, taking 29 minutes over an eight-hour shift. At both units, ‘Equipment set up (e.g. sling set up, shower chair set up)’ took the most indirect care time (Unit 1: 31 minutes, Unit 2: 38 minutes).

Most of the verbal communication time was spent on ‘communication of information about a resident (internal)’ (Unit 1: 1 hour and 53 minutes, Unit 2: 2 hours and 42 minutes) and ‘communicating with a resident’ (Unit 1: 1 hour and 51 minutes, Unit 2: 2 hours and 4

minutes). At both units, more than half of the verbal communication time was spent on concurrent verbal communication. Significant difference between the two units was found in the time spent on ‘communication of information about a resident (internal)’.

### **3.3.2. Activity frequency**

In one hour, there were 56 occurrences of activities at Unit 1 and 73 occurrences of activities at Unit 2. The most frequently occurring activity was verbal communication, followed by direct care and indirect care (Table 3.3).

### **3.3.3. Activity duration**

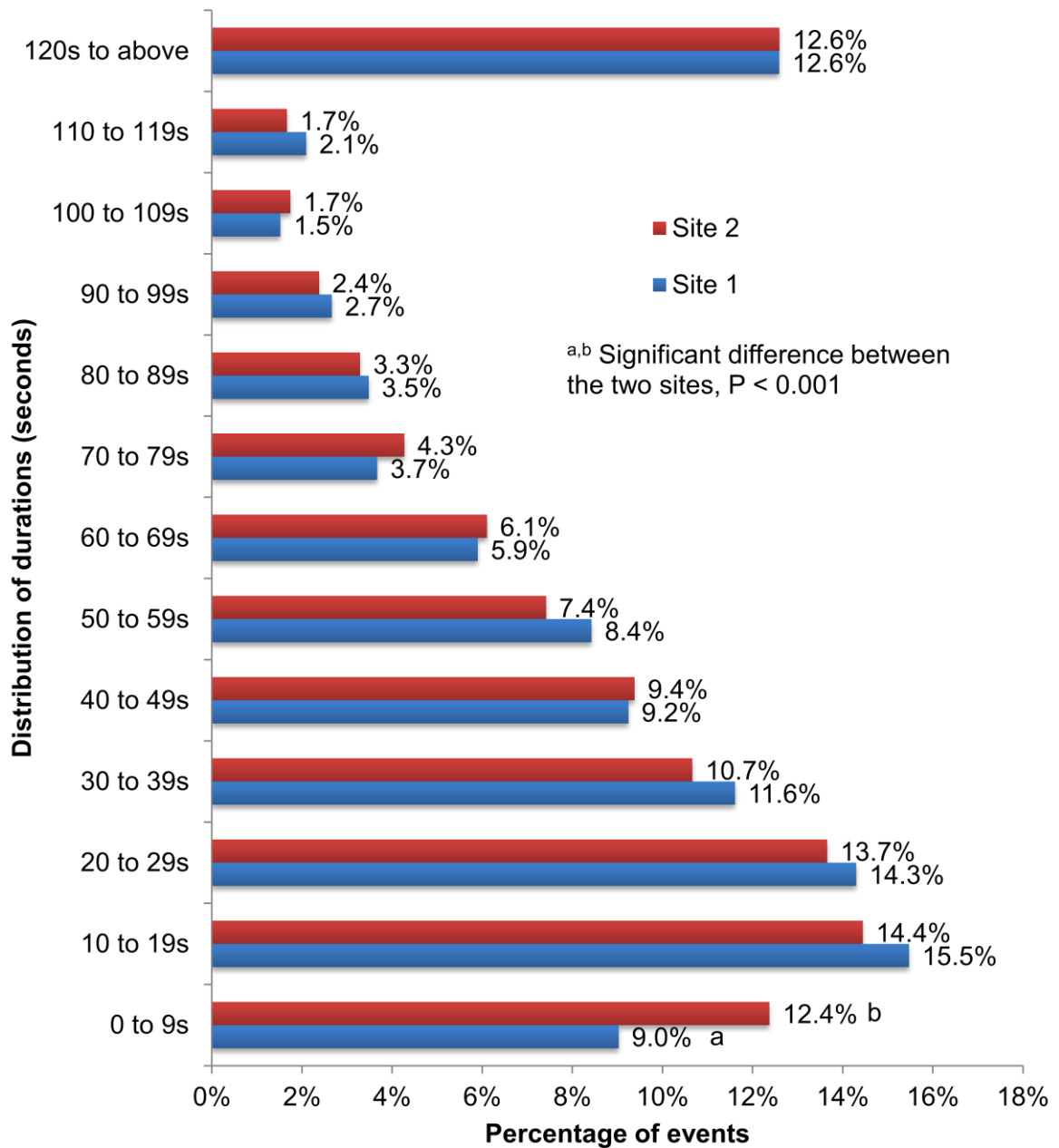
From the mean and standard deviation shown in Table 3.3, the activity duration was very short and varied dramatically. The short activity duration is also shown in Figure 3.1. Of the 3,679 occurrences of activities recorded at Unit 1 (excluding the 889 verbal communication which occurred in the first seven days), 9.0% were completed in less than 10 seconds, which was significantly shorter than at Unit 2 (12.4% of 6,715 occurrences of activities,  $P < 0.001$ ). 15.5% of the occurrences of activities recorded at Unit 1 and 14.5% at Unit 2 took between 10 and 19 seconds. Overall, more than two-thirds of the observed occurrences of activities at both units had duration of less than 1 minute. Time, frequency and duration of each activity can be found in Appendix A.

### **3.3.4. Switch between two consecutive activities**

A PCW frequently switched from one activity to another. On average, 49.8 switches between two consecutive activities were observed in an hour at Unit 1 and 62.5 switches were observed at Unit 2. A PCW switched from one activity to another at a rate of one per minute. Most of the switches were within or between verbal communication activities, direct care activities and indirect care activities. The directions of the most frequently observed switches were similar, as were the number of these switches at both units (Table 3.4).

**Table 3.4 Direction and number of the most frequently observed switches between two consecutive activities.**

<b>First activity</b>	<b>Second activity</b>	<b>Number of switches per hour</b>
Communicating with a resident.	Communication of information about a resident (internal).	1.6
Communication of information about a resident (internal).	Communicating with a resident.	1.6
Equipment set up (e.g. sling set up, shower chair set up).	Assisting a resident with transfer to and from a bed, a chair, etc.	1.1
Communicating with a resident.	Communicating with a resident.	0.9
Taking off personal protective equipment.	Water hand washing (related to toileting or pad change).	0.8
Communicating with a resident.	Equipment set up (e.g. sling set up, shower chair set up).	0.6
Assisting a resident with transfer to and from a bed, a chair, etc.	Equipment set up (e.g. sling set up, shower chair set up).	0.9



**Figure 3.1 Distribution of duration at Unit 1 and Unit 2.**

### 3.4. Discussion

In this study 56 out of the 58 designated activities performed by PCWs at two Australian RAC homes were measured. The activities were classified into eight categories: direct care, indirect care, infection control, documentation, transit, staff breaks, verbal communication and others. In comparison with a previous study in a single RAC home [9], this study provides a much more accurate and complete picture of how PCWs spend their time on work activities described in the following terms: actual time taken over an eight-hour shift, the time spent on it as a percentage of the time consumed by all of the observed activities, the activity frequency and duration. It also provides data on the switches between two consecutive activities. Our findings will be useful for nursing managers to understand how PCWs work and what the workload actually is in looking after residents with high-care needs in RAC homes. Although the care needs of the residents represented an uncontrolled variable in what was a natural setting, it appeared that a PCW's workload looking after residents and meeting their care needs was high in both RAC homes.

Personal care workers spent 30.7% of their time on direct care. This is less than the finding (40.2%) from a previous study by Munyisia *et al.* [9] which was also conducted in an Australian RAC home. Indirect care consumed 17.6% of PCWs' time, which is almost twice as the time (8.9%) obtained in the study by Munyisia. The difference in time may be caused by the different study design. For example, our study used time-motion technique to collect data while their study used a work sampling technique. The other possibility is that the differences are due to differences in care systems and practices in different RAC homes. Furthermore, in this study the percentage of time was calculated from the actual duration of activities, whereas their results were based on the number of occurrences of activities.

Further analysis needs to examine how direct care activities distributed throughout a shift and whether the direct care activities were spread out evenly over an hour or performed in quick succession, for example, at the beginning of the hour. This can make a significant difference to residential care, as was also mentioned in a previous study [10].

A current trend in RAC homes was to move from paper-based records to an electronic information system. One of the expected outcomes of using the electronic information system is to reduce documentation time and create more time for care delivery. In this study, we found that PCWs spent only 3% of their time on documentation, not much time could be saved from documentation.

Communication with a resident and communication of information about a resident are the prime verbal communication activities. This may be an indication that the PCWs had made an effort to spend time interacting with residents (e.g. explaining the care to a resident in order to receive cooperation from the resident) and cooperate with the working partners to provide care. The content of the verbal communication and the way it is conducted may be among the critical elements which most affect the quality of care.

Personal care workers not only spent a great deal of time on verbal communication, but also frequently switched between verbal communication, direct care and indirect care activities. This may indicate that verbal communication is one of the important activities which support direct care and indirect care.

Although the observational time periods at the two RAC homes were different (Unit 1: 7:00 to 14:00 or 15:00, Unit 2: 10:00 to 17:00), no statistically significant difference was found in the time spent on direct care, indirect care, infection control or staff breaks. These activities account for about 70.0% of a PCW's working time. This suggests that apart from the unavoidable breaks which all staff must take, these activities represent the core of PCWs' workload. Nursing managers need to consider this finding carefully when allocating tasks, staff number and skill mix on a shift.

Personal care workers at Unit 1 spent significantly less time on 'communication of information about a resident' than their counterparts at Unit 2. This may be associated with the difference in verbal communication skill of the PCWs. The PCWs at Unit 1 were non-native English speakers but their counterparts at Unit 2 were native English speakers. Verbal communication was less of a challenge for the PCWs at Unit 2.

The often short duration of activities and the quick and frequent switching between activities caused extreme busyness and some stress. The practical routine and familiarity with the residents and their individual needs help the PCWs arrange their work to cope with this. This routine and familiarity with the residents can facilitate the work. This was also found in a previous study [23].

Although routine and familiarity may support their work, a PCW does have to think about what to do next while performing the task at hand. Working in such a busy environment may lead to a cognitive overload, which may cause job fatigue and contributing, in turn, to nursing burn out. Therefore, nursing managers may need to consider which level of workload is appropriate for a PCW working in an RAC home.

Among the designated 58 work activities of PCWs, 56 were observed, suggesting that our activity classification system reflects a PCW's work activities in Australian RAC homes and provides a good reference for other studies of work activities in RAC homes.

### **3.5. Limitations**

The benefit of using a single observer is the potential consistency of the observations [24], however it may also cause systematic errors in observation. We addressed this potential limitation through an inter-rater reliability comparison study, which provided satisfactory results. There may be a 'Hawthorne effect' [13] (the participants might change their work behaviour under the observation) from PCWs being observed continuously, however we found that in the busy RAC home working environment, PCWs had to focus on their job and very soon ignored the existence of the observer. This was also found in previous studies [25, 26].

### **3.6. Conclusion**

We described the work pattern of PCWs in two Australian RAC homes. The work activities were examined using the following measurements: activity time, frequency, duration, and the switch between two consecutive activities. Fifty-six out of 58 designated work activities grouped into eight categories were observed. We found that direct care, indirect care,

infection control and staff breaks were the major part (70.0%) of the work and there was no statistically significant difference between the two RAC homes in the time spent on these activities. More than two-thirds of the observed activities at both units had a very short duration-- less than 1 minute. Personal care workers frequently switched within or between verbal communication, direct care and indirect care activities.

Our findings are useful for nursing managers for staff performance appraisal, task allocation, scheduling and cost estimation. The information may also help to design effective aged care services and provide possible research directions in RAC homes. Furthermore, it provides evidence for the government in funding allocation by accurately measuring the amount of time needed in conducting each category of care activities to meet a resident's relevant care needs. Further research on how verbal communication supports other types of care is needed.

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## **Chapter 4. Time Spent on Daytime Direct Care Activities by Personal Care Workers in Two Australian Residential Aged Care Homes: A Time-Motion Study**

### **Abstract**

This study aimed to examine the time, frequency and duration of each direct care activity conducted by PCWs in Australian RAC homes.

A time-motion study was conducted to observe 46 PCWs at two high-care units in two homes (14 days at Unit 1 and 16 days at Unit 2). Twenty-three direct care activities, including verbal communication with residents, were further classified into eight categories for analysis.

Overall, a personal care worker spent approximately 45% of time on direct care, corresponding to 3.5 hours in an 8-hour daytime shift. The two units had similar ratios of PCWs to residents and each resident received 30 minutes of direct care. No statistically significant differences between the two units were found in the time spent on verbal communication, personal hygiene and continence activities. Personal care workers at Unit 1 spent significantly less time on toileting and mobility activities than those at Unit 2, but more time on lunch activity. Although verbal communication took the longest time (2 hours), it occurred concurrently with other activities (e.g. dressing) for 1.5 hours.

The findings provide information that may assist decision makers in managing the operation of high-care residential aged care homes, such as planning for task allocation and staffing.

### **Introduction**

With a rapidly ageing population, the number of older people needing residential aged care in Australia is expected to increase [1]. The direct care workforce, however, has a chronic

shortage of trained staff [2]. This represents a big challenge for RAC homes to provide quality, safe, efficient and appropriate delivery of care.

Personal care workers provide personal care to meet aged care residents' daily needs (e.g. personal hygiene). Richardson and Martin in 'The Care of Older Australians A Picture of The Residential Aged Care Workforce' reported that more than 66% of PCWs felt that they did not have enough time to spend with each resident [3]. This leads to a question about how PCWs spent their time with residents.

Knowledge about how PCWs spent their time can improve nursing managers' understanding about the time required to directly meet residents' care needs, thus estimating staff workload. This can inform evidence-based decisions on whether task re-allocation is needed [4] in order to maintain quality of care and improve work efficiency [5].

In addition, this knowledge will set the baseline for examining the impact of any implemented change [4] such as introduction of an electronic information system [6-8]. Furthermore, such details are important in informing public policy or managerial decision on staffing levels [9], either for newly built aged care homes or existing homes in which resident case mix has changed.

In lean management, time is also an important measure [10]. Lean management aims to use less to do more [11]. By making the performance visible, reducing the number of non-value-adding activities, eliminating waste and standardising the work, lean management has the potential to optimise care processes [10-12]. The first step to lean management is making the care process visible and time is a key measure of the process [12].

Direct care activities are those directly involved with residents [13-15]. Previous studies have focused on the time spent on caring for dementia residents [16,17]. Several studies provided broad understanding of how PCWs spend their time. They reported that 30% - 45% of a PCW's time was spent on direct care in RAC homes [6,15,18]. None of these studies, however, reported how much time was allocated to each direct care activity in high-care

RAC homes. This limits the understanding about the time needed for meeting different care needs.

To fill this gap, this paper aims to examine how much time is spent on each direct care activity and the frequency and duration of conducting them.

## **Methods**

A time-motion observational study was conducted in 2010. An observer shadowed a participant and recorded this person's activities sequentially for a period of time using a pre-defined classification system of activities [19].

### **4.2.1. Classification of activities**

The classification system was developed over the course of three focus group discussions. Each focus group contained three researchers and three registered nurses (RNs) with extensive work experience in aged care. A previously validated classification system [14] was given to the focus group as an initial version. During the three discussions, this system was tuned to make it more appropriate for a time-motion study. The final version contained 58 activities which were grouped into direct care, indirect care, infection control, verbal communication, documentation, transit, staff breaks and other activities not included in the previous categories [15].

Activities presented in this paper are direct care activities and one activity (i.e. verbal communication with a resident) from the category of verbal communication. These activities were further classified into eight sub-categories, which were intended to provide adequate granularity, yet remaining abstract enough for conceptualisation and presentation (see Table 4.1). To name each category, the wording from the ACFI was used.

### **4.2.2. Settings**

Two RAC homes were recruited. The first, operated by a non-profit organisation, was located in Sydney and had 155 beds. The second was a stand-alone non-profit home in

Newcastle with 108 beds. Both RAC homes provided low and high care. Older people living in a low-care unit require limited help with their ADL, whereas those living in a high-care unit fully depend on care staff [20].

**Table 4.1 The classification system of direct care activities.**

<b>Direct care categories</b>	<b>Activities</b>
Assessment	1 Physical assessment.
	2 Specimen collection; urine collection.
	3 Weighing a resident.
Personal hygiene	4 Routine hygiene (e.g. daily shower or wash).
	5 Continence related hygiene (e.g. shower or wash following pad change).
	6 Oral care.
	7 Shave or grooming.
	8 Dressing a resident.
	9 Assisting a resident with hand washing following the use of toilet.
Toileting	10 Toileting - prompted by a resident.
	11 Toileting - prompted by a personal care worker.
	12 Scheduled toileting.
Continence	13 Pad check.
	14 Pad change.
Mobility	15 Resident mobility; passive & active exercises; turning a resident in bed.
	16 Assisting a resident with transfer to and from a bed, a chair, etc.
	17 Transferring a resident to or from the dining room or board room.
Medication	18 Medication administration.
Nutrition	19 Assisting a resident with eating and drinking (include feeding systems).
	20 Assisting a resident with food (e.g. cutting up, uncovering or delivery of food).
Verbal communication	21 Assisting a resident to receive a phone call.
	22 Attending to a resident call for assistance.
	23 Communication with a resident.

In Australia, 60% of the RAC homes are not-for-profit with 45% of them having more than 60 beds [21]. Among these large facilities which operated more than 60 beds, nearly 60%

provide both low and high care [2]. Our study RAC homes fell into this category of RAC homes.

Observations were conducted in two high-care units of the two study RAC homes. Unit 1 had 32 residents. One RN and 4.5 full-time equivalent PCWs worked in a daytime shift. Unit 2 had 23 residents who were looked after by one RN and three full-time PCWs.

#### **4.2.3. Ethics approval**

Ethics approval was acquired from the institutional ethics review board upon agreement from the participant RAC homes. Because only PCWs were observed, consent was not sought from residents. When a PCW was providing care to a resident in a bathroom or behind a privacy curtain, the observer stayed outside. The activities performed by the PCW were identified through listening to care instructions that the PCW gave to the resident.

#### **4.2.4. Training of the observer**

Observation was conducted by a single observer to maintain the consistency of recording. A six-hour orientation on observation practice was provided to the observer by a researcher experienced in observational studies in RAC homes. Both of them independently observed four PCWs in one shift at Unit 1. More than 95% agreement was achieved in their recorded data, with differences in the remaining 5% being resolved by discussion and consensus. According to the suggestion of Pelletier and Duffield [22], the observer had adequate competence to collect valid and reliable data.

#### **4.2.5. Selection of participants**

The observer randomly approached a PCW, explained the purpose and procedure of the study and asked for the person's written consent. Once the person gave written consent, the observation started. If consent was not given, the observer approached another PCW. Where possible, a different PCW was observed the next day to maximise the number of participants.

#### **4.2.6. Data collection**

The observer was introduced to the PCWs and RNs by the nursing manager one day before the formal observation. Because of resource constraint, observation time was confined to daytime shift (morning and part of afternoon shift). Once the observation started, no direct communication was made between the observer and the PCW.

At Unit 1, 11 PCWs were observed over 14 days. Three were observed twice. On each day, one PCW was continuously observed from 7 A.M. to either 2 or 3 P.M. At Unit 2, 27 PCWs were observed from 10 A.M. to 5 P.M. over 16 days, with five observed twice. Two PCWs were observed each day.

Activities and their start time were recorded sequentially in an Excel spreadsheet using a tablet computer. The start time of an activity was the end time of its precedent activity. During the first seven days at Unit 1, the observer noticed that when a PCW spoke with a resident, the person could simultaneously conduct another activity. Thus this communication was identified as ‘concurrent verbal communication’, whereas communication that happened on its own was recorded as ‘pure verbal communication’. To ensure an accurate recording of the time spent on verbal communication, the end time of each verbal communication was recorded for the remaining seven days at Unit 1 and for all 16 days at Unit 2.

#### **4.2.7. Data analysis**

Microsoft Excel 2007 and IBM SPSS Statistics Version 19.0.0 were used for data analysis. A 95% confidence interval was used to indicate data accuracy. Data about the communication with a resident during the first seven days at Unit 1 was excluded from the analysis since its end time was not recorded and concurrent communication could not be identified from the dataset.

Comparisons between the two units include a Z test on the percent of activity time and a Mann-Whitney U test on activity duration (see Table 4.2). Pearson’s chi square test was

performed on the number of activity instances (see Figure 4.1). A value for  $p$  of less than 0.05 was taken to indicate statistical significance.

Assessment and medication activities were not included in statistical comparison because their sample sizes were not large enough. The comparison of the time spent on nutrition activity was confined to lunch time to ensure a valid comparison, because at Unit 1 both breakfast and lunch were observed, but at Unit 2 only lunch was observed.

## **Results**

Overall, 45.4% of PCWs' time was spent on direct care activities, corresponding to 3.5 hours over an 8-hour daytime shift. 1,943 activity instances were recorded at Unit 1, with an average of 24 per hour, and 2,913 at Unit 2, with an average of 32 per hour.

### **4.3.1. Time spent with each resident**

Similar PCW-to-resident ratios were found at the two units (1:7.1 at Unit 1 and 1:7.7 at Unit 2). Each resident received a similar amount of direct care time (27 minutes at Unit 1 and 29 minutes at Unit 2) in an 8-hour shift.

### **4.3.2. Comparison of activity time**

No statistically significant difference between the two units was found in the overall time that a PCW spent on direct care (see Table 4.2). At both units, a PCW spent most time on verbal communication (2 hours), followed by personal hygiene (43 minutes). No significant differences between units were found in communication and personal hygiene, nor with continence activities.

Significant differences between the two units were found in toileting, mobility and lunch activities. A PCW at Unit 1 spent less time on toileting (Unit 1: 7 minutes vs. Unit 2: 17 minutes,  $p < .001$ ) and mobility activities (Unit 1: 34 minutes vs. Unit 2: 53 minutes,  $p < .001$ ) than a PCW at Unit 2, but more time on lunch activities (Unit 1: 26 minutes vs. Unit 2: 7 minutes,  $p < .001$ ).

#### **4.3.3. Comparison of activity duration**

In regard to the duration of an activity (see Table 4.2), a significant difference was only found in communication with a resident (Unit 1: 91 seconds vs. Unit 2: 72 seconds,  $p = 0.04$ ).

#### **4.3.4. Concurrent communication with a resident**

Among the three types of verbal communication activities (see Table 4.1), communication with a resident was the most time-consuming. It took about two hours in an 8-hour shift with 30 minutes spent on pure verbal communication and 1.5 hours on concurrent verbal communication (see Table 4.3). The time spent on conducting direct care activities while a PCW was talking to a resident was 54 minutes. This was less than the total time spent on concurrent verbal communication, because a PCW might be concurrently conducting an indirect care activity.

#### **4.3.5. Distribution of activities over hours**

Figure 4.1 shows the percent of instances of direct care activities for each hour over the observation period. No significant difference was found between the two units in the hours between 11 A.M. and 2 P.M. when 35.5% of activity instances occurred.

Figure 4.2 shows the distribution of each direct care activity over the observation hours. For example, at Unit 1 toileting activity occurred more frequently after breakfast (9 to 10 A.M., 16% of the toileting activities) and lunch (1 to 2 P.M., 37%) than the other hours. At Unit 2, toileting activity also peaked after meal time.

**Table 4.2 Time, frequency and duration of each direct care activity at the two units.**

**(Observation time: 7 A.M. to 2 or 3 P.M. at Unit 1; 10 A.M. to 5 P.M. at Unit 2.)**

Direct care activities		Equivalent 8 hours and percent of time		Frequency per hour		Duration (seconds) Mean (Standard deviation, 95% Confidence intervals)	
		Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
<b>Total</b>		<b>3:11:40 (39.93%)</b>	<b>3:39:39 (45.76%)</b>	<b>23.6</b>	<b>31.7</b>	<b>66.6 (122.1, 60.9 to 72.2)*</b>	<b>49.7 (52.3, 47.6 to 51.8)*</b>
Assessment information	1	0:01:03	0:00:06	0.09	0.02	90.4 (58.1, 36.7 to 144.1)	35.5 (26.2, -199.6 to 270.6)
	2	0:00:31	0:00:02	0.05	0.01	76.5 (18.1, 47.7 to 105.3)	18.0 (-)
	3	0:01:06	0:00:08	0.06	0.02	133.0 (122.4, -18.9 to 284.9)	47.5 (33.2, -251.1 to 346.1)
	<b>Total</b>	<b>0:02:40 (0.56%)</b>	<b>0:00:16 (0.06%)</b>	<b>0.20</b>	<b>0.05</b>	<b>100.2 (77.2, 59.1 to 141.4)</b>	<b>36.8 (24.4, 6.5 to 67.1)</b>
Personal hygiene	4	0:21:01	0:16:45	1.94	1.43	80.5 (92.1, 66.0 to 95.0)	87.8 (122.1, 66.8 to 108.8)
	5	0:01:57	0:02:40	0.16	0.32	90.0 (43.8, 63.5 to 116.5)	63.7 (62.1, 40.0 to 87.3)
	6	0:00:20	0:00:08	0.09	0.03	29.0 (13.1, 16.9 to 41.1)	32.0 (14.4, -3.8 to 67.8)
	7	0:01:14	0:00:07	0.07	0.02	123.0 (77.7, 41.5 to 204.6)	39.5 (17.7, -119.3 to 198.3)
	8	0:17:49	0:22:45	1.72	2.52	77.1 (64.7, 66.2 to 87.9)	67.8 (57.2, 60.4 to 75.2)
	9	0:00:58	0:00:46	0.15	0.15	48.8 (36.0, 25.9 to 71.6)	38.3 (20.1, 26.7 to 49.9)
	<b>Total</b>	<b>0:43:19 (9.02%)</b>	<b>0:43:11 (9.00%)</b>	<b>4.12</b>	<b>4.48</b>	<b>78.0 (77.7, 69.6 to 86.3)</b>	<b>72.5 (83.8, 64.4 to 80.6)</b>
Toileting	10	0:05:29	0:09:26	0.63	1.33	64.6 (46.3, 51.6 to 77.7)	53.5 (41.0, 46.2 to 60.9)
	11	0:01:09	0:06:21	0.14	0.85	62.7 (51.2, 28.3 to 97.1)	56.3 (50.4, 44.9 to 67.7)
	12	0:00:39	0:01:52	0.07	0.29	64.7 (61.9, -0.2 to 129.6)	47.9 (30.1, 36.0 to 59.8)
	<b>Total</b>	<b>0:07:17 (1.52%)*</b>	<b>0:17:39 (3.68%)*</b>	<b>0.84</b>	<b>2.47</b>	<b>64.3 (47.7, 52.8 to 75.9)</b>	<b>53.8 (43.3, 48.1 to 59.5)</b>
Continence	13	0:00:36	0:02:58	0.11	0.58	39.6 (45.9, 4.3 to 74.8)	38.8 (35.4, 29.1 to 48.6)
	14	0:08:19	0:09:02	1.09	1.25	56.8 (44.9, 47.3 to 66.3)	54.4 (35.9, 47.7 to 61.0)
	<b>Total</b>	<b>0:08:55 (1.86%)</b>	<b>0:12:00 (2.50%)</b>	<b>1.20</b>	<b>1.83</b>	<b>55.2 (45.0, 46.1 to 64.2)</b>	<b>49.5 (36.4, 43.9 to 55.0)</b>

Mobility	15	0:02:26	0:05:22	0.28	0.58	63.7 (68.0, 34.3 to 93.1)	70.0 (62.2, 52.9 to 87.1)
	16	0:19:46	0:28:45	2.19	3.84	67.1 (67.1, 57.2 to 77.1)	56.3 (40.9, 52.1 to 60.6)
	17	0:12:13	0:19:15	1.74	2.96	52.1 (39.6, 45.5 to 58.7)	49.0 (33.5, 45.0 to 53.0)
	<b>Total</b>	<b>0:34:25</b>	<b>0:53:22</b>	<b>4.21</b>	<b>7.37</b>	<b>60.7 (57.7, 54.5 to 66.8)</b>	<b>54.4 (40.6, 51.4 to 57.5)</b>
		<b>(7.17%)* (11.12%)*</b>					
Medication	18	<b>0:01:42</b>	<b>0:00:20</b>	<b>0.25</b>	<b>0.04</b>	<b>51.0 (39.9, 32.3 to 69.6)</b>	<b>58.3 (34.0, 4.1 to 112.4)</b>
		<b>(0.35%) (0.07%)</b>					
Nutrition	19	0:34:54	0:06:18	2.33	0.50	111.0 (162.1, 87.7 to 134.3)	94.8 (103.3, 64.1 to 125.5)
	20	0:04:22	0:09:34	0.59	1.45	54.7 (60.7, 37.1 to 72.3)	49.8 (47.1, 41.7 to 57.8)
	<b>Total</b>	<b>0:39:16</b>	<b>0:15:52</b>	<b>2.93</b>	<b>1.95</b>	<b>99.6 (148.9, 80.5 to 118.7)</b>	<b>61.3 (68.8, 51.2 to 71.5)</b>
		<b>(8.18%) (3.31%)</b>					
Verbal	21	-	0:00:17	-	0.07	-	32.7 (17.2, 14.6 to 50.7)
communication	22	0:10:32	0:04:08	0.79	1.34	98.9 (488.5, -23.2 to 220.9)	23.2 (18.6, 19.9 to 26.5)
	23	1:51:45	2:04:17	9.31	12.11	89.6 (129.3, 75.5 to 103.7)*	77.4 (118.1, 70.4 to 84.3)*
	<b>Total</b>	<b>2:02:17</b>	<b>2:08:42</b>	<b>10.10</b>	<b>13.51</b>	<b>91.1 (229.4, 68.3 to 114)*</b>	<b>71.8 (113.1, 65.5 to 78.1)*</b>
		<b>(25.48%) (26.81%)</b>					

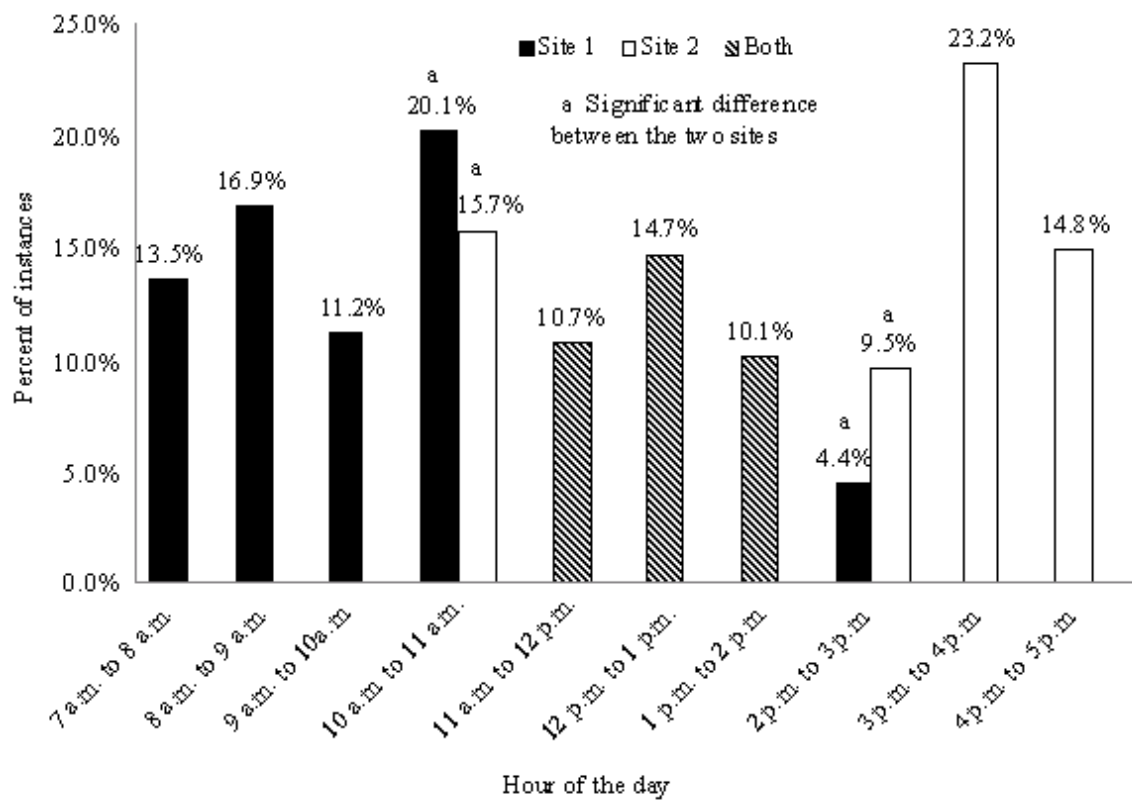
\*Statistically significant difference between the two units in the percent of time spent on an activity or in the duration of conducting an activity.  $p < .001$ .

\*Data about the communication with a resident during the first seven days at Unit 1 was excluded from the analysis because its end time was not recorded and concurrent communication could not be identified. The percent of time spent on assessment and medication at the two units was not compared as their sample sizes were not large enough for statistical comparison. The total time spent on nutrition was not compared due to different observation time period at the two units, but lunch time was compared and is presented in the text.

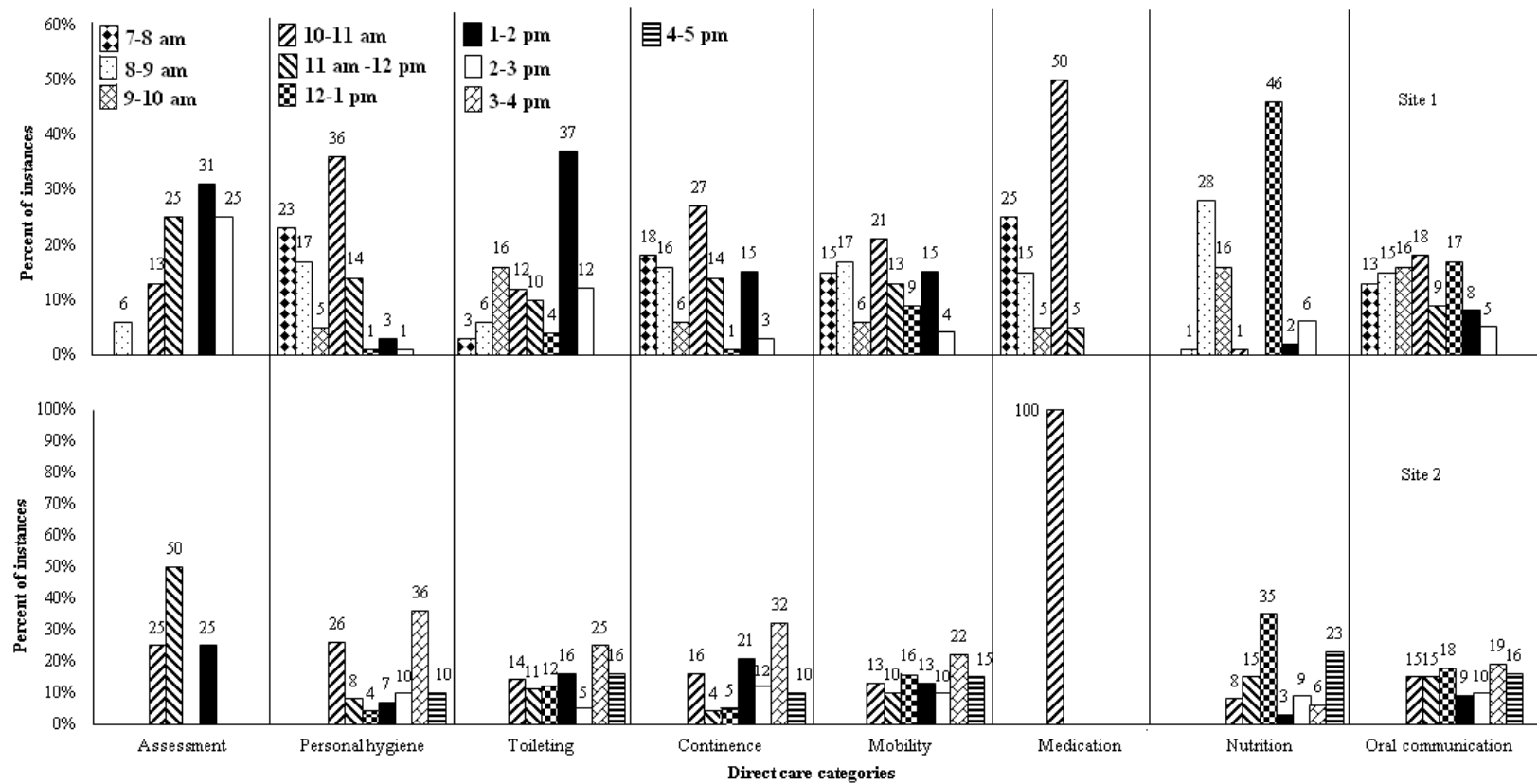
**Table 4.3 The direct care activities that happened concurrently with communication with a resident.**

Activities		8-hour shift (h:m:s)	Categories
Communication with a resident	Pure	0:32:01	Verbal communication
	Concurrent	1:28:53	
	<b>Total</b>	<b>2:00:54</b>	
Direct care activities that concurrently occur with communication with a resident	Routine hygiene (e.g. daily shower or wash).	0:10:01	Personal hygiene
	Dressing a resident.	0:09:35	Personal hygiene
	Assisting a resident with transfer to and from a bed, a chair, etc.	0:08:56	Mobility
	Transferring a resident to or from the dining room or board room.	0:08:06	Mobility
	Toileting - prompted by a resident.	0:05:06	Toileting
	Pad change.	0:02:55	Continence
	Assisting a resident with eating and drinking (include feeding systems).	0:02:54	Nutrition
	Resident mobility; passive & active exercises; turning a resident in bed.	0:02:05	Mobility
	Assisting a resident with food (e.g. cutting up, uncovering or delivery of food).	0:01:57	Nutrition
	Toileting - prompted by a personal care worker.	0:01:07	Toileting
<b>Total</b>		<b>0:54:00</b>	

Combined the two units data collected after the first 7 days of observation.



**Figure 4.1 Percent of instances of direct care distributed in different hours over the observation periods at Unit 1 and Unit 2.**



**Figure 4.2 The percent of instances of each category of activities distributed in different hours over the observation periods.**

(The percent is marked on the top of each bar)

## 1    **Discussion**

2    In an RAC home, some of a resident's daily care needs, such as meals, must be met on a  
3    regular schedule. Some care needs, such as recreational activity, can be delivered at a  
4    relatively flexible time interval. Other activities might happen randomly depending on  
5    the health condition, psychological and physical well-being of the person on the day.  
6    These randomly timed activities make it a challenge to predict what the next care  
7    activity will be and how much time is required to complete it. This has increased the  
8    challenge for the managers in RAC homes to adequately plan and deliver care services  
9    that meet older people's needs.

10   This study provided information relevant to the patterns of direct care activities which  
11   may be of help to managers and other staff in RAC homes. As the two study RAC  
12   homes were completely independent of each other in their organisation of care services,  
13   facility layout and care staff, some common findings at both facilities might be  
14   applicable to other high-care services in Australian residential aged care.

### 15   **4.4.1. The common findings at both RAC homes**

16   The time recorded in this study was that spent on directly interacting with a resident  
17   rather than the full time needed to complete a direct care task, which may involve other  
18   activities such as indirect care. For example, to complete a shower task, a PCW needs to  
19   first complete certain indirect care activities such as preparing towel.

20   The common findings at both units include (1) no significant difference was found in  
21   the overall time spent on direct care; (2) the PCW-to-resident ratio was about one PCW  
22   to seven or eight residents in a high-care RAC home. This may indicate that there could  
23   be a basic, common staff ratio that was followed by service providers to run a high-care  
24   home; (3) on average, each resident received 30 minutes of direct care in an 8-hour day  
25   shift; (4) no significant difference between the two units was found in the time spent on  
26   verbal communication, personal hygiene and continence activities; (5) no significant  
27   difference was found in the percent of direct care activities that occurred between 11  
28   A.M. and 2 P.M., which might suggest that residents' needs over this period of time were  
29   similar; (6) the high occurrence of toileting activities after meal time at both units may

1 indicate that residents' toileting need was high after meals. This high toileting need may  
2 be because that PCWs were busy with food delivery or assisting residents with eating  
3 and drinking during the meal time, therefore they postponed residents' toileting requests  
4 arose during the meal time.

5 Previous studies [6,15,18] only presented the total direct care time which was consistent  
6 with the first point presented above, but did not address the other points. This study has  
7 advanced knowledge by providing more detailed information about each direct care  
8 activity. Nursing managers may use this knowledge to estimate staff workload, make  
9 decisions on task re-allocation [4] and staffing levels [9], evaluate the impact of  
10 implemented changes [4] and develop strategies to optimise care processes.

11 These findings were drawn from the observational studies conducted in two RAC  
12 homes and contextual factors should be considered when referencing the findings of this  
13 study. The generalisability of the findings should be validated by a larger scale of  
14 investigation to inform public policy on staffing levels.

#### 15 **4.4.2. The differences in toileting and mobility activities**

16 Personal care workers at Unit 1 spent significant less time on toileting and mobility  
17 activities than their counterparts at Unit 2 and conducted these two activities less  
18 frequently. This may be due to the difference in functional dependence levels of the  
19 residents. Another possible reason could be the different toileting practices — ceiling  
20 hoist system was used at Unit 2 but not at Unit 1.

21 Assistive technologies may reduce physical burden on PCWs [23] and the convenience  
22 of using them might motivate PCWs to deliver toileting care more often to maintain  
23 residents' continence. If not used only when necessary, however, it has the potential to  
24 reduce the frequency with which residents are assisted to walk. In turn, this might lead  
25 to dramatic loss of their walking ability which is a serious problem.

#### 26 **4.4.3. Communication with residents**

27 Similar to what was found by a previous study [6], verbal communication was often  
28 conducted concurrently with direct care activities. A verbal communication could be

1 instrumental or social. It was likely that, while conducting a direct care activity, a PCW  
2 spoke with the resident to instruct the person in a care task so as to acquire cooperation  
3 [6,15] or for the purpose of social engagement.

4 Communication with residents is essential for increasing familiarity and maintaining  
5 personal relationship with residents and these contribute to the maintenance of residents'  
6 sense of competence and dignity [24]. Future research may examine how much social  
7 communication was engaged in while completing an instrumental task and how much  
8 occurred outside this task. This is important in the context of promoting person-centred  
9 care.

## 10 **Limitations**

11 The results may not be representative of aged care homes nationally because the units  
12 were not selected on this basis. The exclusion of some of the communication data at  
13 Unit 1 was also a limitation of this study.

14 There was a potential for PCWs to change work behaviour under constant observation  
15 due to the Hawthorne effect [25]. Several previous studies in healthcare settings,  
16 including RAC homes, have suggested that the Hawthorne effect is not significant in  
17 direct observation [6,26,27], consequently we did not measure it in this study.

18 Data about the functional dependence levels of residents, such as their ability to feed  
19 themselves, were not collected, but the managers at both units suggested that their  
20 residents need high care.

21 As the observer did not directly observe a PCW when they were providing care in a  
22 bathroom or behind a privacy curtain, there could be inaccuracy in recording activities  
23 when a PCW was socialising with a resident. In this situation, the activity was indicated  
24 by the activity that was performed initially. There was no way to examine how much  
25 difference was generated by this practice under the ethics condition of this study.

26 It was possible that the recorded time on verbal communication was increased by the  
27 effort made by a PCW to allow the observer to hear the care instructions. As the care  
28 instructions were necessary in provision of care and no direct communication was made

1 between the observer and the PCW, it was assumed that there was minimal impact on  
2 communication time.

### 3 **Conclusion**

4 We conducted a time-motion study in two high-care units in two Australian RAC homes  
5 to examine the time, frequency and duration of 23 direct care activities that meet older  
6 people's day-to-day care needs. At both units, a PCW spent 3.5 hours on direct care in  
7 an 8-hour shift, with 30 minutes for each resident. The PCW-to-resident ratios were  
8 similar at the two units (one PCW looked after seven to eight residents). No significant  
9 difference between the two units was found in the time spent on verbal communication,  
10 personal hygiene and continence activities. Personal care workers at Unit 1 spent less  
11 time on toileting and mobility activities but more time on lunch than their counterparts  
12 at Unit 2. The pattern of occurrence of each care activity in different hours was also  
13 investigated.

14 Further investigation about the care process, such as identifying non-value-adding  
15 activities, examining equipment changeover time and resident's waiting time before  
16 needs are met, is needed to improve process ability to meet residents' needs.

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## 1     **Chapter 5. The Work Pattern of Nursing Care Staff in a Residential** 2                             **Aged Care Home: A Time-Motion Study**

### 3     **Abstract**

4     Residential aged care services are challenged by an increasing number of residents and  
5     a shortage of nursing staff. Developing strategies to overcome this challenge requires an  
6     understanding of nursing care staff work patterns. This study aimed to investigate  
7     nursing work processes and time usage in a residential aged care home.

8     Nursing care activities were classified into ten categories: medication administration,  
9     wound care, physical review, infection control, verbal communication (pure and  
10    concurrent), documentation (electronic and paper-based), print and fax, transit, staff  
11    breaks and other. An observational time-motion study was conducted at two units of a  
12    residential aged care home where 97% of residents needed high level care. Seven  
13    nursing care staff of two care units were observed over 12 morning shifts, one  
14    participant each day. Medication administration was documented electronically at one  
15    unit but on paper in the other unit. Nursing work processes and time usage for  
16    conducting activities were analysed.

17   A total of 14,073 activities were recorded over 98 hours of observation. All the nursing  
18   care staff followed a common work process. No significant difference between the two  
19   units was found in the time nursing care staff spent on each category of activities,  
20   although documentation tools for medication administration were different. The biggest  
21   proportion of their time was spent on verbal communication (28%), with four fifths of  
22   this proportion spent on pure verbal communication. Medication administration (25.9%)  
23   was the second most time-consuming activity, followed by documentation (19.4%).  
24   Verbal communication, medication administration and documentation were also the  
25   most frequently conducted activities. The average duration of each activity category was  
26   less than one minute, except for staff breaks and other. Individual nursing care staff  
27   conducted activities in a similar pattern, with slight differences noted within the  
28   infection control and wound care.

1 Task and time determine the organisation of the work process. An electronic  
2 documentation tool may not alter nursing care staff's time utilisation. There could be a  
3 basic amount of time required for caring for a resident needing high level care. Verbal  
4 communication played an important role in care provision.

## 5 **Introduction**

6 It is estimated that the proportion of the Australian population aged 65 years or over  
7 will increase from 14% to 25% over the next 40 years [1]. This will substantially  
8 increase the demand for RAC homes. The situation is worsened by the chronic shortage  
9 of skilled nursing care staff, high staff turnover and staff aging [2]. All of these factors  
10 create a considerable challenge for the delivery of high quality, safe and efficient aged  
11 care services.

12 Strategies like task re-allocation, process management and introduction of information  
13 technologies are promising to help RAC homes to overcome these challenges. However,  
14 the development and implementation of these strategies require a basic knowledge of  
15 the processes of actual care provision in RAC homes.

16 Two major care services that a resident receives in an RAC home are personal care and  
17 nursing care. Personal care services include help with ADL, such as eating, dressing and  
18 grooming [3]. Nursing care services include management of residents' health conditions,  
19 such as medication management, wound care and pain management [3].

20 Studies on personal care activities have examined nursing care staff's time spent on  
21 these activities in RAC homes [4-11], with a couple described PCWs' work processes in  
22 conducting specific activities (e.g. bathing, oral care) [8, 10].

23 Studies on nursing care mostly focused on medication management as it is crucial to  
24 resident safety [12-17]. For example, Ellis et al. conducted focus group discussions with  
25 nurses, finding that nurses needed to collect detailed information about residents and  
26 medication before using various techniques to effectively administer medication [13].  
27 Thomson et al. conducted a time-motion study to examine nurses' time spent on each of  
28 the pre-defined seven steps in medication administration. They found that medication  
29 preparation and provision required longer time than any other steps [15].

1 However, medication management is only one of several nursing tasks. To fully  
2 understand the nature of nursing care in RAC homes, knowledge of nursing care staff  
3 work processes in providing other types of care is also needed. This knowledge is  
4 helpful for nursing managers to understand how nursing care services are actually  
5 delivered on the floor. It will facilitate the development of targeted strategies to improve  
6 the quality of nursing care services and better planning for any incidental adverse  
7 changes in nursing care processes. To our knowledge, only one study explored nursing  
8 care staff work processes in an RAC home and it focused on wound care [18].

9 Therefore, this study aimed to describe nursing care staff work processes in providing  
10 nursing care and to examine the time, frequency and duration of each activity.

## 11 **Methods**

12 The study was conducted from June to September 2013. The study procedure consisted  
13 of three stages: preliminary study, pilot study and data collection. The preliminary study  
14 was aimed at developing a classification of nursing care staff activities to be used in  
15 time-motion observations. The pilot study tested the feasibility of the data collection  
16 tool. It also enabled the observer to gain proficiency in observation by practising use of  
17 the activity classification system. Afterwards, the observer moved on to collect  
18 empirical data that would be used for analysis.

19 Ethics approval was granted by the university ethics board subject to the approval of the  
20 management of the aged care organisation.

### 21 **5.2.1. The preliminary study**

22 The preliminary study was conducted in five morning shifts (6:30 a.m. to 3 p.m.) at  
23 three units of an RAC home and one unit of another RAC home. One RN who worked  
24 at the three units and one EEN who worked at the other unit were observed. Each day,  
25 the researcher followed one person to record their activities on paper. The activities  
26 were then entered into an Excel spreadsheet for grouping. A discussion with an  
27 experienced RN who had worked and researched in RAC homes led to a classification  
28 system of 116 activities grouped into ten categories.

1 The classification system was then validated by two facility managers, two RNs and one  
2 EEN who worked in the two RAC homes. The content validity ratio for each activity  
3 ranged from 0.6 (agreed by four of the five reviewers) to 1.0 (agreed by all five  
4 reviewers). There was unanimous agreement on 96% of the activities. Table 5.1 shows  
5 the resultant classification system of nursing care staff activities.

6

1 **Table 5.1 Classification of nursing care staff activities.**

Categories	Activities
<b>Medication administration</b>	<b>Preparation</b>
	preparing a medication trolley (e.g. put packed medication on to the trolley)
	locating or identifying a resident (e.g. look for a resident in a dining room, check if a resident is ready for medication)
	identifying an S8 drug (Schedule 8 drugs of addiction) (e.g. open the locked cabinet, find a drug)
	preparing/assisting preparation of S8 drugs tablet
	preparing/assisting preparation of S8 drugs liquid
	preparing/assisting preparation of S8 drugs injection
	preparing/assisting preparation of S8 drugs patch
	preparing/assisting preparation of S8 drugs via PEG (percutaneous endoscopic gastrostomy) feeding tubes
	identifying an ordinary medication from the trolley
	preparing ordinary tablet medication
	preparing liquid medication
	preparing powder medication (e.g. movicol)
	preparing eye drops/ointment
	preparing injection (e.g. B12, insulin)
	preparing puffer/inhaler
	preparing nebuliser
	preparing patch
	preparing topical medication (e.g. cream)
	preparing resource (i.e. nutrition drink)
	preparing for PEG feeding
	preparing a cup of water/juice
	preparing equipment for BGL (blood glucose level) checking
	checking BGL
	bringing prepared medication and other supplies (e.g. tissue) to a resident
	preparing PRN medication
	preparing a resident for medication provision
	<b>Provision</b>
	providing/assisting provision of S8 drugs tablet
	providing/assisting provision of S8 drugs liquid
	providing/assisting provision of S8 drugs injection
	providing/assisting provision of S8 drugs patch

	providing/assisting provision of S8 drugs via PEG feeding tubes
	providing ordinary tablet medication
	providing liquid medication
	providing powder medication (e.g. movicol)
	providing eye drops/ointment
	providing injection (e.g. B12, insulin)
	providing puffer/inhaler
	providing nebuliser
	providing patch
	providing topical medication (e.g. cream)
	providing resource (i.e. nutrition drink)
	providing medications via PEG feeding tubes
	providing a PRN medication
	<b>After provision</b>
	travelling back to medication trolley
	disposing clinical waste and general waste/put medication (e.g. eye drops) back on to trolley
	bringing/collecting spoons and cups to/from the wash up room or washing them
<b>Wound care</b>	preparing wound care trolley
	preparing for wound care (e.g. put supplies on to the trolley, prepare dressing)
	wound care for a resident
	cleaning wound care trolley
<b>Physical review</b>	preparing/organising physical review equipment (e.g. a blood pressure monitor)
	physical review for a resident
<b>Infection control</b>	alcohol handwash (medication-related)
	alcohol handwash (non-medication-related)
	water handwash (medication-related)
	water handwash (non-medication-related)
	putting on/taking off gloves (medication-related)
	putting on/taking off gloves (non-medication-related)
<b>Verbal communication</b>	verbal communication with a resident (medication-related)
	verbal communication with a resident (non-medication-related)
	verbal communication with another nurse (medication-related)
	verbal communication with another nurse (non-medication-related)
	verbal communication with a personal care worker (medication-related)
	verbal communication with a personal care worker (non-medication-related)
	verbal communication with other internal staff (e.g. physiotherapist) (medication-

	related)
	verbal communication with other internal staff (e.g. physiotherapist) (non-medication-related)
	verbal communication with an external health professional (e.g. a doctor) (medication-related)
	verbal communication with an external health professional (e.g. a doctor) (non-medication-related)
	verbal communication with a visitor (medication-related)
	verbal communication with a visitor (non-medication-related)
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(medication-related)
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(non-medication-related)
	shift handover
<b>Documentation</b>	<b>Paper-based documentation</b>
	collecting/putting a documentation book from/back to a filing area
	flipping an S8 drug documentation book
	reading an S8 drug documentation book
	writing in an S8 drug documentation book
	flipping medication administration records
	reading medication administration records
	writing in medication administration records
	reading daily medication orders
	writing on daily medication orders
	reading/writing on a paper note, handover sheet
	flipping a wound care book/form
	reading a wound care book/form
	writing in a wound care book/form
	flipping a physical review book/form
	reading a physical review book/form
	writing in a physical review book/form
	flipping other documentation books (e.g. diary)
	reading other documentation books (e.g. diary)
	writing in other documentation books (e.g. diary)
	filing a document in a filing tray or filing book
	<b>Electronic documentation</b>
	<b>Portable device</b>

	logging in/out the electronic system
	locating a resident's record in the electronic system on the portable device (medication-related)
	locating a resident's record in the electronic system on the portable device(non-medication-related)
	reading in the electronic system on the portable device(medication-related)
	reading in the electronic system on the portable device (non-medication-related)
	ticking/entering medication-related information in the electronic system on the portable device
	non-medication-related activities in the electronic system on the portable device
	<b>Desktop computer</b>
	logging in/out of a desktop computer
	login/out the electronic system on a desktop computer
	locating a form in the electronic system on a desktop computer (medication-related)
	locating a form in the electronic system on a desktop computer (non-medication-related)
	reading data in the electronic system on a desktop computer (medication-related)
	reading data in the electronic system on a desktop computer (non-medication-related)
	entering data in the electronic system on a desktop computer (medication-related)
	entering data in the electronic system on a desktop computer (non-medication-related)
<b>Print and fax</b>	preparing a fax cover sheet (either type on computer or handwrite on a piece of paper)
	faxing documents (e.g. stamp "faxed" on a faxed document, file a faxed document)
	printing/photocopying a document (e.g. form for transferring a resident to hospital )
<b>Transit</b>	pushing a medication trolley
	pushing other trolley or pulling a trailer (e.g. wound care trolley)
	walking/standing in corridor, dining room, etc.
<b>Staff breaks</b>	staff breaks (e.g. lunch break)
<b>Other</b>	other activities not included above

1

## 2 5.2.2. The pilot study

3 The pilot study was conducted in seven morning shifts in eight units of the two RAC  
4 homes that were involved in the preliminary study. One day was spent on testing the  
5 feasibility of three data collection tools: iPad, iPod touch and a tablet with Windows XP  
6 system. Weighing the trade-offs of various parameters such as device weight, screen  
7 size, touchscreen sensitivity and battery life, the iPad was considered the optimal  
8 available tool for data collection.

1 The data collector practised using the iPad to conduct time-motion observation for six  
2 more days. A commercial software InMotion Pro[19] was installed on the iPad to record  
3 time-motion data in appropriating its functions of recording the start and end time and  
4 the duration of an activity when the observer hit the activity button on the touchscreen.

### 5 **5.2.3. Empirical data collection**

6 The formal data collection was conducted in 12 morning shifts in two units of an RAC  
7 home, six days at each unit. Ninety-seven percent of residents required a high level of  
8 care in these units. In each unit, one nursing care staff provided nursing care and six  
9 PCWs provided personal care to the residents.

10 Unit 1 had 38 beds and Unit 2 had 40 beds. Medication administration was documented  
11 electronically for 18 months at Unit 1 but on paper at Unit 2. At both units, wound care  
12 and physical review were documented on paper, and then transcribed to desktop  
13 computers.

14 In a typical morning shift at both units, Schedule 8 (S8) drugs were administered by an  
15 RN with the assistance of an EEN or a PCW, and ordinary medications were  
16 administered by an RN or an EEN. At Unit 2, ordinary medications could also be  
17 administered by a PCW with Certificate IV Level II in medication management.

18 Participants of the time-motion observations were seven nursing care staff who  
19 regularly administered ordinary medications. They were one RN, four EENs and two  
20 PCWs with Certificate IV Level II in medication management. Occasionally, they  
21 assisted with S8 drug administration and documentation. In each shift, one nurse was  
22 observed.

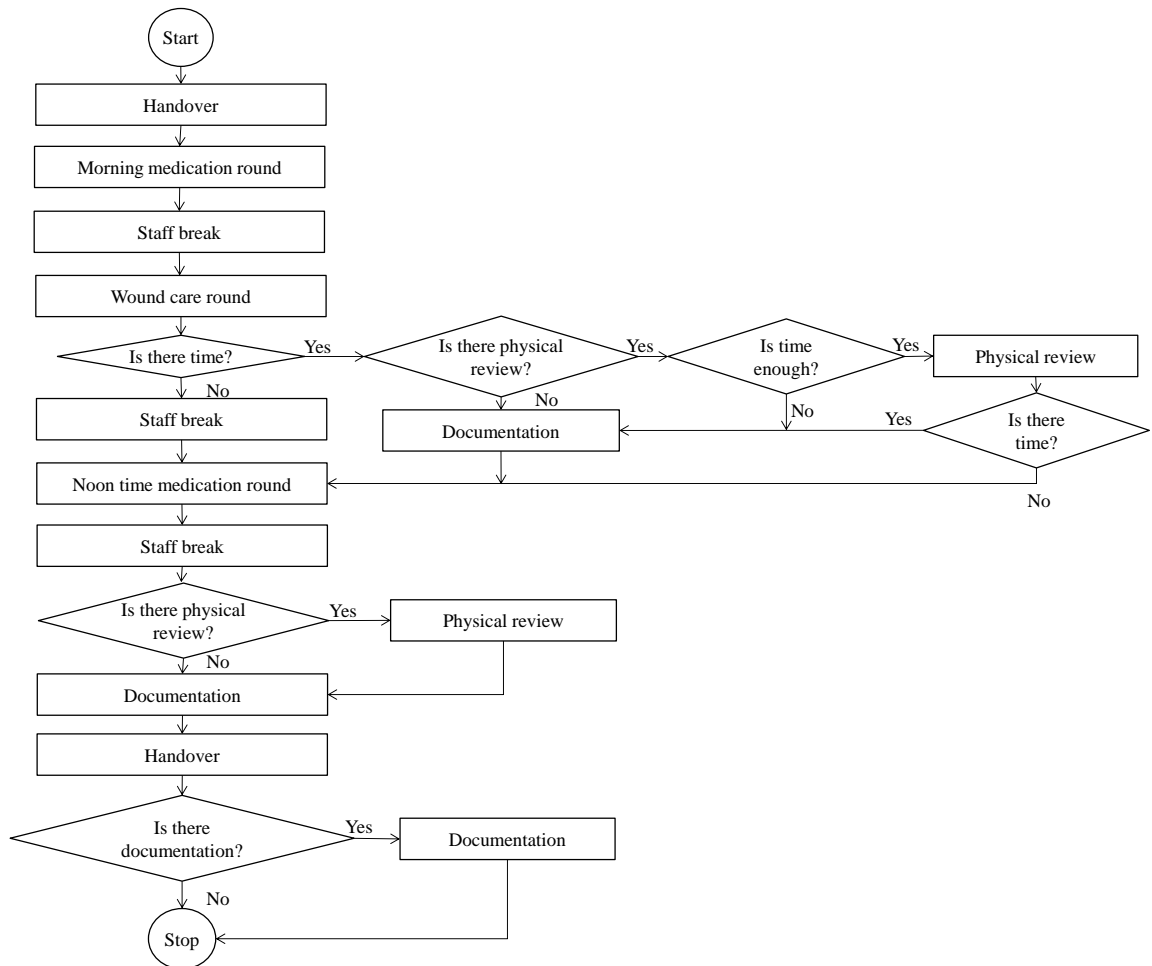
### 23 **5.2.4. Data analysis**

24 Data was exported to Excel spreadsheets for analysis. The unit of statistical analysis  
25 was the activity. A Z test was used to compare the percentage of time a nurse spent on  
26 each category of activities between the two units. Statistical significance was assumed if  
27 the p value was less than 0.05. A diagram about nursing care staff's work processes in  
28 the morning shift was drawn and presented to the nurse participants who provided  
29 feedback for revision. This led to the production of a validated process diagram.

## 1 Results

### 2 5.3.1. A common work process of nursing care staff in morning shifts

3 Figure 5.1 illustrates a common work process that nursing care staff followed in  
 4 morning shifts. The shift started and ended with handovers. Three major tasks that a  
 5 nurse performed during the shift were medication administration, wound care and  
 6 documentation. The nurse did documentation both at the point-of-care and also after  
 7 care provision. If the nurse had time, he or she would do a physical review. Otherwise  
 8 this task would be allocated to a PCW. Nursing care staff took a break after the morning  
 9 medication round and before and after the noon medication round.



11 **Figure 5.1 A common work process of nursing care staff in morning shifts.**

### 1    **5.3.2. Activity time**

2    Ninety-one hours of work were observed. More than 70% of nursing care staff's time  
3    was spent on verbal communication (28%), medication administration (25.9%) and  
4    documentation (19.4%). As shown in Table 5.2, there was no significant difference  
5    between the two units in the time spent on these categories of activities.

6    However, significant differences were noted when examining the subcategories of  
7    verbal communication and documentation. The proportion of time nursing care staff  
8    spent on concurrent verbal communication at Unit 1 (5.7%) was significantly more than  
9    it was at Unit 2 (4.0%).

10    As portable devices were used for medication documentation at Unit 1 but paper was  
11    used at Unit 2, the time needed for documenting electronically and on paper was  
12    significantly different between the two units. However, the proportion of time nursing  
13    care staff spent on desktop computers did not differ between the two units (8.0% at Unit  
14    1, 6.3% at Unit 2).

15    In an eight-hour shift, nursing care staff spent less than an hour on staff breaks, half an  
16    hour on transit activities, 20 minutes on wound care and 12 minutes on infection control  
17    activities. They spent the least amount of time on physical review, print and fax.

### 18    **5.3.3. Activity duration**

19    As shown in Table 5.2, except staff breaks and other, the average duration of each  
20    activity category was less than one minute. The duration of each activity can be found in  
21    the Appendix A supplementary table 3.

### 22    **5.3.4. Activity frequency**

23    A total of 14,073 activities were recorded (7,012 at Unit 1 and 7,061 at Unit 2). Figure  
24    5.2 shows the average number of occurrences of each activity in each hour during a  
25    morning shift. The most frequently conducted activities, medication administration,  
26    verbal communication and documentation, followed similar patterns over time, peaking  
27    between 7 a.m. and 9 a.m., and again between 12 p.m. and 1 p.m. Wound care was done  
28    mainly between 10 a.m. and 12 p.m. The number of infection control and transit  
29    activities fluctuated slightly over time.

1 **Table 5.2 Nursing care staff's time spent on each category of activities.**

	Unit 1		Unit 2		p value	Both units
	% (95% CI)	8 hour (h:m:s)	% (95% CI)	8 hour (h:m:s)		Duration (seconds) mean (SD)
<b>Medication administration</b>	26.6 (23.7, 29.4)	2:7:29	25.1 (22.7, 27.6)	2:0:40	0.459	18 (24)
Preparation	16.0 (14.2, 17.8)	1:16:49	16.9 (15.0, 18.8)	1:21:7	0.504	18 (23)
Provision	8.0 (6.6, 9.4)	0:38:33	6.0 (5.1, 7.0)	0:28:57	0.983	31 (33)
After provision	2.5 (2.1, 2.9)	0:12:5	2.2 (1.8, 2.6)	0:10:35	0.271	8 (10)
<b>Wound care</b>	4.5 (3.4, 5.6)	0:21:29	4.4 (3.5, 5.2)	0:20:56	0.871	44 (41)
<b>Physical review</b>	0.2 (0.0, 0.4)	0:1:1	0.3 (0.1, 0.5)	0:1:26	0.569	38 (37)
<b>Infection control</b>	2.5 (2.0, 3.0)	0:12:6	2.8 (2.3, 3.3)	0:13:30	0.406	11 (15)
<b>Verbal communication</b>	28.9 (23.7, 34.2)	2:18:46	27.2 (22.7, 31.7)	2:10:23	0.620	27 (84)
Pure	23.2 (18.2, 28.1)	1:51:11	23.2 (18.9, 27.5)	1:51:17	0.995	31 (97)
Concurrent	5.7 (4.6, 6.9)	0:27:35	4.0 (3.0, 5.0)	0:19:5	0.021	17 (34)
<b>Documentation</b>	18.2 (15.9, 20.6)	1:27:34	20.6 (18.4, 22.7)	1:38:45	0.152	18 (29)
Paper-based documentation	5.7 (4.4, 7.0)	0:27:17	14.3 (12.8, 15.8)	1:8:44	<0.0001	17 (26)
Electronic documentation	12.6 (10.8, 14.3)	1:0:16	6.3 (5.1, 7.4)	0:30:1	<0.0001	21 (32)
Portable device	4.5 (3.9, 5.1)	0:21:49	-	-	-	9 (10)
Desktop computer	8.0 (6.5, 9.5)	0:38:26	6.3 (5.1, 7.4)	0:30:1	0.068	38 (42)
<b>Print and fax</b>	0.3 (0.1, 0.5)	0:1:29	0.5 (0.1, 0.9)	0:2:28	0.366	47 (50)
<b>Transit</b>	7.0 (5.9, 8.0)	0:33:21	7.1 (6.2, 8.1)	0:34:16	0.790	22 (20)

<b>Staff breaks</b>	12.1 (4.9, 19.3)	0:58:6	9.9 (4.2, 15.6)	0:47:33	0.639	455 (631)
<b>Other</b>	5.4 (3.3, 7.5)	0:25:53	6.1 (3.8, 8.3)	0:29:4	0.673	69 (136)

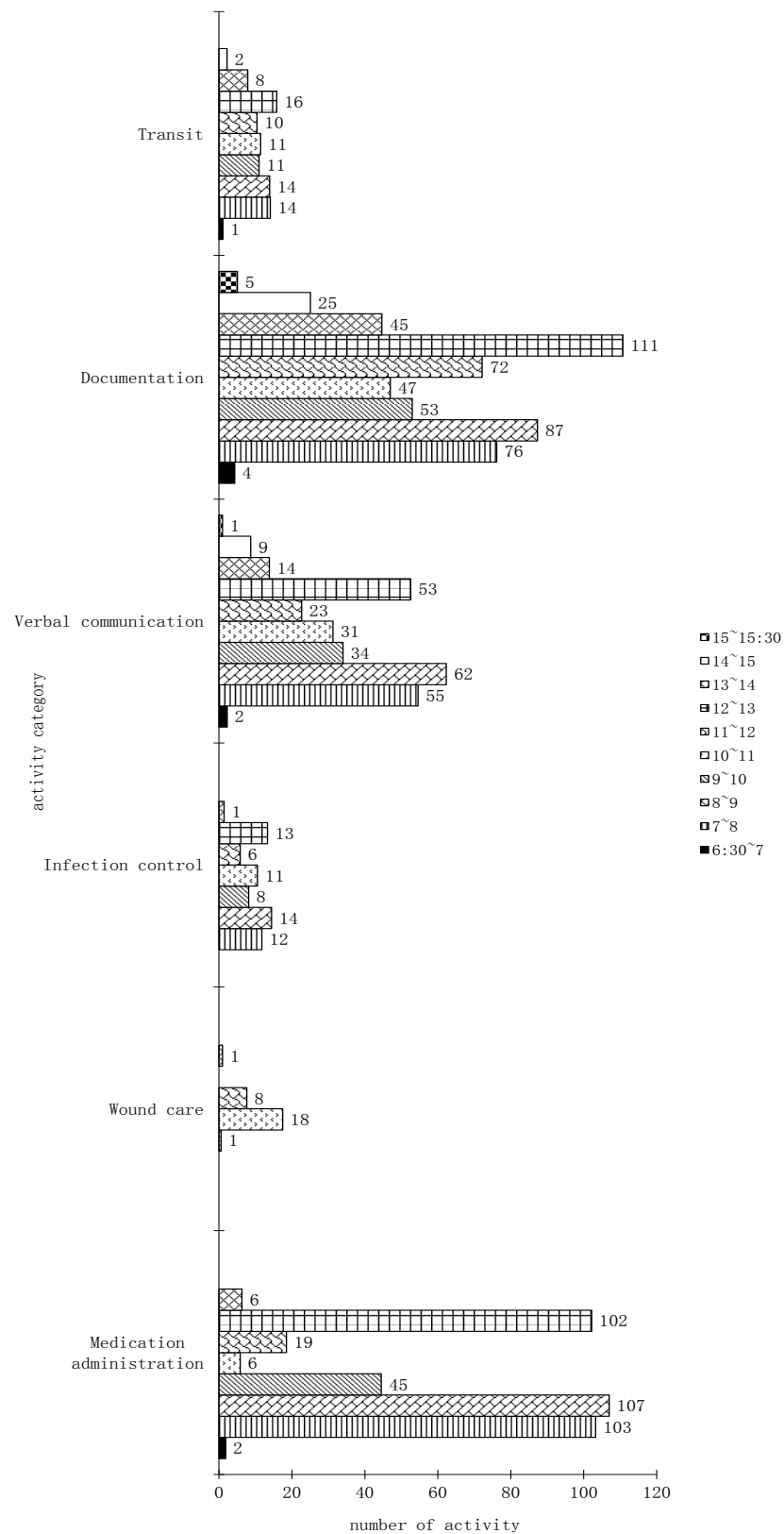
1 CI: confidence interval, SD: standard deviation

2

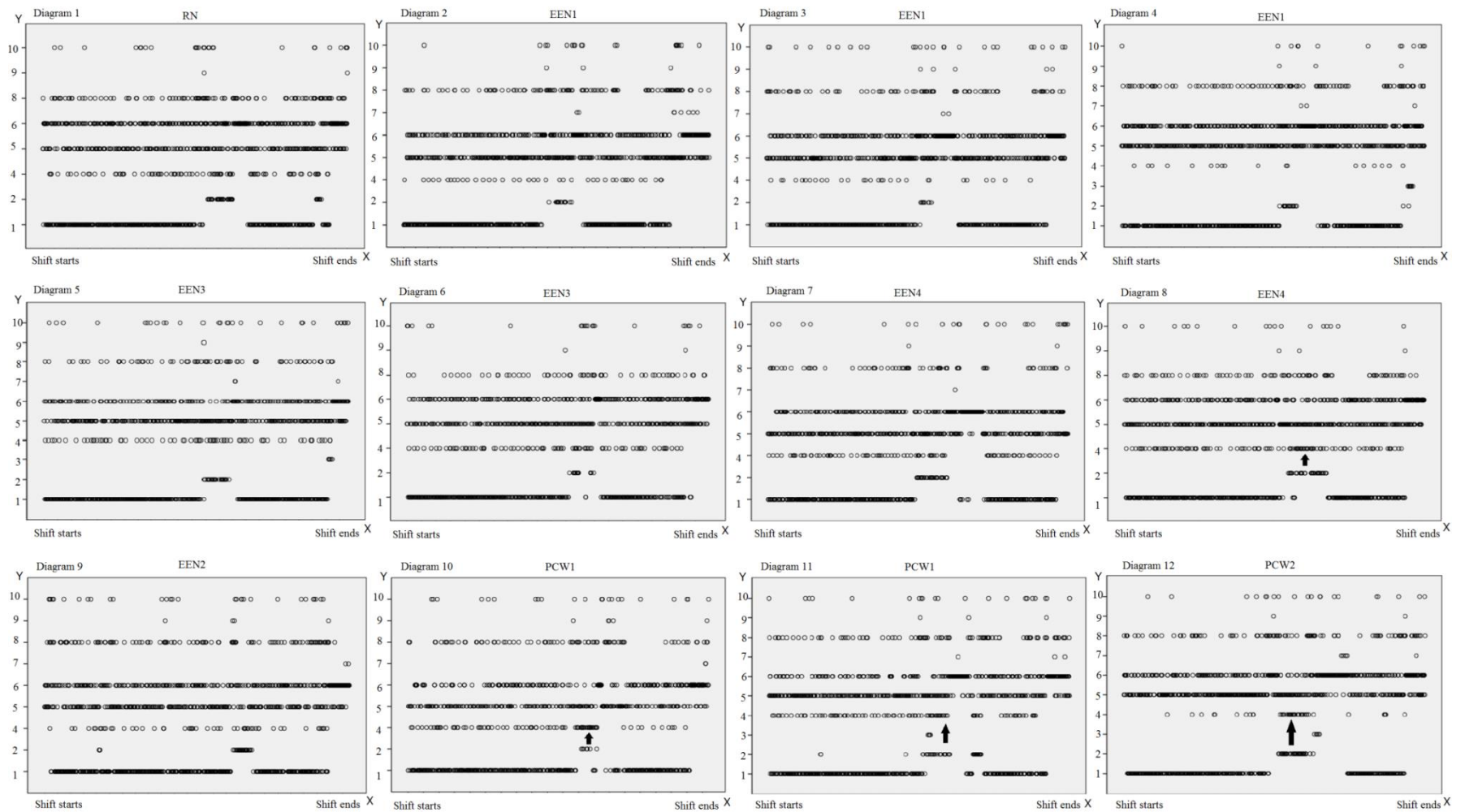
### 3 **5.3.5. Activity pattern**

4 Activities undertaken by a nurse in a shift were plotted over time (see each of the 12  
5 diagrams in Figure 5.3). Each activity is identified by a number between 1 and 10 on the  
6 y axis. Each ‘bubble’ represents the execution of the corresponding activity category.  
7 The time of a shift is represented by the x axis. For example, Diagram 1 in Figure 5.3  
8 shows the activity pattern of the RN. Medication administration (number 1) was  
9 conducted from the beginning of the shift for a long time before wound care (number 2).  
10 When wound care was completed, medication administration was resumed. The  
11 activities of infection control (number 4), verbal communication (number 5),  
12 documentation (number 6) and transit (number 8) lasted throughout the shift. Physical  
13 review (number 3) and print and fax (number 7) were not done. Two staff breaks  
14 (number 9) were taken by the RN. ‘Other’ (number 10) were scattered throughout the  
15 shift intermittently.

16 Comparison of the 12 diagrams shows a similar pattern in individual nursing care staff  
17 activities. However, some differences can be noticed. For example, wound care activity  
18 was occasionally conducted in the middle of the medication administration process  
19 (Diagrams 9 and 11). The pattern of infection control activity appears to be different  
20 among individual nursing care staff. For example, PCW2 conducted this activity least  
21 frequently (Figure 5.3 Diagram 12). EEN3 (Diagrams 5 and 6) conducted this activity  
22 more frequently than EEN 1 (Diagrams 2 to 4). EEN1 conducted this activity variedly  
23 from shift to shift. Infection control activity occurred more frequently with wound care  
24 process in four shifts (see arrows in Diagrams 8 and 10 to 12) than in the other shifts.



**Figure 5.2 The number of occurrences of main activity category in each hour in a morning shift.**



1

1. Medication administration 2. Wound care 3. Physical review 4. Infection control 5. Verbal communication 6. Documentation 7. Print and fax 8. Transit 9. Staff break 10. Others RN: registered nurse EEN: endorsed enrolled nurse PCW: personal care worker with Certificate IV Level II in medication management

2

**Figure 5.3 Activity pattern of each observational shift.**

## Discussion

Each participant was observed a number of different times, for example EEN1 was observed three times but the RN was observed only once. This is because participants who usually worked more shifts in a week were observed more, participants having fewer shifts were observed less. This observation schedule relatively reflected the roster pattern of these participants.

The aims of this study were to describe nursing care staff work processes and examine the time, frequency and duration they used to conduct work activities. The results show that there are certain work processes that all the nurse participants followed to complete nursing tasks in morning shifts in an RAC home. An observational study examining medication administration in a hospital also found that nursing care staff followed certain work processes [20].

The process diagram (Figure 5.1) shows that two factors determining nursing care staff work processes are task and time. Tasks include those that must be done by nursing care staff (e.g. medication administration) and those that can be delegated to other staff (e.g. physical review). There are priorities in tasks. For example, wound care is done before physical review. The time factor has two dimensions: time of a day and availability of time. Time of day determines when a task must be done, for example, medication administration must be done in the morning and at noon. More flexible arrangements can be made for wound care, physical review and documentation on desktop computers. The availability of time determines whether a task will be allocated to other staff. Attention can be paid to the tasks that can be arranged more flexibly when developing a task re-allocation strategy to improve work efficiency.

Overall, no significant difference between the two units was found in the time spent on each category of activities. This may indicate that there could be a basic amount of time required for caring for a resident needing high level care. More studies on this topic are needed to validate this finding in other RAC homes, because this information is useful for managers in estimating nursing workload.

Verbal communication occupied an even higher proportion of nursing care staff time than medication administration, indicating the importance of this activity in care provision. Verbal communication was largely comprised of pure verbal communication which took 23.2% of nursing care staff time at both units, significantly longer than concurrent verbal communication with other activities (5.7% at Unit 1, 4.0% at Unit 2). This may reflect the high level of concentration that is required by the staff in providing nursing care. When talking to other people in this process, nursing care staff often stopped what they were doing.

The significantly longer time nursing care staff spent on concurrent verbal communication at Unit 1 than nursing care staff at Unit 2 may be caused by the different staffing level. The RN and EENs worked at both units, but PCWs with a medication management qualification worked only at Unit 2. A previous work sampling study in high-care units of an RAC home found that RNs and EENs spent 25% and 27% of their time on concurrent verbal communication with medication management [6], substantially higher than our findings.

Although nursing tasks were documented electronically or on paper, we found no significant difference in the proportion of time nursing care staff spent on documentation (18% at Unit 1, 20% at Unit 2). These proportions of time spent on documentation at the two units were similar to EENs' documentation time (19%) but a lot lower than RNs' (28.5%) measured by a work sampling study 23 months after the implementation of an electronic documentation system [21].

This study found that infection control activity patterns differed among individual nursing care staff. Also, PCWs conducted infection control activity more frequently than other types of nursing care staff when providing wound care. Further study is needed to investigate reasons for these differences in staff behaviour in infection control and whether the findings can be replicated.

The short activity duration may indicate that nursing care staff frequently switched between activities. This was also observed by Cornell et al in a hospital [22]. They suggested that the frequent switch may be caused by unpredictable demands from patients or other nursing care staff and the time management strategies used by the staff.

However, our study shows that these switches may be necessary for nursing care staff to complete a task. For example, a nurse may conduct many activities to medicate a resident, such as getting medication from the trolley, crushing tablets, preparing a cup of water and feeding the person. The more activities done, the more switches between activities.

## **Limitations**

One of the limitations of this study is the relatively small number of nursing care staff observed. However, they were the staff who regularly worked a majority of the morning shifts. Therefore, their work represented the nursing care pattern of the studied RAC home.

Six shifts of observation at each unit may seem small, limited by study resources. However, the number of activities recorded is high (more than 7,000). As the unit of statistical analysis is the activity, the sample size is considered large enough to reflect the work pattern of the nursing care staff.

Direct observation may cause the Hawthorne effect [23] which means nursing care staff may change their work behaviour. However, we found that the nursing care staff was comfortable with being followed and observed by the observer, possibly because they had a similar experience in which they were paired with nurse students to provide training. The Hawthorne effect was also minimised by two observational strategies. First, the observer had conducted the pilot and preliminary study, so the nursing care staff had already understood the purpose of the study and familiarised themselves with the presence of the observer. Second, unless a conversation was necessary for understanding the participant's work, the observer would not initiate any conversation with the participant, thus minimising interruption to the normal work routine.

## **Conclusion**

This study gives useful information about nursing care staff work processes and time usage in providing nursing care in an RAC home. Nursing care staff members have established a common work process to complete their tasks. Task and time determine the organisation of the work process. Tasks that can be arranged more flexibly should

be considered by nursing managers in their effort to optimise any task re-allocation strategy. The use of the electronic documentation may not change nursing care staff's time utilisation. There could be a basic amount of time required for nursing care staff to take care of a resident needing high level care. Verbal communication has an important role in the work of nursing care staff. Further investigation on how, when, where and the content of nursing care staff's communication with residents or other staff will be useful for understanding the contribution of verbal communication in care provision.

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## **Chapter 6. Medication Administration Process and Problems in a Residential Aged Care Home: An Observational Study**

### **Abstract**

This study aimed to investigate the medication administration process in an RAC home and identify problems that are potentially harmful. Knowledge about the actual medication administration process that nursing care staff follow is necessary to uncover mishaps in medication administration and ensure resident safety. Seven nursing care staff worked at two units were observed. Field notes taking, informal conversation and document review were conducted.

Nursing care staff followed a common work process to pass medication, but differences existed between individuals. Problems were: documenting before providing the medication to a resident; documenting for several residents at a time when using paper-based medication administration records, preparing medication for two residents at a time; and missing required steps in medication preparation and provision. Problems may be linked to time constraints. Possible best practice needs to be determined and shared among nursing care staff.

### **Introduction**

Medication administration in RAC homes is a complex process [1]. Studies have reported that people living in RAC homes take an average of seven to nine medications [2-4]. Error rate in medication administration has been found to range from 28% to 40% [5,6].

Causes of medication errors are often a mixture of human error and system deficiencies [1,7-9]. Human error can be viewed from the person approach or the system approach [10]. In the person approach, errors are seen as the results of front-line operators' forgetfulness or carelessness. However, isolating errors from the context they occur could cause risk of recurrent errors [10]. Taking a system's view, errors maybe caused by an adverse conjunction of barriers [11] such as time constraint, large amount of medication and interruption [8,9].

The process of medication administration needs to be fully understood in order to uncover the recurrent errors in this process. The time spent on the activities conducted by nurses in this process has been examined in RAC homes [12-14].

However the actual detailed processes that can give more information about the causes of errors have not been sufficiently investigated. Verrue et al. conducted a cross-sectional observational study in RAC homes [15]. They found that in more than half of the wards studied, medication was administered by PCWs who were not qualified for this task. They also found that 99% of medication was crushed to facilitate swallowing.

Through focus group discussions with nurses, Ellis et al. found that nurses always faced time constraints when administering medication [1]. They classified medication administration into three phases: 'preparing to race', 'running the race' and 'finishing the race'. In the first phase, nurses needed to collect information about residents (e.g. current health status) and medication (e.g. side effects) by reviewing documents and communicating with other members of the care team. In the second phase, nurses administered medication to residents but needed to prioritise different residents' care demands in order to complete their work in time. In the last phase, they assessed a resident's response to medication and documented it.

Understanding the actual medication administration process that nurses follow is critical to guide improvement effort [1,9] and develop safeguards and robust systems [16]. Therefore, this study investigated the process of medication administration in an RAC home and whether problems might occur during this process.

## **Methods**

### **6.2.1. Settings**

The study was conducted in two units of a non-profit ageing-in-place RAC home. One unit (Unit 1) had 38 beds and the other (Unit 2) had 40 beds. The average age of residents was 83 years old. Residents' average length of stay was 12 months. Ninety-seven percent of residents required a high level of care. Unit 1 used electronic medication administration records and Unit 2 used paper-based records. Each unit had one nurse who administered medication to the residents in a work shift.

### **6.2.2. Participants**

Seven nursing care staff who were charged with the responsibility of medication administration in these two units gave consent to be observed in the study. One was a registered nurse, four were endorsed enrolled nurses and two were PCWs with Certificate IV Level II in medication management. They had an average of 6.3 years (5 months to 13 years) of experience in medication administration. They administered ordinary medication, but not drugs of addiction.

### **6.2.3. Data collection**

Participants were followed individually when they were passing morning medication to residents (from 7 a.m. to 10 a.m.). Twelve morning medication rounds were observed from August to September 2013, six in each of the two units. Informal conversations between participants and the observer occurred during the observation process. These were usually several short sentences that included the information related to medication administration, e.g. the nurse might quickly explain why a specific work process was followed. Field notes were taken to record information obtained from informal conversations and the observation of the medication administration process.

Documents about organisational policies and guidelines of medication management were made available to the observer for review before data collection. This enabled the observer to understand the organisational requirements about the medication administration process. These documents were used as a benchmark for the identification of problems. Medication incident reports from the previous seven months were also collected and read.

### **6.2.4. Ethical considerations**

The university's ethics committee and the management of the aged care organisation approved all the study procedures.

### **6.2.5. Data analysis**

A diagram depicting the general process of the morning medication round was developed using the workflow mapping method developed by Kmetz [17]. The diagram was then discussed with the participants, with revisions made according to their feedback.

## **Results**

### **6.3.1. The organisation of medication to be administered**

Tablets were pre-packed in small plastic bags by the pharmacy according to the administration time and date. The bags were connected one by one in a roll for seven-day use and stored in the cabinets in the medication room. A nurse working in the previous night shift removed the bags to be administered in the morning from the roll and organised them into the resident's compartment in the medication trolley. Medication stored in a refrigerator would be taken out by the nurse working in the morning shifts. The other ordinary medications (e.g. puffers) were stored in the medication trolley.

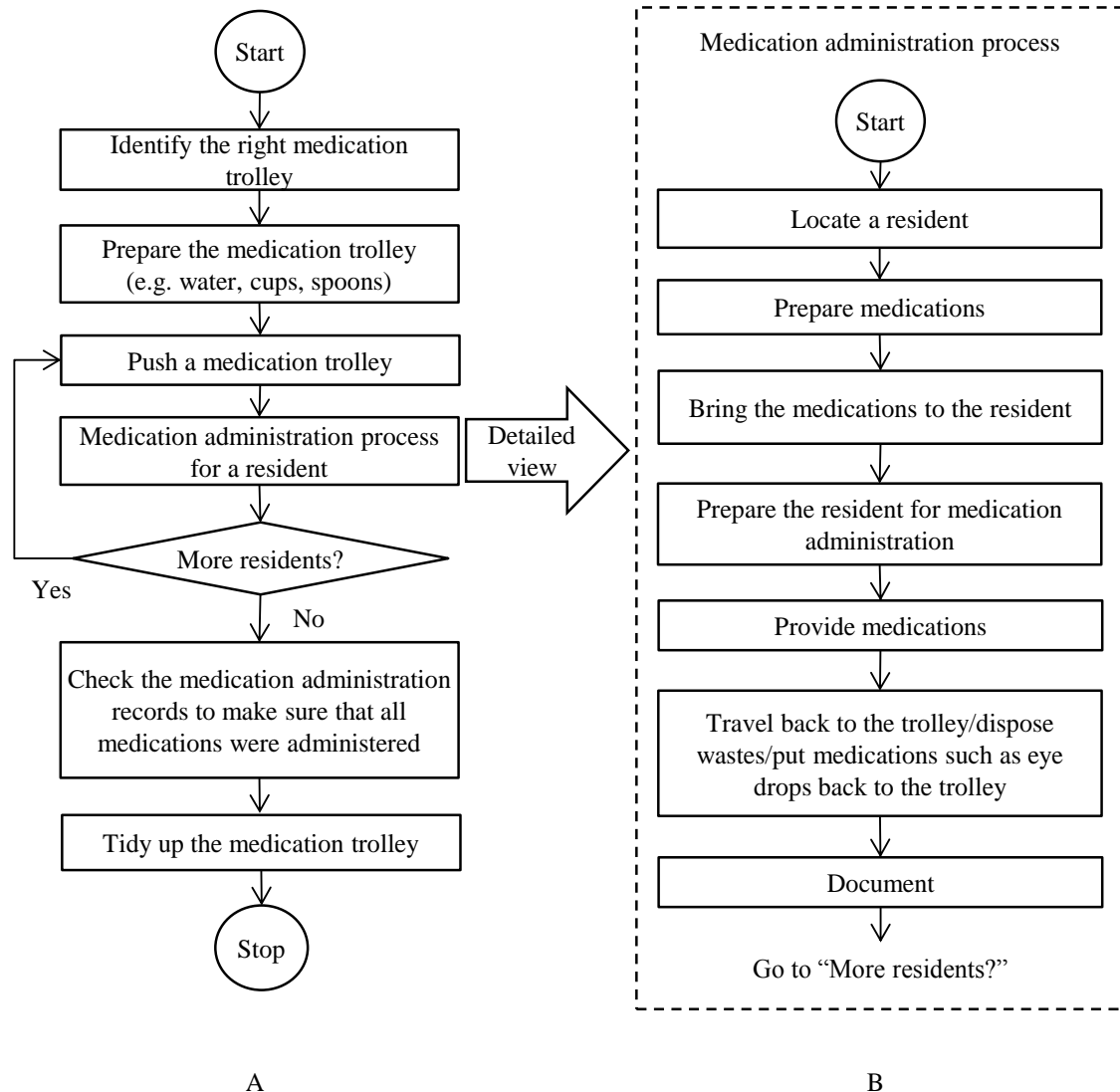
### **6.3.2. The common process of the morning medication round**

Figure 6.1 (A) illustrates the common work process of the morning medication round. A nurse could start with any resident who was ready for medication. Figure 6.1 (B) depicts the process of medication administration for a resident, including activities from locating a resident, preparing medication to documenting the administration. This process could occur in a resident's room, a dining room, a lounge room or a corridor, depending on where the resident was and how the medication was to be given. For example, providing medication via a percutaneous endoscopic gastrostomy (PEG) feed happened in a resident's room for privacy reasons.

Nurses prioritised their tasks to meet residents' needs. They attended to the residents who needed insulin before 8 a.m., the time when breakfast was served. Insulin might be the only medication given to these residents at this point, other medication was given later. Nurses gave nebulisers to residents who needed these after they finished breakfast. They attended to the residents who needed PEG feed at the end of a medication round. Nurses usually pushed the medication trolley in the unit for several rounds in order to administer medication to all the residents.

During the medication administration process, the nurse also fulfilled residents' requirements (e.g. turn on the TV), comforted depressed residents, communicated with peers and visitors for information about residents, checked information about unfamiliar medication and occasionally dealt with emergencies (e.g. fall incident). Unexpected

small troubles may occur. For example, the bumping floor caused all the spoons fell off the moving trolley. The nurse had to pick them up, bring them to the wash up room and collect clean ones for use to feed medication to residents.



**Figure 6.1 A common process of the morning medication round and the process of medication administration for a resident.**

Nurses reported that establishing a good rapport with a resident was important to facilitate medication administration. For example, calling a resident by his/her preferred name, knowing medicine-taking habits (e.g. using a spoon or not), remembering their medication schedules and having successful strategies to deal with a person who refused

to take medication. One nurse mentioned that it was also important not to be worried about the time or, at least, not to show concern even if it was there, because residents could sense it and react negatively, even to the point of refusing the medication.

### **6.3.3. Differences in individual nurses' work process**

Although there was a common work process followed by nurses for medication administration, differences were observed. The majority of nurses followed the order of residents' room numbers to administer medication and then moved to the dining room. But one PCW started from the rooms in a particular corridor, because she thought that medication administration for residents living in that corridor would take her the longest time. She felt that completing medication administration for those residents would make her less worried about not finishing work on time.

Nurses were also observed taking out the medication from the refrigerator at different times during a medication round. One nurse took out the medication from the refrigerator right before the administration while the others placed the medication in the trolley at the beginning of the medication round.

Instead of attending to residents one by one, two nurses were observed to prepare medication for the next resident while waiting for the present one to take the medication. This happened only when two residents were at the same place (e.g. the lounge) and one was able to take medication but the other could not. The nurse would provide medication to the capable person first. While waiting and overseeing the first resident to take the medication, the nurse would prepare medication for the other. This did not violate the organisational guideline because the resident was witnessed to take medication.

### **6.3.4. Problems**

#### ***Documenting before providing medication to a resident or documenting for several residents at a time***

In Unit 2 where the paper-based medication administration records were used, nurses were observed to sometimes document before providing medication to a resident or to document for several residents at once. This practice did not appear to be compliant

with the organisational policy which required a nurse to sign the medication chart immediately after administering the medication to the resident and before attending to the next person. In Unit 1 where the electronic records were used, this practice was not observed.

### ***Preparing medication for two residents at a time***

When administering medication in the dining room in Unit 2, one nurse was observed preparing medication for two residents at a time. This practice gave rise to the risk of wrong medication or wrong resident.

### ***Missing steps in the process of medication administration***

On one occasion, a nurse did not check whether a resident was in the room or not before preparing the medication. By the time she brought the medication into the resident's room, she realised that the person was not there. This resulted in the nurse temporarily storing the prepared medication in the person's compartment in the medication trolley and moved on to the next resident. This procedure may lead to the error of missed medication as it was similar to a description of the cause of a missed medication in a medication incident report: "Missed morning medication. Resident was not in room when I went to give her medication. Inadvertently did not give at a later time."

Three actions which did not appear to be compliant with the organisational guidelines were observed: 1) Some nurses poured the liquid medication into a small medication cup on the trolley without measuring at eye level to ensure accuracy; 2) According to the guideline, a nurse should wait at least one minute between puffs of multiple inhalations. However, this waiting step was only observed with one nurse; and 3) On one occasion, a nurse did not ask the registered nurse on duty for the permission to administer a pro re nata (PRN) medication to a resident. The guideline required that the decision on whether to give a PRN medication to a resident must only be made by a registered nurse.

These actions which violated organisational guidelines were few in number and observed only on occasion.

## Discussion

Medication administration in RAC homes, as in other healthcare settings [18], is a complex process with lots of activities conducted, tasks prioritised, information communicated and decisions made. Older people living in RAC homes are frailer, with more complicated health conditions, health care needs and more medication taken than their peers living independently [19]. A study examined medication administration errors in RAC homes found that 90% of the residents were exposed to at least one error [4]. Knowledge about the work processes in which errors occurred is necessary for identifying the causes of the errors. The complexity of the medication administration process must not be underestimated when developing strategy to reduce errors in RAC homes.

Differences in how activities were organised were observed among individual nurses. These differences may result in different amount of time required to complete a medication round. Time constraint is known to be harmful to medication safety [8,9] because nurses had to administer large amount of medication within approximately three hours, so reasonable amount of time can be left between the morning medication round and noon medication round. At the same time, nurses had to meet the demands from residents and colleagues. It will be useful for the frontline nurses to know how to administer medication efficiently without violating the organisational guidelines, so as to ease their stress that caused by the time constraint. Such knowledge is also helpful for nursing managers to determine or develop the possible best practice.

The sub-optimal behaviour of documenting before providing medication to a resident or documenting for several residents at once could be due to problems with paper-based documentation, which required a nurse to flip through pages to locate a resident's medication record. When a resident's documents could not be located easily, the process can be stressful and various less-than-optimal procedures can be adopted. As this problem was not seen with the use of the electronic medication administration records, it is likely that the electronic system is able to improve documentation practice. There is a need to understand how the electronic medication administration records can take away the temptation to adopt quick but unsafe practices.

Time will impact on how medications are administered to the residents [1]. The problems of preparing medication for two residents at a time and omitting some steps in medication preparation and provision are probably caused by the time constraint. Although incidents directly caused by these problems have not been seen, they are possible when these problems are combined with other barriers (e.g. interruption [12]). Both frontline nurses and managers should be aware of and understand these problems and the possible adverse consequences, so that improvement effort can be made and reach its goal.

### **Limitations**

As the study was conducted in one RAC home, the generalisability of the results might be limited by the local organisational policy and staff behaviour. Direct observation may have a potential Hawthorne effect, which means that study participants under observation might change their work behaviour [20]. However, we found that participants seemed to be comfortable with the observer, perhaps because they had experience of giving in-job training to the nurse students.

### **Conclusion**

This study generated knowledge about the detailed work processes that nurses followed to administer medication to residents in an RAC home. The results showed that although nurses followed a general work process to administer medication, individual nurses sometimes organised their work activities differently. The potentially harmful problems were identified and needed to be solved with consideration of the complexity of the medication administration process, nurses' heavy workload and time constraints.

The findings of this study will be useful for nursing managers to develop targeted strategies to improve the medication administration process, reduce or eliminate the errors and improve resident safety. Investigations into the impact of the introduction of the electronic medication administration records on the safety of the medication administration are necessary.

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## **Chapter 7. Nursing Time Spent on Administering Each Type of Medication in a Residential Aged Care Home**

### **Abstract**

This study aimed to examine nursing time spent on administration of each type of medication in an RAC home; to determine whether the administration time for residents differs by individual medication needs. Information on nurses' time spent on medication administration is useful for estimation of nurses' workload that is required to ensure resident safety.

Nurses were observed over 12 morning shifts using a time-motion observational method at two high-care units in an RAC home. Field notes were also taken. On average, a resident took nine medications in the morning, seven of which were tablets. Some residents took up to four types of medication (3.6%), but most residents took one or two types of medication (83% of residents), six to ten tablets (52%), did not need tablets to be crushed or mixed in thickened fluid (62%) but needed a nurse's help to take the tablets (67%). Medication administration per resident required an average of 200 seconds. The administration time required per resident varied significantly by individual medication needs. Residents' levels of medication needs must be considered when estimating nurses' workload.

### **Introduction**

Medication administration is prone to errors [1], because it is hindered by various factors such as residents' intricate health conditions (e.g. swallowing difficulty) [2], nurses' high physical and mental load [3], and the large amount of medication to be administered under time pressure [4, 5]. A three-month observational study found that 90% of residents living in RAC homes were exposed to at least one error [6].

Time has a great impact on how nurses conduct activities and organize their work processes. Understanding the nursing time spent on medication administration is useful for the estimation and allocation of nurses' workload in order to ensure resident safety. It is also necessary for evidence-based decisions on staffing levels [7], as well as being

useful for performance monitoring, strategy development, internal management, and comparisons with other aged care systems.

To date, studies examining the nursing time spent on medication administration in RAC homes are rare [8-10]. Dellefield et al. conducted a work sampling study to investigate how RNs use their time in day shifts in an RAC home [8]. They found that 31% of the time was spent on direct care, including medication administration. Using the same data collection method, Munyisia et al. quantified the time spent on activities of nursing care staff — RNs, EENs, PCWs and recreation activity officers [9]. They found that RNs and EENs spent 18% of their time on this task. Thomson et al. broke the medication administration process into seven steps: preparing the medication trolley, locating and identifying the resident, preparing the medication, preparing a resident to receive medication, providing medication to the person, observing the person's response in case of any immediate adverse event, and travelling back to the medication trolley [10]. The study found that preparing medication for a resident required 70 to 105 seconds which was longer than providing medication (40 to 70 seconds).

There is a lack of knowledge about the nursing time needed for administration of each type of medication, essential evidence for the planning and implementation of appropriate nursing resources to ensure safe medication management. With increasing numbers of very frail older people with complex medical needs entering RAC homes, the importance of this knowledge is growing.

Therefore, this study examined nurses' time needed for administration of each type of medication and whether the time needed per resident varied with the number of medications taken by a resident and the methods used by nurses for preparation and provision of medication.

## **Methods**

### **7.2.1. Settings**

The study was conducted in two units of an RAC home. Residents living in the two units had an average age of 83 and an average stay of 12 months. 97% of the residents needed high care. Unit 1 had 38 beds and Unit 2 had 40 beds.

### **7.2.2. Participants**

Seven nurses participated in the study- one RN, four EENs and two PCWs with Certificate IV Level II in medication management. Their average years of work experience in medication administration were 6.3 years (5 months to 13 years).

### **7.2.3. Data collection**

#### ***Time-motion observation***

Time-motion observation requires an observer to follow one participant at a time and record the sequence of the activities and the time spent on each by this person [11]. A pre-defined classification system of activities is needed to record these data.

Nurses' activities were identified through a five-day observation. A discussion of these activities with an experienced research RN with extensive work experience in RAC homes led to the first version of the classification system. This classification system was then validated by three nurses and two managers who worked in RAC homes. The final version of the classification system contained a total of 116 activities grouped into ten categories: medication management (i.e. preparation, provision and cleaning up), wound care, physical review (i.e. observation or assessment), infection control, verbal communication, documentation, print and fax, transit (e.g. walk), staff breaks and other activities.

#### ***Structured field notes***

In the preliminary study, the observer recorded the different methods used by nurses to prepare and provide tablets (see Table 7.1). These methods were further validated in the pilot study. A structured field note sheet was designed to record current time, location, code of the resident, methods used for preparing tablets and methods used for providing tablets.

#### ***Data collection procedure***

A single data collector performed the formal data collection from August to September 2013. Twelve morning shifts (6:30 a.m. to 3:00 p.m.) were observed, six in each of the

two units. The commercial software InMotion Pro [12] was installed on an iPad to record the quantitative data. Structured field notes were taken on paper.

**Table 7.1 Methods used by nurses to prepare and provide tablets.**

Code	Methods for tablet preparation
0	Tablets were not crushed or mixed in thickened fluid.
1	Tablets were not crushed but mixed in thickened fluid.
2	Tablets were crushed and mixed in thickened fluid.
Code	Methods for tablet provision
0	The resident took the tablets by himself or herself, the nurse did not wait while this was done.
1	The resident took the tablets by himself or herself, but the nurse waited while this was done.
2	The nurse helped the resident to take the tablets.
3	The nurse provided tablets via a percutaneous endoscopic gastrostomy (PEG) feed.

Note: tablets were pre-packed in a small plastic bag by the pharmacy and were crushed directly in the bag using a pill crusher, rather than in a vessel.

#### **7.2.4. Data analysis**

Time-motion data were exported to excel spread sheets. Data recorded in the structured field notes were entered into the excel spread sheets by matching the activity start time recorded by the iPad and the “current time” recorded in the structured field notes.

Activities recorded during morning medication rounds were analysed in this paper (61 out of 116 activities, 52.6%). They included activities of medication preparation and provision, cleaning up (e.g. disposal of clinical waste), infection control, verbal communication, documentation, transit and other activities. Types of medication prepared and provided by nurses to residents were tablets, liquid medication, powder medication, eye drops or ointment, injection, puffer or inhaler, nebulizer, patch, resource drink and topical medication for the body. Nurses’ time spent on preparation and provision of these medications and the use of PEG feed to provide medication were analysed.

The unit of analysis was a resident. IBM SPSS version 19 was used for statistical analysis. The T test, the Mann-Whitney U test and the One-way ANOVA test were used for statistical comparisons (see Table 7.4). For a comparison between two groups, a statistically significant difference was assumed when the p-value was less than 0.050.

When multiple comparisons were made, Bonferroni correction was applied. A statistically significant difference was indicated by  $p < 0.0167$  ( $0.05/3$ ) for comparison of three groups, and by  $p < 0.0125$  ( $0.05/4$ ) for comparison of four groups.

### 7.2.5. Ethical considerations

Ethical approval (number: HE09/043) was sought and granted by the university's Human Research Ethics Committee and agreed by the management of the aged care organization.

## Results

On average, a nurse spent three hours passing 315 medications to 35 residents in a medication round (standard deviation [SD] = 33 minutes, ranging from 2.3 hours to 4.5 hours). As shown in Table 7.2, 32.3% of the time was spent on medication preparation, 14.3% on medication provision and 4.4% on cleaning up. 3.5% of the time was used for infection control, 26.1% for verbal communication, 12.7% for documentation, 8.0% for transit and 5.5% for other. The total is greater than 100%, because some verbal communication occurred concurrently with other activities (e.g. providing medication to a resident and talking with the person at the same time).

**Table 7.2 Percentage of time nurses spent on activities and corresponding time in a three-hour morning medication round.**

Activity category	Percentage of time in a medication round	3-hour medication round (minute:second)
Medication preparation	32.3%	58:8
Medication provision	14.3%	25:44
Cleaning up (e.g. putting eye drops back into the trolley, disposing clinical waste)	4.4%	7:55
Infection control	3.5%	6:18
Verbal communication	26.1%	46:59
Documentation	12.7%	22:52
Transit	8.0%	14:24
Others	5.5%	9:54

### 7.3.1. Average time spent on each type of medication

On average, a resident took nine medications in the morning, seven of which were tablets. At both units, tablets and powder medication were the most widely used types of medication (see Table 7.3). Most of the medication required less than 30 seconds to prepare or provide.

The PEG feed took the longest time for both preparation (47 seconds) and provision (147 seconds). The preparation of an injection took 37 seconds, followed by preparation of tablets (35 seconds), powder medication (often Movicol, 29 seconds) and puffer/inhaler (24 seconds).

**Table 7.3 Percentage of residents needing each type of medication and average time spent on preparing for and providing to a resident.**

Medications	% of residents		Preparation (seconds)				Provision (seconds)			
	Unit 1	Unit 2	Mean	SD	95% confidence interval		Mean	SD	95% confidence interval	
					Lower bound	Upper bound			Lower bound	Upper bound
Tablet	97.5	100.0	35.0	26.0	32.3	37.7	43.5	42.0	38.5	48.5
Liquid medication	6.6	13.3	19.9	12.9	15.6	24.2	28.1	35.2	8.6	47.6
Powder medication	31.3	35.9	28.5	21.7	24.7	32.2	21.4	11.8	12.9	29.9
Eye drops/ointment	10.1	18.5	8.7	4.9	5.5	11.8	23.9	14.9	19.8	27.9
Injection	9.6	1.5	37.2	18.2	28.9	45.5	18.2	9.5	13.7	22.8
Puffer/inhaler	10.1	12.8	24.0	17.5	17.7	30.3	17.2	12.8	12.7	21.7
Nebulizer	3.5	3.6	19.5	12.1	11.8	27.2	24.9	13.4	15.3	34.5
Patch	3.0	5.1	17.1	12.2	10.0	24.2	16.1	16.3	6.3	25.9
Resource drink	5.6	4.6	14.7	9.9	9.6	19.8	25.4	28.7	-4.8	55.5
PEG feed	6.1	0.0	45.6	29.8	26.7	64.5	146.9	97.8	65.2	228.7

Providing tablets to a resident was the second most time-consuming activity (44 seconds). This was followed by providing liquid medication (28 seconds), a resource drink (25 seconds), nebulizer (25 seconds), eye drops or ointment (24 seconds) and powder medication (21 seconds). The use of topical medication for the body was not

observed because this task was allocated to care workers who provided personal care (e.g. shower) to residents.

### **7.3.2. Time spent on a resident**

Medication administration to 419 residents was recorded, with 211 in Unit 1 and 208 in Unit 2. The average time needed per resident was 200 seconds (SD = 119 seconds). The activities during this time may include preparation and provision of various types of medication, bringing medication to the resident, talking with the resident, travelling back to the medication trolley, documentation, and hand wash.

Although a resident might take up to four types of medication, 82% of the residents took only one or two types. 52% of the residents took six to ten tablets, 62% did not need the tablets to be crushed or mixed in thickened fluid and 67% needed a nurse's help with taking the tablets (see Table 7.4).

No significant difference was found between the two units in the average time a nurse spent on a resident (see Table 7.4). However, the time increased significantly with the number of types of medication taken by the residents. The average time spent on a resident who took one type of medication was 144 seconds, but the time almost tripled to 404 seconds when four types of medication were needed.

When a resident needed one to five or six to ten tablets, the time required for preparing these tablets was 30 to 40 seconds, significantly less than the time needed for preparing more than 11 tablets (55 seconds). However, when providing tablets, six was the tipping point. A resident having fewer than six tablets needed an average of 40 seconds, significantly less than for those who had six tablets or more (46 seconds for 6-10 tablets and 62 seconds for 11-20 tablets).

As shown in Table 7.4, when preparing tablets for a resident, crushing and mixing tablets in thickened fluid (code 2) took 56 seconds on average, significantly longer than not crushing or mixing and not crushing but mixing the tablets in the thickened fluid (code 0: 24 and code 1: 30 seconds). There were also significant differences in the time needed for providing tablets when the resident took the tablets by himself or herself while the nurse waited (code 1: 30 seconds), when the nurse helped a resident to take

the tablets (code 2: 45 seconds) and when the nurse provided tablets via a PEG feed (code 3: 94 seconds). Cases where residents took tablets by themselves while the nurse did not wait (code 0) accounted for 19% of the residents.

**Table 7.4 The average time a nurse spent on a resident and on preparing and providing tablets to this resident.**

Category	% of residents	Time for a resident (seconds)				Preparing tablets (seconds)				Providing tablets (seconds)			
		Mean	SD	95% CI		Mean	SD	95% CI		Mean	SD	95% CI	
				Lower	Upper			Lower	Upper			Lower	Upper
Unit													
Unit 1	-	198 <sup>*a</sup>	122	182	215	34 <sup>a</sup>	27	30	39	53 <sup>a</sup>	54	45	62
Unit 2	-	201 <sup>a</sup>	115	186	217	42 <sup>a</sup>	28	37	46	38 <sup>a</sup>	29	33	43
Number of types of medication taken by a resident													
1 type	42.0	144 <sup>a</sup>	93	131	158	-	-	-	-	-	-	-	-
2 types	40.6	211 <sup>b</sup>	108	195	227	-	-	-	-	-	-	-	-
3 types	13.8	283 <sup>c</sup>	110	254	312	-	-	-	-	-	-	-	-
4 types	3.6	404 <sup>d</sup>	98	350	459	-	-	-	-	-	-	-	-
Number of tablets taken by a resident													
1-5 tablets	36.5	182 <sup>a</sup>	132	161	203	31 <sup>a</sup>	21	26	35	40 <sup>a</sup>	44	30	49
6-10 tablets	51.6	210 <sup>b</sup>	115	195	226	38 <sup>a</sup>	27	34	42	46 <sup>b</sup>	36	40	51
11-20 tablets	11.7	213 <sup>b</sup>	83	189	237	55 <sup>b</sup>	36	43	67	62 <sup>b</sup>	69	40	84
Methods for preparation of tablets for a resident													
0	61.6	187 <sup>a</sup>	108	173	200	24 <sup>a</sup>	18	21	27	-	-	-	-
1	6.4	192 <sup>ab</sup>	154	131	252	30 <sup>a</sup>	13	25	36	-	-	-	-
2	29.6	229 <sup>b</sup>	123	207	251	56 <sup>b</sup>	29	51	61	-	-	-	-
Methods for provision of tablets to a resident													
0	19.1	159 <sup>a</sup>	106	135	183	-	-	-	-	-	-	-	-
1	7.6	193 <sup>abc</sup>	91	160	226	-	-	-	-	30 <sup>a</sup>	36	15	44
2	67.3	205 <sup>b</sup>	118	191	219	-	-	-	-	45 <sup>b</sup>	42	40	50
3	2.1	318 <sup>c</sup>	123	223	412	-	-	-	-	94 <sup>c</sup>	52	54	134

\* The same superscript letter between measurement items represents no significant difference in the time. Different superscript letters between measurements denote a significant difference in the time.

## Discussion

Morning medication round is time-consuming, with lots of activities required during this process. Nurses spent an average of three hours on this nursing task, equivalent to 37.5% of the time in an 8-hour morning shift. This proportion is higher than 31% and 18% found by previous studies [8, 9], possibly due to the different duties and workload of the participants and the different data collection methods.

The time required for a medication round ranged from 2.3 to 4.5 hours, a 2.2-hour difference. This may suggest that the individual practice, organization of activities and work processes are quite different among nurses. Therefore, the possible best practices need to be determined and implemented for safe, timely and efficient medication administration [13].

As in a previous study [10], medication preparation required more time than medication provision. Medication preparation took the largest proportion (32.3%) of the nursing time spent on a medication round, more than twice as much as the time spent on medication provision (14.3%). The medication preparation activity defined in this study was the preparation itself (e.g. crushing tablets). It did not include identification of medication from the medication trolley, review of related information on medication administration record or other activities before providing medication to the resident. The large amount of time spent on medication preparation emphasizes the importance of this activity.

A nurse only spent 3.5% of the time on infection control, equivalent to 6.3 minutes in a three-hour medication round for 35 residents and 10.8 seconds per resident. Infection control activities include the use of gloves and cleaning hands in this study. The hygiene of nurses' hands is important for the health of residents living in RAC homes [14]. Nurses use alcohol-based hand rub or water to clean their hands. Alcohol-based hand rub was used most often. It is recommended that the duration of a water hand wash episode is 40 to 80 seconds and the duration of alcohol-based hand rub episode is 20 seconds [15]. The frequency and duration of infection control activities need to be examined to evaluate the effectiveness of the current practice.

## Conclusion

This study provides knowledge of nurses' time spent on preparing and providing each type of medication to residents with different levels of medication needs in an RAC home. The time required per resident varied with individual medication needs. When residents' medication needs change (e.g. the number of medication or the type of medication changes), the time needed for medication administration will change accordingly. Therefore, it is important for nursing managers to take into consideration the current levels of residents' medication needs when estimating nurses' workload involved in this nursing task. This knowledge is also useful for making evidence-based decisions on task re-allocation and staffing to adapt to the change and to ensure medication safety for residents.

Similar studies in other RAC homes are needed to validate and enrich this knowledge. Further research may investigate the differences between individual nurses in conducting medication administration to facilitate the establishment of best practice [13].

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## **Chapter 8. The Impacts of an Electronic Medication Administration Record System in a Residential Aged Care Home**

### **Abstract**

This study aimed to examine the documentation time, process, benefits and unintended adverse consequences of using an eMAR system compared with paper-based records in an RAC home.

Time-motion observation, taking of field notes, informal conversation and document review were used to collect data in two units of an RAC home. Each unit had one medication nurse. Seven nurses were observed over 12 morning shifts. Unit 1 used the eMAR system and Unit 2 used paper-based records, with 38 beds and 40 beds, respectively.

In a three-hour medication round, a nurse at Unit 1 spent 21 minutes on documentation, 4 minutes less than the time a nurse spent at Unit 2 (25 minutes). A problem which violated the organisation's documentation requirement was observed with the use of the paper-based records, that is, documenting before providing medication to a resident. This problem was recorded 22 (10.58%) times out of 208 medication administration processes in the morning and 19 (13.19%) times out of 144 medication administration processes at noon. However, it was not observed with the use of the eMAR system.

Benefits of introducing the eMAR system included improving nurses' compliance with documentation requirements, freedom from the error of signing twice, reducing the possibility of forgetting to medicate a resident, facilitating nurses to record the time of medication administration to a resident and increasing documentation space. Unintended adverse consequences of introducing the eMAR system included inadequate information about residents, delayed addition of a new resident's medication profile in the records, nurses' forgetting to medicate a resident due to power outage of the portable device and inefficient free-text data entry on the portable device.

The impacts of the eMAR system can be both positive and negative. Work processes and technology devices related to the use of the eMAR system need to be carefully designed to avoid adverse consequences.

## Introduction

Managing medication for the frail elderly is challenging [1]. Research has found that residents living in RAC homes were prescribed significantly more medications than those living independently [2]. International studies found that residents in RAC homes were prescribed an average of seven to nine medications [3-5]. As various healthcare workers such as doctors, pharmacists and nursing care staff collaboratively work in the medication management process [6], and each needs to make specific decisions and actions, this process can be error-prone [7].

It is believed that an eMAR system can reduce medication errors and improve efficiency [8, 9]. This expectation has driven some RAC homes to implement an eMAR system. However, there is a paucity of empirical evidence to suggest whether and how an eMAR system can meet the stated expectations.

Vogelsmeier et al. used multiple methods including observation, process mapping, key informant interviews and field notes to explore workarounds to an eMAR system in five RAC homes [10]. The eMAR system was used on a portable device with a touchscreen. The study found that there were some workflow blocks intentionally designed in the eMAR system to improve resident safety, for example documenting after preparing medication and documenting again after providing medication. However, staff overrode these blocks because they felt that they were cumbersome or time consuming. The study also found some unintentional adverse blocks (e.g. limited fax capacity). The staff had to work around these blocks in order to complete tasks.

The study conducted by Vogelsmeier et al. was part of a larger study summarized by Scott-Cawiezell et al. [1]. Scott-Cawiezell et al. reported that implementation of the eMAR system was guided by the medication safety team of each RAC home. Use of the eMAR system created some benefits such as shortened medication order entry process, improved clarity of the medication administration records and provision of real-time data to the healthcare provider. However the use of the eMAR system could not solve the workaround issue in isolation. An effective mechanism needed to be developed by the medication safety teams, in consideration of the functionality of the eMAR system to maximise its benefits and minimise or eliminate the adverse consequences [1].

The findings from these studies suggest that the actual way that an eMAR system is used by the staff on the floor may limit the effectiveness of the system and prevent realisation of the expected benefits. More evidence about how an eMAR system can be used effectively to improve resident safety and documentation efficiency is needed. This will direct management in designing relevant, targeted intervention mechanisms to improve the effectiveness of eMAR.

The study reported here aimed to investigate the impact of an eMAR system in an RAC home. It addressed the following three questions: 1) How much time do nurses spend on documentation using the eMAR system compared with paper-based records? 2) What are the processes that a nurse might follow in use of the eMAR system or paper-based records to medicate a resident? 3) What are the benefits and unintended adverse consequences of introducing the eMAR system?

## **Methods**

Multiple methods were used to collect both quantitative and qualitative data in morning shifts in two units in an ageing-in-place RAC home.

### **8.2.1. Settings and the participants**

Ninety-seven percentage of residents living in the two units required a high level of care. Their average age was 83 years old and the average length of stay was one year. Unit 1 had 38 beds and Unit 2 had 40 beds. The two units shared one medication room in which medications were stored and medication trolleys were placed. Each unit had an office where the staff could complete documentation. Unit 1 used the eMAR system while Unit 2 used paper-based records for medication administration.

Seven medication staff members who worked regularly on morning shifts in the two units participated in the study. They comprised one registered nurse, four endorsed enrolled nurses and two PCWs with Certificate IV Level II in medication management. Their average years of work experience in medication management were six years, with a minimum of five months to a maximum of 13 years. At Unit 1, only the endorsed enrolled nurses administered medication. At Unit 2, all three types of staff administered medication.

### **8.2.2. The eMAR system**

The eMAR system at the RAC home had been in use for 18 months. They were accessible on five desktop computers and at the point-of-care on two touchscreen portable devices.

Each nurse was assigned a unique user name and password to log into the eMAR system. After logging in, a nurse could choose the start time of a medication round. The nurse could then view a resident list showing who needed medication during this round. Each record on the list clearly noted medication 'status', the person's 'room', 'first name' and 'last name'. The 'status' could be blank or display 'complete' or 'missed' to indicate whether or not a resident had taken medication. The blank status suggested that the nurse had not yet attended the resident. 'Complete' suggested that the nurse had medicated the resident and the person had taken all the medications. 'Missed' suggested that the nurse had attended the resident but did not administer part or all of the medication, for example because the resident refused.

Clicking on a record, the nurse could further review a resident's profile, including name, photo, allergies, special instructions and alert to the due date of non-daily medication. Afterwards, the nurse could click on the 'confirm' button to confirm that this profile matched the resident who was to be medicated.

This step was followed by a review of information at the top of the screen giving the resident's name, number of packed medications and whether the person had unpacked or short-course medication. Medication for the selected medication round time was also presented. Each medication record had a checkbox for the nurse to record the completion of administering this medication, 'drug name', 'frequency', 'dose', and 'note' for any comment about this administration.

If all medication had been ticked or a reason had been entered for missed medication, the nurse could hit the 'done' button to return to the resident listing screen. If any medication was not ticked, the eMAR system would prompt the nurse to enter a reason for the missed medication.

Reasons for a missed medication or administration of a pro re nata (PRN) medication must be documented in the eMAR system and also in the resident's progress notes.

After documentation of this data, the system would automatically populate the data into the progress notes.

During a medication round, new data were stored on the portable device. At the end of the round, the nurse connected the device to the internet so as to synchronize the data with the database. When logging out, the eMAR system would alert the nurse if there was a resident whose medication chart had not been signed.

The eMAR system recorded the time of medication administration automatically, and it could also call nurses' attention to changes and errors in a resident's medication profile. The short-course medication and nurse-initiated medication charts were not provided by the eMAR system. They were recorded on paper-based charts.

### **8.2.3. The paper-based records**

At Unit 2, nurses used paper-based medication administration records. Each resident had several pages of the records which might include some or all of the following charts or sheets:

- a medication administration time chart
- a primary medication chart
- a packed medication signing sheet
- a non-packed medication signing sheet
- a short-course medication signing sheet
- a PRN medication signing sheet
- telephone orders
- nurse-initiated medication signing sheet

Each signing sheet could be used to record information for a month. There was space to sign to signify the completion of each medication during a pre-defined time slot (e.g. morning). When signing for an administered medication, a nurse needed to write down the initials of their name. If a medication was not administered, the nurse must write a

designated letter which provided a pre-defined reason (e.g. ‘N’ for no stock, ‘R’ for refuse and ‘H’ for hospital). During a medication round, the nurse also used an insulin administration book and a pain patch documentation book.

#### **8.2.4. Data collection methods**

Both quantitative and qualitative data were collected using four methods: time-motion based observation, informal conversation with medication staff, field notes and document review. Time-motion observation has been used by previous studies to evaluate the care processes in RAC homes [11, 12]. It requires an observer to follow one participant at a time and sequentially record the time taken for the person to conduct an activity, using a pre-defined activity classification system (see Chapter 5). The documentation activities were renamed to allow comparison between the paper-based records and the eMAR system (see Table 8.1).

Short informal conversation between the observer and the participant was conducted to collect information about what the participant liked or disliked about the electronic or paper-based records. The content of the conversation was included in the field notes. Other information that was not obtained from the time-motion recording and the informal conversation, but observed by the data collector, was also recorded in the field notes.

Document review was also conducted. It included the organisation’s documentation requirements and seven-month medication incident reports in the RAC home.

**Table 8.1 Documentation activities during a medication round**

<b>Documentation activities during a medication round</b>
Locating a resident's record (medication-related)
Locating a resident's record (non-medication-related)
Reading a resident's record (medication-related)
Reading a resident's record (non-medication-related)
Documenting on a resident's record (medication-related)
Documenting on a resident's record (non-medication-related)
Reading/writing on the paper note or the handover sheet
Other (e.g. collecting paper-based records)

#### **8.2.5. Data collection**

A single data collector observed one participant on each day (6:30 a.m. to 3 p.m.) for 12 days, six in each unit. Time-motion data were recorded using commercial software InMotion Pro [13] installed on an iPad. Field notes were taken on paper.

#### **8.2.6. Data analysis**

Work processes of nurses using the eMAR system and the paper-based records in a medication administration process for a resident are shown in Figures 8.1 and 8.2. The workflow mapping method proposed by Kmetz [14] was used for its easy readability. It contains five visually distinct symbols: rectangle representing processes and activities, diamond representing two mutually exclusive decisions, circle representing start and stop, single direction arrow representing material or information flow and document representing paper input or output. The diagrams were validated by a registered nurse and two endorsed enrolled nurses.

Data recorded in the iPad were exported to Microsoft Excel files for statistical analysis. The unit of analysis was each activity. The Z test was conducted to compare the time nurses spent on each documentation activity between the two units. A statistically significant difference was assumed when the p value was less than 0.05. Field notes were entered into Word files for analysis.

#### **8.2.7. Ethics approval**

Ethics approval was given by the Ethics Committee of the University of Wollongong subject to the approval of the management of the RAC home, which was subsequently provided.

### **Results**

#### **8.3.1. Time nurses spent on documentation activities in a medication round**

Table 8.2 shows the percentage of the time nurses spent on documentation activities during a medication round at the two units. The total amount of the time nurses spent on documentation at Unit 1 was significantly less than it was at Unit 2 (Unit 1:12% vs. Unit 2: 14%,  $p=0.011$ ), a difference of 4 minutes (21 minutes vs. 25 minutes) in a three-hour medication round.

In terms of medication-related documentation activities, the time nurses spent on locating, reading and documenting at Unit 1 was significantly less than it was at Unit 2 (Table 8.2). In contrast, non-medication-related locating and reading activities at Unit 1 required significantly more time than they did at Unit 2. However, there was no significant difference between the two units in the non-medication-related documentation time. The time spent on the paper note, the handover sheet and the other activities was not significantly different between the two units.

Nurses at Unit 1, who used the eMAR system, also did some paper-based documentation which accounted for 15% of the total documentation time, equivalent to 3 minutes in a three-hour medication round. Paper-based documentation accounted for 71% of nurses' time spent on documenting non-medication-related information, 69% of nurses' time was spent on locating non-medication-related information, and approximately 50% of nurses' time was spent on reading medication-related or non-medication-related records.

### **8.3.2. Medication administration process for a resident using the eMAR system or the paper-based records**

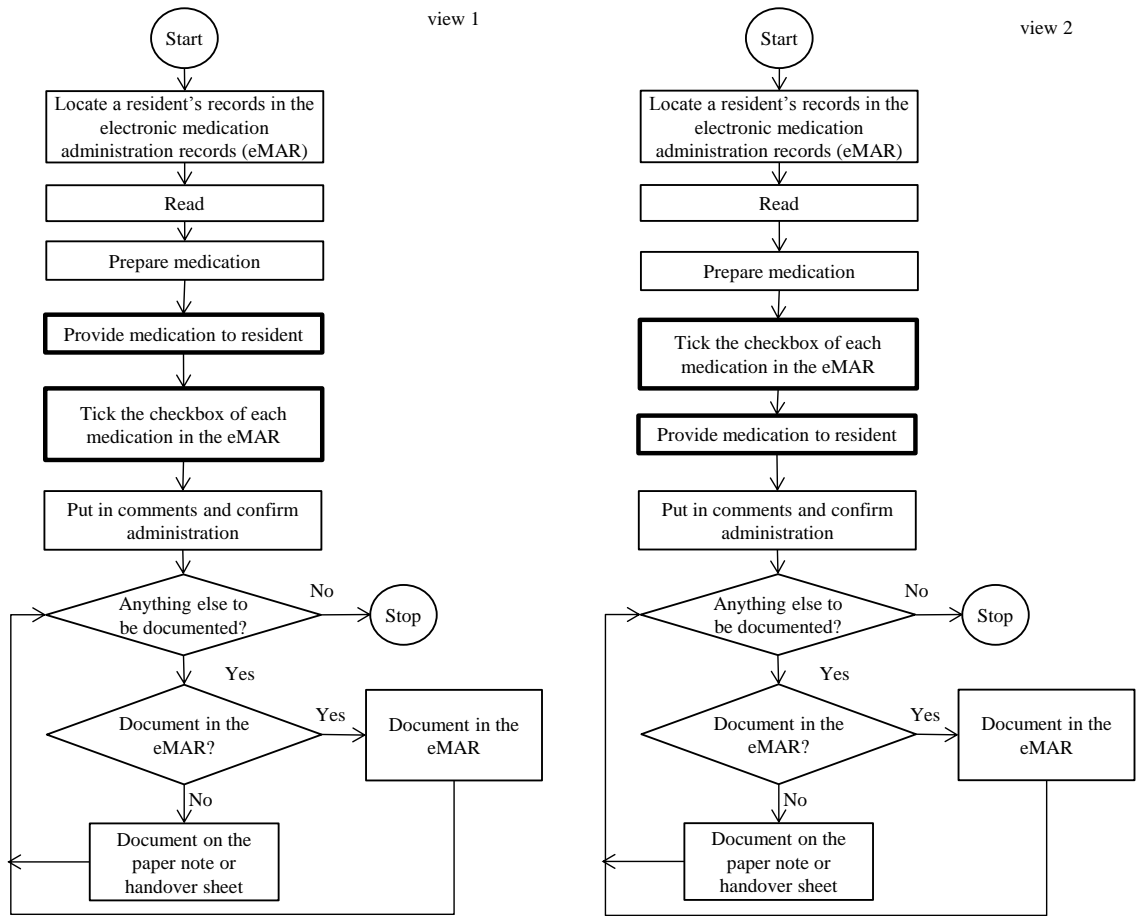
Figure 8.1 shows the work processes of medicating a resident using the eMAR system. A nurse ticked the checkbox for each medication either before or after providing it (bold boxes in Figure 8.1). However, ticking the checkbox did not enter data into the eMAR system. Only by clicking the 'done' button would the data be recorded in the system. The nurse always only hit the 'done' button after providing the medication.

Figure 8.2 illustrates the medication administration processes using paper-based records. In View 1, 'provide medication' is before 'document on the resident's charts', whereas in View 2, they are in the reverse order. View 1 was compliant with the organisation's requirement that documentation be done after providing medication. The process shown in View 2 does not appear to be compliant with the requirement. The time-motion data showed that this problem was recorded 22 (10.58%) times out of 208 medication administration processes in the morning and 19 (13.19%) times out of 144 medication administration processes at noon. This problem was not observed with the use of the eMAR system.

**Table 8.2 The percentage of time nurses spent on each documentation activity in a medication round at the two units.**

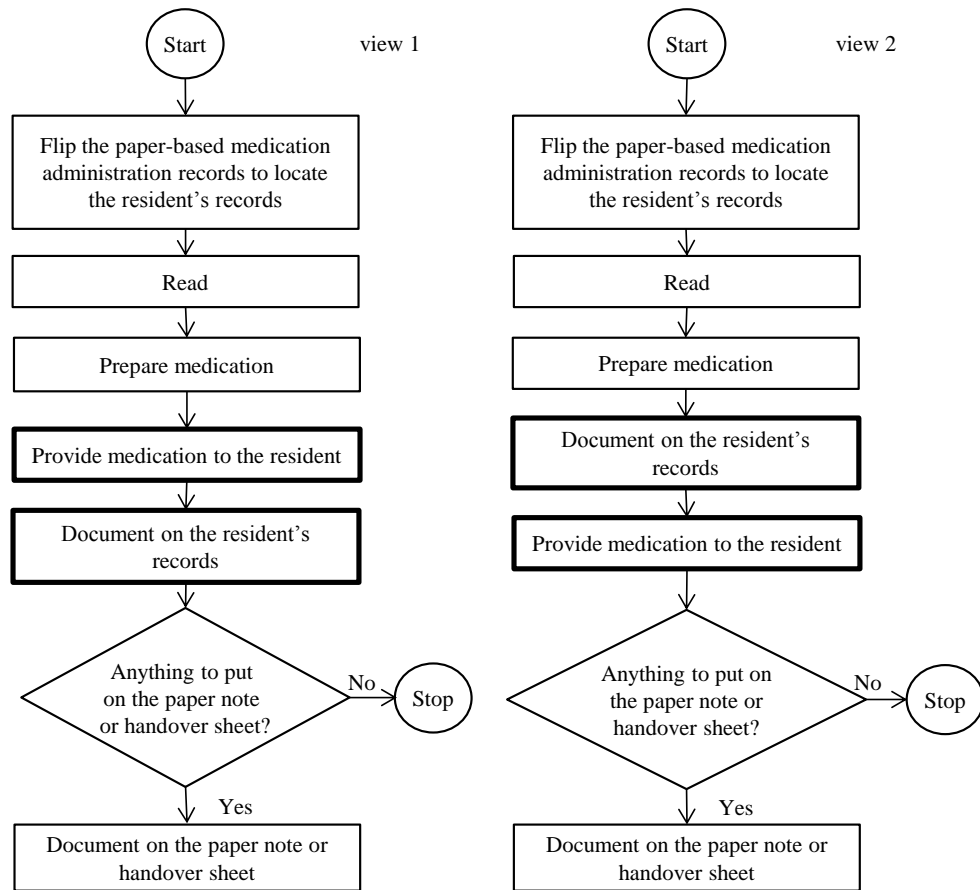
Activities	Unit 1 (eMAR)		Unit 2 (paper records)	p value
	%, (95% confidence interval)	% of paper documentation in each activity	%, (95% confidence interval)	
Total documentation	11.75 (10.51 - 12.99)	14.97	14.10 (12.79 - 15.42)	0.011
Locating a resident's record (medication-related)	3.53 (3.06 - 4.01)	9.16	5.92 (5.16 - 6.69)	<0.0001
Locating a resident's record (non-medication-related)	0.29 (0.13 - 0.46)	68.62	0.08 (0.01 - 0.15)	0.019
Reading a resident's record (medication-related)	0.42 (0.23 - 0.61)	48.96	0.84 (0.62 - 1.07)	0.005
Reading a resident's record (non-medication-related)	0.53 (0.08 - 0.98)	50.00	0.03 (-0.01 - 0.08)	0.032
Documenting on a resident's record (medication-related)	4.57 (3.88 - 5.27)	7.80	5.88 (5.10 - 6.66)	0.014
Documenting on a resident's record (non-medication-related)	0.58 (0.32 - 0.83)	70.68	0.41 (0.19 - 0.64)	0.352
Reading/writing on the paper note or the handover sheet	1.12 (0.81 - 1.44)		0.81 (0.49 - 1.14)	0.177
Other	0.32 (-0.13 - 0.77)		0.11 (-0.01 - 0.23)	0.379

Statistically significant difference between the two units was assumed when the p value was less than 0.050.



**Figure 8.1 Two ways of using the eMAR system during a medication administration process for a resident.**

**(Difference is emphasised with bold boxes)**



**Figure 8.2 Two ways of using the paper-based medication administration records during a medication administration process for a resident.**

**(Difference is emphasised with bold boxes)**

### 8.3.3. The impacts of the eMAR system

The impacts of the eMAR system are summarised in Table 8.3.

**Table 8.3 The impacts of the eMAR system.**

Benefits	Unintended adverse consequences
<ul style="list-style-type: none"><li>• Improving nurses' compliance with organisation's documentation requirements</li><li>• Freedom from the error of signing twice</li><li>• Reducing the possibility of nurses' forgetting to medicate a resident</li><li>• Facilitating nurses to record the time of medication administration to a resident</li><li>• Increasing documentation space</li></ul>	<ul style="list-style-type: none"><li>• Inadequate information about residents in the eMAR system</li><li>• Delayed addition of a new resident's medication profile in the eMAR system</li><li>• Nurses' forgetting to medicate a resident due to power outage of the portable device</li><li>• Inefficient free-text data entry</li></ul>

#### ***Benefits with the use of the eMAR system***

*Improving nurses' compliance with documentation requirements.* The organisation's documentation requirements clearly defined that the documentation should be done before moving on to the next person. When using the paper-based records, the nurses sometimes gave several residents medications before signing their charts. Nurses might do this in an attempt to save time, but it did not comply with the organisational protocol. This problematic documentation practice was not observed when using the eMAR system.

*Freedom from the error of signing twice.* When there was one-month signing space available on one piece of paper, this provided plenty of chances for signing a medication twice under two dates. One error recorded in the medication incident reports was that a nurse signed the medication chart twice when using the paper-based records because she forgot that she had done it after interruption by other care staff in the medication administration process. The eMAR system had alleviated this error by letting a nurse select the medication round time immediately after logging into the system and recording the date and time of this round.

*Reducing the possibility of nurses' forgetting to medicate a resident or to sign on medication charts.* The eMAR system provided good support for a nurse to remember

which resident had or had not been given medication. If a resident had not been medicated or chart not signed, the ‘status’ of this person in the eMAR system would be blank. It was easy for the nurse to notice it, otherwise the eMAR system would prompt the nurse with a message about it.

This was much more convenient than using the paper-based records. When using paper-based records, nurses invented a technique to help them remember who had or had not taken medication. They pulled the first page of a resident’s paper records half out to indicate that the person had not been medicated. After the person was given medication, they pushed the page back. Nurses also flipped through the record book at the end of a medication round to check if all the medication charts were signed. However, sometimes nurses did not do these procedures.

*Facilitating nurses to record the time of medication administration for a resident.* Nurses mentioned that, if a resident had the same medication at both morning and noon, they would try to leave the time gap between the two administrations as long as possible. Therefore, they needed to know when a medication was given to the resident in the morning. The eMAR system recorded the time of medication administration and it was easy to access this information next time. It was not easy to do this with the paper-based record.

*Increasing documentation space.* The eMAR system provided free-text space for a nurse to document extra information. For example, the nurse could document the reason for missed medication by selecting the pre-defined reasons from a drop-down list, or type in the reason in the free-text box. When using the paper-based records, such information could only be noted using the pre-defined letters, because of a lack of space to write more. Any further information was documented on the paper note or the handover sheet.

### ***Unintended adverse consequences with the use of the eMAR system***

*Inadequate information about residents.* One nurse expressed her need to review what medication had been given to a resident in previous shifts. This could be done easily in paper-based records. Paper-based records provided a good overview of the history of medication administration of a resident, with all the medication administration records

over 24 hours and one month displayed on one page. However, data in the eMAR system on a portable device were cleared at 12 a.m. every day. Data recorded from shifts in previous days were not accessible on the device at the point-of-care, but on desktop computers, as they were synchronized in the database.

The common weakness of both the eMAR system and the paper-based records was not providing nurses with the convenience of sharing information about how a resident took a medication. Sharing information about what methods should be used to provide medication to a resident was needed in order to maintain quality of care and promote person-centred care. Although this information could be given by the eMAR system in the 'special instructions' box, this was not done. We observed that, to provide the same medication to the same resident, different nurses used different methods. For example, a nurse fed a resident with spoon but another one let the person take the medication by himself.

*Delayed addition of a new resident's medication profile in the eMAR system.* When a new resident was admitted to the RAC home, it took approximately five days for the pharmacy to upload the person's medication profile into the eMAR system. During this period, nurses had to document for this person on paper-based records. After a long and stressful medication round, nurses may forget to medicate the new person or forget to sign on the charts, since all the other residents' records were in the eMAR system except this person. The only way to prevent this oversight was for the nurse to check the paper-based records at the end of the medication round. In one case, while checking the paper-based records, the nurse found that she forgot to give medication to a resident, so she went back to give medication to that person.

*Nurses' forgetting to medicate a resident due to power outage of the portable device.* The battery life of the portable device was usually long enough for one medication round, but power outage was observed once in the middle of a round. The portable device prompted a low battery message at the bottom right corner on the screen, however the nurse failed to notice and the device was powered off a few minutes later.

As the nurse did not properly log out of the system and connect the device to the internet, the data stored in the device was not synchronized with the server and with

another portable device. Although the nurse used the other device to continue the medication round, she could only rely on her memory about who had or had not been medicated. This resulted in the nurse forgetting to medicate a resident, but fortunately the person came to the nurse for his medication.

*Inefficient free-text data entry.* Staff also mentioned that the touchscreen of the device was not sensitive enough. One nurse stated that it would be good to have a keyboard to use during a medication round, so they did not need to hit the on-screen keyboard, which was not really easy for free-text data entry.

## **Discussion**

### **8.4.1. Impact on nurses' time spent on documentation**

One of the original expectations for the introduction of eMAR system was to reduce nurses' time spent on documentation to give nurses more time on direct resident care. A previous study in RAC homes reported that after using eMAR system, the number of medications given per hour increased from approximately 40 to 57 [1], indicating improved documentation efficiency. However, our study found that the reduction in documentation time was small, possibly due to the already small amount of time spent on documentation activities (less than 30 minutes in a medication round). This may suggest that the use of the eMAR system may not make a major contribution to improving documentation efficiency. However, our study was conducted in one RAC home, and this may limit the generalizability of this finding.

### **8.4.2. Impact on the medication administration process for a resident**

A previous study found nurses overrode important safety workflow blocks designed intentionally in the eMAR system because they were time consuming [10]. Our study found that the use of the eMAR system can positively change nurses' documentation behaviour, improving their compliance with the organisational protocol. This may be because it was not as easy for nurses to quickly switch between different residents' entries in the eMAR system as with the paper-based records.

Correct documentation behaviour can facilitate nurses in recording accurate data, which are important for managing quality of care and resident safety. As nurses' documentation behaviour can be influenced by time constraints, the designers of the

eMAR system must consider the efficiency of using the eMAR system in reality when designing safety features in the eMAR system. If these safety features can be seamlessly integrated into nurses' work processes, they can positively shape the work processes and contribute to resident safety.

#### **8.4.3. Benefits and unintended adverse consequences of introducing the eMAR system**

Medication administration requires high concentration, so nurses' cognitive load in the medication round is high. If interrupted, nurses may forget to medicate a resident or sign on medication charts. The eMAR system can reduce the possibility of such events by providing functions to remind and alert nurses. However, this benefit can be hindered by related work processes that were not integrated effectively with the eMAR system and device deficiencies have fostered an error-prone environment. This suggests that processes and devices that will interface with the eMAR system need to be carefully designed to facilitate the effective use of the eMAR system.

The eMAR system allowed nurses to focus on medications that are due in a specific time frame [1, 8]. This feature can prevent dating and timing errors. However, it did not meet nurses' need to review information from previous shifts. This suggests that nurses have multiple requirements in the amount of information given by the eMAR system when administering medication. When designing the eMAR system, the designers must understand when nurses will need what information and give nurses the flexibility of accessing the needed information in the eMAR system.

The increased documentation space, especially the free-text space, provided by the eMAR system compared to the paper-based records offered an opportunity for important medication-related information to be documented and stored immediately. However, the speed of entering free-text data can be a concern to nurses who aim for high efficiency. The managers of RAC homes may consider providing physical keyboards to facilitate quick free-text data entry, but also need to consider the physical space available on the medication trolley which has been filled with the portable device, some paper-based records, spoons and cups, water and juice, etc.

Despite the increased documentation space in the eMAR system, some useful information (e.g. use a spoon to provide medication) about residents has not been shared in the eMAR system, which should have facilitated person-centred care. Nursing managers need to develop strategies to collect and enter these data about residents' personal preference in taking medication. This information will be useful for nurses in sharing knowledge and facilitating caring for new residents, especially in this high staff turnover care environment.

## **Conclusion**

This study provides information about the time nurses spent on documentation, the medication administration processes using the eMAR system and paper-based records and the impact of the eMAR system in an RAC home. Although the eMAR system does not substantially save the documentation time, it has the potential to improve nurses' compliance with an organisation's documentation requirements. The eMAR system can help reduce the possibility of nurses' forgetting to medicate a resident, however if the work processes and the devices related to the use of the eMAR system are not carefully designed, this benefit may be reduced.

To maximise the benefits of introducing the eMAR system, managers need to be able to predict and plan for the unintended adverse consequences before purchasing and implementing the system. They need to consider, for example, whether the system meets daily documentation needs, how the staff on the floor will actually use the system and whether specific work processes should be adjusted to support efficient work rather than hindering efficiency or providing chances for potential errors. The eMAR system designers must fully understand what information is needed by nurses at what time and in what format in order to effectively support medication administration.

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## **Chapter 9. Fitting Clinical Workflow: The Case for Wound Care in a Residential Aged Care Home**

### **Abstract**

Residential aged care homes have, or are in the process of implementing, EHR systems to improve quality of care and reduce cost. For the system to deliver benefits, it must support nursing tasks and be seamlessly integrated into the nursing workflow. To identify whether and how an EHR system can do this most effectively, direct observation was conducted in an RAC home on nurses' use of an EHR system for wound care.

The work processes of wound care and its documentation were investigated. Problems in the use of the EHR system were identified: 1) functional deficiencies of the EHR system which included a lack of functions to remind nurses of the existence of a wound chart, unavailability of an existing function when needed and a lack of sufficient detail in the information provided; 2) a lack of portable devices to allow nurses to access the EHR system at the point-of-care, resulting in nurses using paper for point-of-care documentation. The findings suggest that continuous improvement in both the EHR system and its management is required to achieve integration of people, task, process and technology for the optimal benefits of EHR.

### **9.1. Introduction**

Many RAC homes have implemented EHR systems in order to improve quality of care, resident safety, efficiency and reduce costs [1]. However, to date, there is little understanding of how EHR systems support nurses in the delivery of care, such as wound care, palliative care or pain management to residents. To fill this knowledge gap, this study investigated the processes of nurses' use of an EHR system for wound care in an RAC home.

The integration of an EHR system into an existing work environment involves people, tasks, work processes and technology [2-4]. People complete a task by following

relevant work processes. The role of an EHR system in this process is to facilitate task completion by providing needed functions.

For an EHR system to bring optimal benefits to nursing care, the system has to support nurses in their task completion. For example, to help a nurse complete the task of documenting vital signs (e.g. blood pressure) of a resident, an EHR system needs to provide the electronic chart of vital signs and a search function for a nurse to locate this chart in the system. In addition to providing adequate functional support [2], EHR systems need to be seamlessly integrated into the work processes to ensure quality of care and resident safety [3], which means that it must provide appropriate support for a user whenever the support is needed.

To achieve the optimal benefits of EHR, the system needs to both meet users' needs and fit in with their work processes and the users need to adjust or redesign their work processes to accommodate the use of the system [2, 5]. For example, Baron et al. reported their experience in integrating an EHR system into a primary care setting in the USA [6]. To accommodate the use of the EHR system, they redesigned the workflow for the delivery of care. Although this process was extremely stressful and increased patient waiting time at the beginning, the situation improved six months later when staff became more confident with the new work processes and the use of the EHR system. The final benefit was reduced patient waiting time.

Wound care is one of the essential nursing tasks to maintain patients' skin integrity. Several wound care management systems have been developed. For example, Mobile Personalized Woundcare System™ (Mobile PWS™) [7], WoundRight [8] and WoundRounds® [9]. All three systems were used on portable devices, but the first two did not require internet connectivity. All provided functions to document wound assessment information, track wound progress and generate a report. Uniquely, Mobile PWS™ allowed a nurse to order wound dressings and set alerts for future care actions. WoundRounds® provided wound image taking function. Both systems also provide a function to create a treatment plan.

Despite these systems developed specifically for wound care, the process of providing wound care and related documentation using an electronic system in RAC homes have

received very little research attention. One study was found which assessed WoundRounds® in an American RAC home [9]. It used a questionnaire survey to evaluate the system's ease-of-use and effectiveness for wound management. It found that within two months, the system was easier for nurses to use. The effectiveness for wound management was also improved.

In order to understand whether and how an EHR system supports nursing care in the context of Australian RAC homes, our study focuses on investigating nurses' wound care processes and their use of the system for documentation.

## **9.2. Methods**

Direct observation was conducted in a non-profit, aging-in-place RAC home from June to September 2013. A single observer followed nurses and recorded their wound care and how they documented it, either in an EHR system or on paper in morning shifts. Informal conversations were conducted whenever questions arose. Field notes were also taken. The research was approved by the ethics committee of the University of Wollongong. Access to the facility was given by the management of the aged care organisation. Written consent was obtained from each participant before the observation started. Four nurses worked in a morning shift, with each of them looking after about 35 residents. Nurses who participated in the study were RNs, EENs and PCWs with Certificate IV Level II.

A web-based EHR system was implemented in 2009. All nursing care staff received a 30-minute one-on-one training three months before the implementation of the system. Staff who were newly employed after the introduction of the system was trained by their peers. A comparison of the time nursing care staff spent on documentation before and after the implementation could be found in [10]. In terms of wound care, the EHR system provided wound charts which allowed nurses to document the wound assessment information, wound dressing and frequency of care. It also provided a function to enable a nurse to search for previous wound charts. The information documented in a wound chart was useful for a nurse to provide the right care to the right wound for the right resident at the right time. The facility did not provide portable devices (e.g. iPads) for point-of-care documentation.

To depict real work processes of how nursing care staff document wound care, as-is work process diagrams were drawn using a workflow mapping technique proposed by Kmetz [11]. The diagram was validated by a registered nurse and two endorsed enrolled nurses.

### **9.3. Results**

#### **9.3.1. Wound care process**

The process of providing wound care is described in Figure 9.1. Before providing wound care to residents, a nurse prepares paper-based documents and a wound care trolley in a nursing station. Then the nurse pushes the trolley to the room of each resident needing wound care and provides the wound care. Paper is used for point-of-care documentation. After completing wound care for all the residents, the nurse comes back to the nursing station and documents the care in the EHR system. In general, a nurse spent one and a half hour on a wound care round, caring for about two to six residents in a morning shift. The number of wounds on each resident might vary from one to five.

#### **9.3.2. Documentation of wound care**

Both paper and the EHR system were used for documentation of wound care. As shown in Figure 9.1, three types of paper-based documents were used during the process. These were a wound care book, a wound summary sheet and a paper note. The wound care book was the main information source for wound care. It consisted of wound charts that were printed off from the EHR system. The wound summary sheet summarised who needed wound care, his or her room/bed number, the location of the wound and scheduled dates for changing the wound dressing or reviewing the wound. It was colour-coded for a nurse to distinguish the time for wound care, either in the morning shift or in the afternoon shift. Wounds to be cared for in the morning shift were listed by a nurse on the paper note before starting wound care. The paper note was used for point-of-care documentation. All the data recorded on the paper note would be transcribed into the EHR system after completing the wound care. The process of transferring data from paper to the EHR system is depicted in Figure 9.2.

### 9.3.3. Problems in the use of the EHR system

Problems related to the use of the EHR system were identified and classified into two categories: functional deficiencies in the EHR system and lack of portable devices to allow users to access the EHR system at the point-of-care. Functional deficiencies included the lack of functions to remind a nurse about the existence of a wound chart, the lack of availability of an existing function when a nurse needed it and the lack of sufficient detail in the information available for nurses.

#### *The lack of functions to remind a nurse about the existence of a wound chart*

The EHR system did not provide feedback about the existence of a wound chart. A nurse who had no knowledge of the existence of the chart might create a second one. This duplication in wound charts caused further confusion for other nurses who needed to retrieve information.

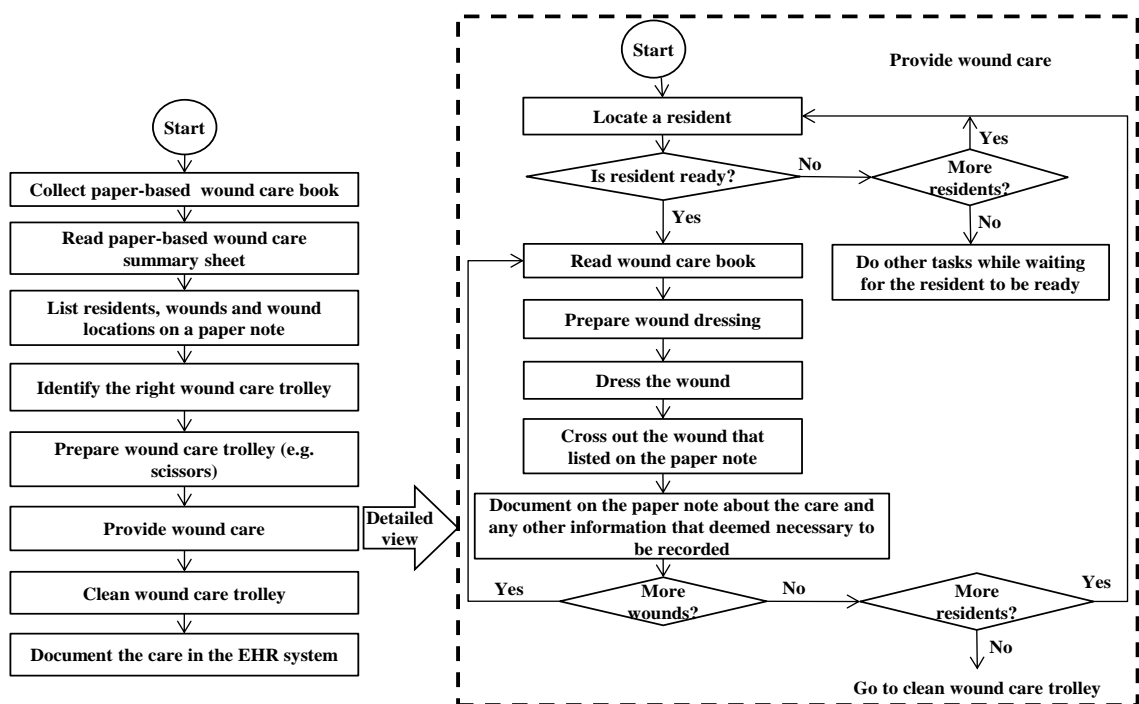
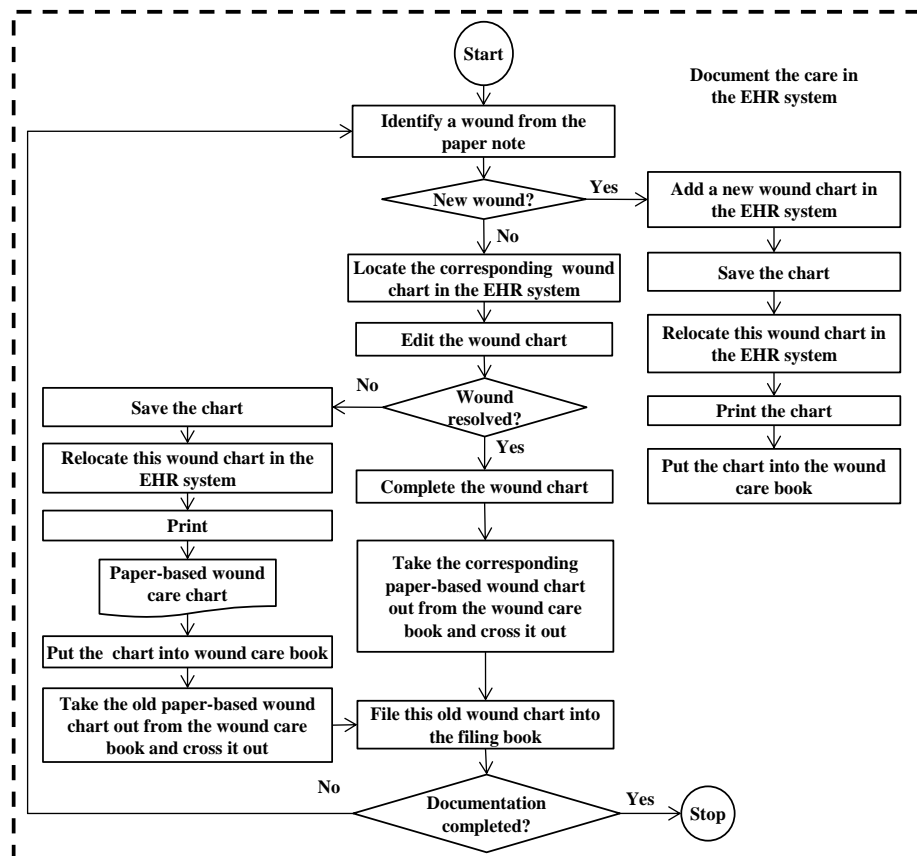


Figure 9.1 Wound care processes.



**Figure 9.2 Transcribing data from paper to the EHR system.**

***The lack of availability of the existing function when a nurse needed it***

Although the EHR system had a print function, this function was not readily accessible to a nurse when updating the chart. This forced the nurse to relocate the chart by clicking into the section ‘View Forms & Charts’, selecting the wound chart from a dropdown box and then the name of the resident from another dropdown box. A list of wound charts for this resident would then be displayed. The nurse needed to identify the right wound chart from this list. Finally, the person could open and print the chart.

***The lack of sufficient detail in information provided to a nurse***

In the example given above about relocating a wound chart, a nurse needed to identify the right chart from a list of wound charts. Although each wound chart in the EHR system had a brief description including resident name, chart name (i.e. wound chart), name of the nurse who created the chart and the creation date of the chart, critical information such as the location of a wound, which the nurse needed to identify the

right chart was not available. This critical information was recorded inside each chart, causing the nurse to manually open each chart in order to identify the right one.

#### **9.4. Discussion**

This study investigated nurses' use of an EHR system for wound care to learn whether and how the system supports nurses in their task completion. Our direct observation identified three functional deficiencies in the EHR system which appeared to add unnecessary processes for nurses to complete a documentation task, instead of shortening this process and saving time. This finding suggests that system development should not stop at the roll-out stage, but must be an on-going, iterative process of redesign to support end users' work. System designers need to continue to work with users to fully understand their work processes and information needs for task completion and the characteristics of the tasks. This knowledge needs to be captured as requirements and be integrated into a redesigned system to improve the capability of the system to support task completion. Only through this continuous process of redesigning the system to fit in with the evolving task requirements, can the benefits of a successfully implemented an EHR system be continuously maintained.

One of the original expectations of RAC homes when introducing an EHR system was to use it to replace paper [12], however paper was still used by nurses. This was because there was a lack of portable devices (e.g. iPad) to enable electronic point-of-care documentation. Therefore, the RAC home may need to consider introducing portable devices to allow nurses to access the system at the point-of-care. In addition, electronic wound charts provided by the current EHR system could only support documentation and information retrieval. This had little help with the management of wounds (e.g. integrated view of wound healing history). Although the current EHR system was not designed specifically for wound management, some features of aforementioned specialised wound care management systems such as Mobile PWS™ [7], WoundRight [8] and WoundRounds® [9] could be considered to be integrated into an updated version of the HER system. For example, tracking wound progress, generating a report and ordering wound dressings [7]. A wound image capture capability offered by the system will also be useful for an accurate documentation of a wound [9]. These

improvements in devices and the EHR system will be likely to lead to improvements in the process of nursing documentation (e.g. saving half of the current wound care documentation time by using a portable device to eliminate paper-based documentation).

## **9.5. Conclusion**

This study investigated the process of wound care and its documentation. Problems in the use of the EHR system in this process were identified. These included three functional deficiencies of the system: the lack of functions to remind a nurse of the existence of a wound chart, the unavailability of an existing function when needed and the lack of sufficiently detailed information. Another problem was the lack of portable devices to allow nurses to access the system at the point-of-care, which resulted in nurses' use of paper for point-of-care documentation and the inefficient, error-prone process of double data entry. Further research may investigate medication administration process as a case to examine the impact of an electronic medication management system.

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## **Chapter 10. General Discussion: Nursing Work Activities through the Lens of Cultural-Historical Activity Theory**

Australian RAC homes are facing the challenges of providing quality, safe and efficient care services due to the increasing number of older people seeking aged care services and a shortage of frontline nursing staff [1, 2]. Currently, there is limited research on nursing work activities in Australian RAC homes. This research aimed to explore and describe nursing work activities in providing personal care and nursing care, identify problems associated with these activities and explain the possible causes and potential impacts of these problems in Australian RAC homes.

Chapters 3 to 9 have presented both quantitative and qualitative descriptions of these activities and identified some problems associated with them. This chapter presents a general discussion about using the cultural-historical activity theory in observations, the findings and provides explanations for possible causes and potential impacts of these problems. It further discussed the implications for practice. A summary of the key findings of this research is presented in Chapter 11.

### **10.1. A reflection on using CHAT in an observational study**

Cultural-historical activity theory provides a six-element framework to systematically plan and conduct the observation, namely who does what, what the object is, what tools or signs are used, what rules are followed by the subject, what the division of labour is in the working environment and how it is embedded in the community. To achieve the aims of this research following the framework of CHAT, the design and conduct of observations considered three aspects: study setting, participants and content of observation.

#### **10.1.1. Study setting**

The study setting included the community, the division of labour and the rules in the CHAT framework. The community was RAC homes- homes for older people and workplace for staff. The division of labour included all the staff (e.g. kitchen staff,

cleaners, nurses) working in the RAC homes. The rules were mainly concerned with policies and guidelines about care provision in the RAC homes.

The observer's knowledge about the study setting was developed during the preliminary study and the pilot study and enriched in the formal observation. The observer gained this knowledge through orientation by a manager about the RAC home, observation of the community, verbal communication with nursing staff and reading of the policies and guidelines of the RAC home. Field notes were taken about the community (e.g. number of units, number of residents and their level of dependence), the division of labour (e.g. number of PCWs, EENs and RNs in a morning, afternoon, and night shift) and the working rules of the RAC homes. This information provided basic knowledge for the observer to understand nursing activities occurred in this environment.

#### **10.1.2. Participants**

The study participants were concerned with the subject in the CHAT framework. More specifically, in the observation of personal care activities, they were PCWs; in the observation of nursing care activities, they were PCWs with medication management certificate, EENs and an RN.

#### **10.1.3. Content of observation**

The content of observation were concerned with the objects done by the participants, tools they used and work processes (i.e. not formally documented rules or routines) they followed when working on the objects.

The objects and tools were considered in the development of the two classification systems of activities. For example, when a nurse was preparing tablet medications (the object), she used a pill crusher to crush the tablets, and a small cup and a spoon to mix the crushed tablets with thickened fluid. The pill crusher, the small cup, the spoon, and the thickened fluid were the tools the nurse used to prepare tablet medications. When the nurse was providing the crushed tablets to a resident, the method of feeding the person was the tool she used. Another tool used at the same time might be verbal communication to encourage or instruct the person to take the tablets. Such detailed information was all recorded when developing the classification systems of activities in

the preliminary study and during the observations in the pilot study and the formal data collection.

Knowledge of objects and tools helped the observer to recognise an activity in time-motion observations. Nurses switched from one activity to another quickly, the observer's familiarity with the objects and tools facilitated quick recognition of an activity and subsequent recording of it.

Cultural-historical activity theory recognises verbal communication as a tool used by a subject to work on an object. This activity was included in the two classification systems of activities developed in this research. However, CHAT did not give any detail about how to design and record this activity in the observation. This research contributed to this aspect by identifying who the nurse was communicating with. For example, a nurse communicating with a resident was a different activity from communicating with a PCW. Another contribution of this research was that it recognised that verbal communication could occur concurrently with another activity. This research was able to record a verbal communication and identify the activity which concurrently occurred with this communication.

The work processes followed by nurses were recorded according to the sequence of activities they conducted. These work processes, although not outlined as rules in the policies or guidelines of the RAC homes, were generally followed by all the nurses to complete care provision. The work processes were not explicitly mentioned in CHAT, but they could be considered as rules or routines developed by the nurses in the workplace. The examination of these work processes can help to identify potential issues and facilitate the subsequent improvement efforts.

An important concept in CHAT is contradiction. A contradiction or problem can be identified within or between the six elements of CHAT. It can also occur between two activity systems. Because the second aim of this research was to identify problems associated with care activities, attention was paid to the six elements, the interactions between them and interactions between activities during the observations. The interpretation of the possible causes of these problems and potential impacts relied on

the observer's understanding about the six elements individually and as a whole and the interactions between activities.

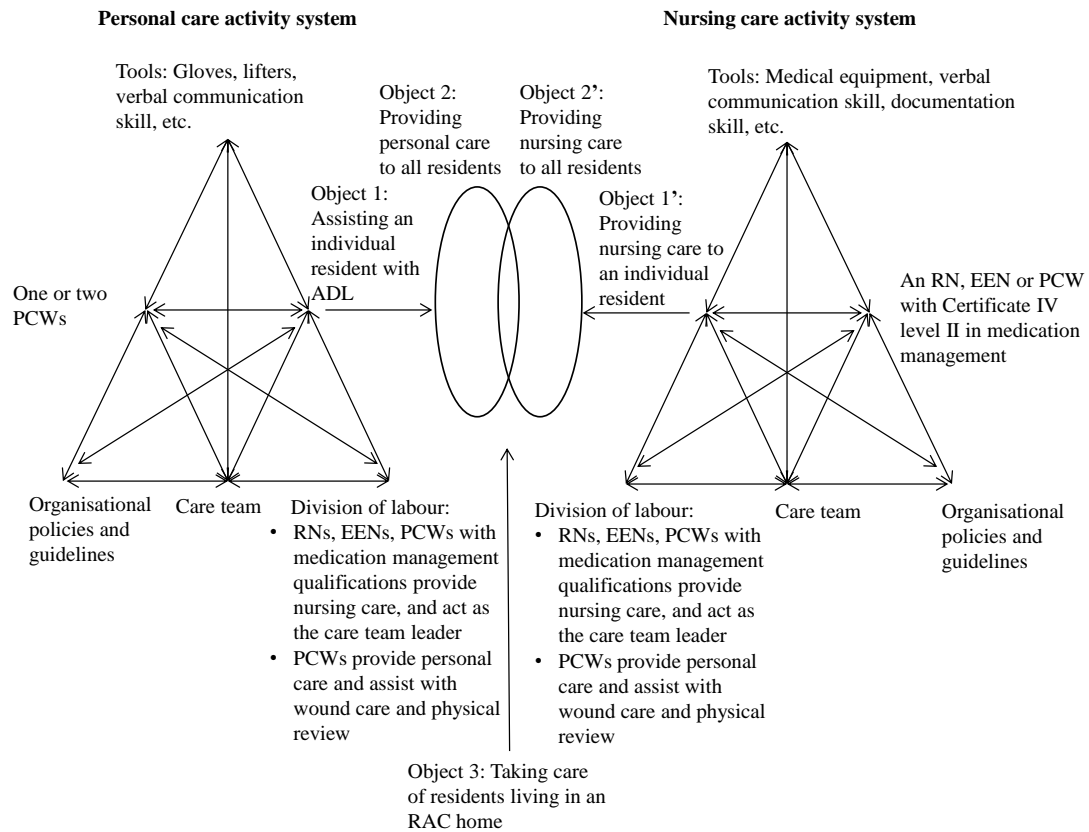
### **Limitations of CHAT**

Cultural-historical activity theory is a high-level framework which provides guidance on what needs to be considered in an observational study. It does not provide guidance on the selection of observational methods. Conducting a time-motion or work sampling observation, or taking structured field notes in the observation, need to be justified by the researcher. The researcher needs to pay attention to many details when conducting an observational study, such as considering methods to minimise the effect of participants changing their behaviours under observation.

#### **10.2. The interaction between personal care and nursing care activity systems**

The aged care services in an Australian RAC home are delivered by a team of staff with appropriate skill mix. These include nursing staff and general staff. General staff include administrative staff, kitchen staff, laundry staff, cleaners, gardeners and service people from outside organisations, such as an electrician and a handyman.

The subjects of this research were nursing staff who undertook nursing work activities, namely RNs, EENs and PCWs. The nursing work activities were further divided into personal care activities undertaken by PCWs without medication management qualifications and nursing care activities undertaken by nursing care staff, including RNs, EENs and PCWs with medication management qualifications. These two activity systems interacted with each other and shared a common goal of providing aged care and healthcare services to the older people living in an RAC home (Figure 10.1).



**Figure 10.1 The interaction between personal care and nursing care activity systems in an RAC home.**

In the personal care activity system, one or two PCWs worked in a team, using tools such as mechanical lifters, gloves, personal care skill and verbal communication skill to deliver the personal care service to older people. They followed relevant organisational policies and guidelines to achieve the objective of assisting residents with their ADL.

In the nursing care activity system, a nurse used tools such as medical equipment, nursing knowledge and skills, documentation skill and verbal communication skill to provide nursing care to older people, following relevant organisational policies and guidelines. The objective was to deliver necessary and appropriate nursing care to residents.

In Figure 10.1, Object 1 and Object 1' are at the individual resident level. They are done for a specific resident. Object 2 and Object 2' are at the group level. They are done for all the residents needing a type of care in an RAC home. For example, in the personal

care activity system, a PCW checks or changes a resident's pad to manage incontinence for the person. This is Object 1. A group of PCWs check or change pads of all the residents who use pads. This is Object 2. In the nursing care activity system, a nursing care staff member provides medications to this resident to treat the person's incontinence (Object 1'). Providing medications to all the residents with incontinence is Object 2'. The Object 2 of the personal care activity system and the Object 2' of the nursing care activity system share a same goal of incontinence management for residents living in an RAC home.

This research did not systematically analyse the interactions between the personal care and nursing care activity systems. Further investigations on this topic are needed to provide insights into the management of care for residents in RAC homes.

### **10.3. Personal care activity system in an RAC home**

The personal care activity system in an RAC home was composed of four sub-activity systems: direct care, indirect care, documentation and infection control. Table 10.1 presents the components of each activity system, including subject, object, tools, rules, community and division of labour. The commonalities of the four sub-activity systems were subject, rules, community and division of labour. The subject was the PCWs. The community was the care team including RNs, EENs and PCWs. In the division of labour, RNs, EENs and PCWs with medication management qualifications provided nursing care and provided guidance to personal care delivery conducted by general PCWs. All staff members followed the organisational policies and guidelines in care service delivery.

In the direct care activity system, PCWs used tools such as mechanical lifters, personal care skill and verbal communication skill to assist residents with their ADL. Among the four sub-activity systems, direct care accounted for most (31%) of the PCWs' time. A previous work sampling study which was also conducted in an Australian RAC home found that PCWs spent 40% of their time on the direct care activity [3]. A more recent time-motion study conducted in a Canadian RAC home found that PCWs spent 60% of their time on personal care including the direct care activity [4]. These findings indicate that direct care is the central activity system for personal care in RAC homes.

In the indirect care activity system, PCWs set up tools such as a mechanical lifter to support the conduct of the direct care activity. The frequent switching between direct care and indirect care activities found in this research suggested that indirect care had an important supporting role to direct care. Among the four sub-activity systems, indirect care was the second time-consuming activity. It accounted for 18% of PCWs' time, almost twice as the time estimated by a previous work sampling study which was also conducted in an Australian RAC home [3]. More studies are needed to investigate the indirect care activity in RAC homes to understand when and how the indirect care activity interacts with direct care activity.

In the documentation activity system, the PCWs in this research used tools such as paper-based charts, pens and writing skill to document the care provided to the residents. The documentation activity was conducted at the end of a shift. It only consumed a small amount of the PCWs' time. It interacted with direct care activity system only when a need to check the records for specific information arose. This indicated that the purpose of the documentation activity for PCWs was data entry according to the organisational policies. Personal care activities were person-centred with intensive human interactions and actions. This required high mental and physical concentration, making it not possible for PCWs to engage in another activity that did not directly support personal care delivery at the moment. Therefore, the majority of PCWs could only squeeze time at the end of a shift to complete their documentation activity.

Previous studies also found that PCWs only spent a small amount of time on documentation activity [3, 4]. This finding suggests that the expectation of introducing an electronic information system to replace paper-based documentation in order to improve documentation efficiency [5, 6] may not be realised for personal care activity in RAC homes. This is also evident in a work sampling study which examined whether the introduction of an electronic information system could reduce documentation time in RAC homes [7]. The study results showed no change in personal care documentation time after the introduction of the system.

In the infection control activity system, a PCW used tools such as alcohol-based hand sanitiser and gloves to minimise infection. This research found that PCWs conduct an

infection control activity between five to nine times per hour. The average duration of conducting an infection control activity was less than one minute (see Table 3.3 in Chapter 3). Whether this time is adequate in RAC homes needs further investigation.

**Table 10.1 Four sub-activity systems in personal care.**

<b>Component</b>	<b>Direct care activity system</b>	<b>Indirect care activity system</b>	<b>Documentation activity system</b>	<b>Infection control activity system</b>
Subject	One or two PCWs	One or two PCWs	One PCW	One PCW
Object	Assisting residents with ADL such as personal hygiene, toileting and mobility	Conducting indirect care activity, such as setting up mechanical lifters, making bed and sorting supplies	Documenting care on paper-based charts	Minimising infection
Tools	<ul style="list-style-type: none"> <li>• Mechanical lifter</li> <li>• Wheelchair</li> <li>• Personal care supplies</li> <li>• Knowledge about the resident</li> <li>• Verbal communication</li> <li>• Personal care skill</li> <li>• Teamwork skill</li> <li>• Task prioritising skill</li> <li>• Time management skill</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge about how to use tools</li> <li>• Verbal communication</li> <li>• Teamwork skill</li> <li>• Personal care skill</li> <li>• Task prioritising skill</li> <li>• Time management skill</li> </ul>	<ul style="list-style-type: none"> <li>• Pen</li> <li>• Paper-based charts</li> <li>• Handwriting skill</li> <li>• Reading skill</li> <li>• Writing skill</li> <li>• Knowledge about personal care</li> </ul>	<ul style="list-style-type: none"> <li>• Water</li> <li>• Paper towels</li> <li>• Alcohol-based hand sanitiser</li> <li>• Gloves</li> <li>• Apron</li> </ul>
Community	Care team: Nursing care staff and PCWs			
Rules	Organisational policies and guidelines			
Division of labour	<ul style="list-style-type: none"> <li>• Nursing care staff provide nursing care and act as the care team leader</li> <li>• PCWs provide personal care, occasionally provide medication to residents</li> </ul>			

### **10.3.1. The contradiction in personal care activity system, possible cause, potential impact and implications**

Problems in an activity system can be the manifestations of contradictions in the activity systems of nursing work. As mentioned in Chapter 2, primary contradictions appear within a component (e.g. tools) of an activity system; secondary contradictions appear between components (e.g. subject and rules) of an activity system; tertiary contradictions appear between the object of the dominant form of an activity system and the object of a culturally more advanced form of the activity; and quaternary contradictions appear between an activity system of interest and its interacting activity systems [8]. Conceptualising the problems to the four levels of contradictions provides useful insight into these problems and will assist in the development of targeted solutions to these problems.

Findings from this research also suggested that the tool of verbal communication was vitally important for the coordination of various activity systems. There was no difference in the amount of time PCWs spent on verbal communication with the older people that they cared for (see Table 4.2 in Chapter 4). However, there was a significant difference between the two units in the amount of time PCWs spent on verbal communication with their care team members about a resident's information (see Chapter 3). This difference may be attributed to the difference in PCWs' verbal communication skill because most PCWs at one unit were non-native English speakers, but their counterparts at the other unit were all native English speakers. This problem might cause inadequate verbal communication among care team members.

Communication among care team members is crucial for PCWs to understand changes in residents' care needs and apply appropriate adjustments to care provision. As residents are cared for by a number of nursing staff rostered on three shifts, consistent and timely knowledge about a resident's care needs among nursing staff is important for person-centred care. Nursing managers need to be aware of the communication barrier among team members when some were non-native English speakers. Training program needs to be implemented to improve communication among team members.

#### **10.4. Nursing care activity system in an RAC home**

The nursing care activity system was composed of five sub-activity systems: medication administration, wound care, physical review, documentation and infection control. Table 10.2 presents these activity systems.

As described in Chapter 5, medication administration, wound care and physical review were conducted sequentially by the nursing care staff. These activities took turns as the central activity system depending on the time of the day. In the morning, medication administration was the central activity system. Nursing care staff focused on completing this activity. Then, the wound care activity system became the central activity system. Depending on the availability of time, physical review may or may not be conducted by nursing care staff. If conducted, it became the central activity system. At lunchtime, medication administration again took the position of central activity system.

The commonalities of these sub-activity systems were subject, rules, community and division of labour. Registered nurses, EENs, PCWs with Certificate IV Level II in medication management conducted nursing care activity. Personal care workers with Certificate III in aged care conducted personal care activity, sometimes assisted with wound care and performed physical review activity. They followed organisational policies and guidelines to deliver care services to the older people living in an RAC home.

**Table 10.2 Five sub-activity systems in the nursing care activity.**

<b>Component</b>	<b>Medication administration activity system</b>	<b>Wound care activity system</b>	<b>Physical review activity system</b>	<b>Documentation activity system</b>	<b>Infection control activity system</b>
Subject	One RN or EEN or PCW with Certificate IV Level II in medication management	One RN or EEN or PCW with Certificate IV Level II in medication management	One RN or EEN or PCW with Certificate IV Level II in medication management, or a PCW with Certificate III in aged care	One RN or EEN or PCW with Certificate IV Level II in medication management	One RN or EEN or PCW with Certificate IV Level II in medication management
Object	Administering medication	Caring for wounds	Conducting a physical review activity such as monitoring blood pressure	Documenting on paper-based or electronic records	Minimising infection
Tools	<ul style="list-style-type: none"> <li>• Medical equipment</li> <li>• Medication trolley</li> <li>• Telephone</li> <li>• Watch</li> <li>• Verbal communication</li> <li>• Task prioritising skill</li> <li>• Time management skill</li> <li>• Knowledge about medication management</li> </ul>	<ul style="list-style-type: none"> <li>• Wound care dressings and equipment</li> <li>• Wound care trolley</li> <li>• Verbal communication</li> <li>• Knowledge about wound care</li> </ul>	<ul style="list-style-type: none"> <li>• Physical review equipment</li> <li>• Verbal communication</li> <li>• Knowledge about physical review</li> </ul>	<ul style="list-style-type: none"> <li>• eMAR</li> <li>• Portable device</li> <li>• Computer</li> <li>• Typing skill</li> <li>• Paper-based charts</li> <li>• Handwriting skill</li> <li>• Reading and writing skill</li> <li>• Knowledge about nursing care</li> </ul>	<ul style="list-style-type: none"> <li>• Water</li> <li>• Paper towels</li> <li>• Alcohol-based hand sanitiser</li> <li>• Gloves</li> </ul>
Community	Care team: RNs, EENs, PCWs				
Rules	Organisational policies and guidelines				

<b>Component</b>	<b>Medication administration activity system</b>	<b>Wound care activity system</b>	<b>Physical review activity system</b>	<b>Documentation activity system</b>	<b>Infection control activity system</b>
Division of labour	<ul style="list-style-type: none"> <li>• RNs, EENs, PCWs with Certificate IV Level II in medication management conduct medication administration, wound care, physical review</li> <li>• PCWs with Certificate III in aged care provide personal care, sometimes assist with wound care and perform physical review</li> </ul>				

#### **10.4.1. Medication administration activity system**

In the medication administration activity system, nursing care staff used tools such as medical equipment, task prioritising skill, time management skill and verbal communication when conducting a medication round. This research investigated the medication administration activity by examining its work processes (see Chapter 6) and time spent on each type of medication (see Chapter 7).

Ellis et al. conducted focus group discussions in two RAC homes in Canada to understand how nursing care staff conduct the medication administration activity [9]. They found that medication administration was conducted in three stages: preparing for medication administration, administering medication, and after medication administration. Compared to their findings, this research provided a more detailed process diagram which illustrated an actual work process generally followed by nursing care staff to pass medications to residents in a medication round. The organisation of various activities conducted during a medication round was visualised in this research. In addition, it explained the differences between individual nurses' work processes, providing more insight into the actual practice on the floor. This information about individual nurses' work processes is useful for determining the best practice [10].

Findings of this research also showed that knowledge about residents was important to facilitate medication administration. This was also found by Ellis et al. [9]. An important way to gather information about a resident is verbal communication [9]. This research found that nursing care staff spent 28% of their time (more than two hours) on verbal communication in a morning shift. The majority of communication was between a nurse and a resident and among nursing staff. A previous work sampling study in an Australian RAC home found even more time spent on verbal communication by RNs (48%) and EENs (38%) [3]. Findings of this research also showed that verbal communication was most frequently conducted during medication administration time periods. These findings on verbal communication indicate that verbal communication played an important role in medication administration. The quality and content of verbal communication in RAC homes need further investigation.

In this research, nursing time spent on administering each type of medication was examined and whether individual residents' medication needs would impact the time needed for this activity was determined. The majority of the residents took tablets. The way the tablets were prepared and provided made significant difference in the time spent on medication administration. To our knowledge, this is the first study of its kind in RAC homes. It contributes to the knowledge of medication administration time in RAC homes. The findings are useful for estimating nursing workload [11], determining staffing levels [12] and allocating tasks [13] to ensure safe medication administration in RAC homes.

#### **10.4.2. Wound care and physical review activity systems**

In the wound care activity system, a nurse used tools such as wound dressings to provide wound care to several residents who needed this care in a shift. This research measured the time that nursing care staff spent on wound care (see Chapter 5) and illustrate the real work processes of conducting wound care round in an RAC home (see Chapter 9). Findings showed that a wound care round accounted a small portion of nursing time in a shift and its management relied on paper such as a wound summary sheet.

The physical review activity was often allocated to a PCW, possibly due to the time pressure felt by a nurse who needed to complete the time-consuming medication administration activity and the wound care activity. This may indicate a need to re-allocate this task.

#### **10.4.3. Documentation activity system**

In the documentation activity system, a nurse used tools such as the eMAR system, the EHR system and the paper-based charts to document nursing care provided to residents. Documentation was conducted both at the point-of-care and after completion of all the nursing care activities. During the provision of medication administration, wound care and physical review, the documentation activity system interacted with these three activity systems by providing information about residents and documentation space.

After the lunchtime medication administration had been completed, documentation became the central activity system.

A couple of studies that evaluated the impacts of introducing an electronic information system in RAC homes [6, 14-17]. They found that the introduction of the system did not change nursing staff's time expenditure on documentation [14] and increased documentation space [6], and generated difficulty in data entry and information retrieval and increased documentation burden [16]. This research also identified these impacts. However, it did not identify technology workarounds which were found by a previous study [17]. This research found repetition in wound care documentation. This was opposite to a previous study which found that the introduction of an electronic information system reduced repetition in data entry [15]. Providing a portable device for wound care rounds or introducing a point-of-care wound documentation system [18] might eliminate the repetition in wound care documentation.

#### **10.4.4. Infection control activity system**

In the infection control activity system, a nurse used tools such as an alcohol-based hand sanitiser to minimise infection. The findings showed that the infection control activity became more frequent during wound care. This was also found by an observational study conducted in an RAC home in the USA [19]. This research also found that nursing care staff spent less than 15 minutes on the infection control activity in an eight-hour morning shift. The average duration of an infection control activity was only 11 seconds. The frequency of this activity per hour was less than 15 times. Whether these time, duration and frequency of the infection control activity were adequate needs further investigation.

#### **10.4.5. Contradictions in nursing care activity system, possible causes, potential impacts and implications**

The problems identified in the nursing care activities were grouped into three categories: medication administration, documentation of medication administration and documentation of wound care. Their corresponding activity system, level of

contradiction, possible causes, potential impacts and implications are presented in Table 10.3.

### ***Contradictions in the activity system of medication administration***

The contradictions in the activity system of medication administration included primary, secondary and quaternary contradictions. The primary contradiction was in the physical tools: the medication trolley and the floor. The shelf extension of the medication trolley was tilted and some parts of the floor were not level. The bumping floor caused the spoons placed on the medication trolley fell onto the floor. The nurse had to pick them up, bring them to the wash up room and collect clean ones for use to feed medication to residents.

The secondary contradictions were all between the nurse subject and the rules. For example, a nurse prepared medication for two residents at a time. This practice did not appear to be compliant with the organisational medication management guideline which required that medication be prepared for one resident at a time. Possible causes of this contradiction included time constraints and the nurse subject's lack of awareness of the rules. Time management strategies that can enable nursing care staff to complete medication administration following correct rules need to be identified and shared among nursing staff. Educational program is needed to ensure that nursing care staff understand organisational policies and guidelines on medication management, and the potential adverse consequences (e.g. through wrong medication) of violating the policies and guidelines.

A quaternary contradiction was found between the activity system of medication administration and the activity system of assisting residents' with their ADL. Both activity systems were essential in the RAC home. Nursing care staff members were facing the dilemma of concentrating on medication administration to ensure resident safety and responding to demands from residents. The demands from the residents may distract or interrupt the medication administration process.

A number of previous studies have identified distractions or interruptions as critical barriers to medication safety [9, 20-23], with interruptions during preparation of

medications regarded as the most important barrier [23]. A possible solution to this problem is to understand residents' habits and preferences about the demands they often make and develop a strategy to meet these needs in order to reduce residents' non-medication-related demands sent to the medication nurse who needs to concentrate closely on his/her task.

### ***Contradictions in the activity system of documentation of medication administration***

The contradictions in the activity system of documentation of medication administration were at the primary, secondary and quaternary levels. Primary contradictions were all presented in the tools. For example, the touch screen of the portable device was not sensitive and the lack of a keyboard, causing inefficient free-text data entry. Power outage of the portable device forced a nurse to rely on her memory to continue a medication round, leading to the consequence of the nurse forgetting to medicate a resident. The occurrence of this consequence may be due to the nurse's not noticing the low-battery message prompted by the portable device. Portable devices can increase the accessibility to an electronic information system at the point-of-care [24]. However, technology failures [16] may cause interferences to nursing work and safety of residents as found in this research.

The eMAR system did not provide adequate information for nurses to use during medication rounds. There were three possible causes of this problem. First, the system designer lacked of sufficient understanding about nurses' work processes. Second, there was a lack of feedback about the system provided to the system designers. Third, useful information was not entered into the system. Knowledge about a resident and the medications taken by this person is vital for safe management of medications [9, 25]. The design of an eMAR system should aim for providing adequate information to a nurse during a medication round. Useful information needs to be entered into the eMAR system to share among nursing staff.

A secondary contradiction was identified between the nurse subject and the organisational guidelines on documentation. When using the paper-based medication administration records, a nurse documented before providing medication to a resident or documented for several residents at a time. The organisational guidelines required that

documentation be done immediately after medicating a resident and before medicating the next person. This contradiction was facilitated by the flexibility of the paper-based medication administration records and seemed to be compelled by the time constraints. The same problem was not observed with the use of the eMAR system (see Chapter 8), indicating the ability of the eMAR system to improve staff compliance with rules. This finding is unlike what was found by previous studies in RAC homes in which nursing staff worked around an eMAR system [17, 26]. This difference may be due to the difference in the design of the eMAR systems. For an eMAR system to generate benefits to medication administration, the system must fit in with nursing work processes.

The quaternary contradiction was between the activity system of documentation of medication administration in the RAC home and the activity system of adding a new resident's medication profile to the eMAR system in the pharmacy. The delayed data addition process in the pharmacy could cause adverse consequences as a nurse might forget to medicate this new resident because data was not in the eMAR system but separately on paper. This problem indicates that the medication administration activity can be affected by the efficiency of the work process outside an RAC home.

These contradictions imply that the effective use of the eMAR system requires four things. Quality and availability of the devices associated with the use of the eMAR system need to be assured. The way that nursing staff use the system such as what information is entered into the system. System designers and suppliers need to fully understand nursing work processes and what information is needed at what time. The work processes outside an RAC home but interact with the work processes inside the home need to be effective.

### ***Contradictions in the activity system of documentation of wound care***

Contradictions found in the activity system of wound care documentation were at the primary and secondary levels. Primary contradictions were all about functional deficiencies in the EHR system used for wound care documentation, for example, the lack of functions to remind a nurse about the existence of a wound chart, resulting in duplicated charts in the system. The primary contradictions in wound care

documentation were possibly caused by the system designer's lack of understanding about how nursing staff document care, what functions are needed and at what point in the documentation process.

The secondary contradiction was between the documentation tool and the object of documenting wound care in the EHR system. The lack of a portable device to allow a nurse to access the EHR system at the point-of-care resulted in a pile of paper-based wound charts carried around by the nurse to provide information about residents during a wound care round. There was a piece of paper for documentation and subsequent transcription of data from the paper to the EHR system. A portable device may be helpful to reduce the amount of paper document used during a wound care round. However, caution should be taken when introducing a portable device for use in wound care rounds, as previous studies have found that portable devices may cause unintended adverse consequences to nursing work, such as longer time spent on documentation [16, 27].

These contradictions identified in the activity system of wound care documentation indicated that the capability and availability of tools affect the effective and efficient use of the EHR system.

**Table 10.3 Contradictions in nursing work activity systems, their possible causes, potential impacts and implications.**

Note: Primary contradictions appear within a component of an activity system; secondary contradictions appear between components of an activity system; quaternary contradictions appear between two interacting activity systems. Physical tools are material tools such as artefacts, instruments, machines and computers; psychological tools include verbal communication, signs, and ideas, etc.

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
Direct care	Significant difference between the two high-care units in the time PCWs spent on communicating information about residents with care team members	Primary contradiction in the psychological tool (verbal communication skill)	The PCWs in one unit were non-native English speakers and those in the other unit were native English speakers	Inadequate verbal communication among care team members	Nursing managers need to be aware of the communication barrier among team members when some were non-native English speakers. Training program needs to be implemented to improve communication among team members
Medication administration	The shelf extension of the medication trolley was tilted and some parts of the floor were not level. The bumping floor caused the spoons placed on the medication trolley fell onto the floor. The nurse	Primary contradiction in the physical tool (medication trolley and floor)	The maintenance of the tools and the physical environment of the RAC home	Interrupted medication administration activity	Improving the physical work environment and tools (e.g. fixing the floor and purchasing quality medication trolley) may reduce difficulties encountered by the busy medication nurses and

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
	had to pick them up, bring them to the wash up room and collect clean ones for use to feed medication to residents				enable them to concentrate on the cognitively intensive medication administration activity
Medication administration	During the medication round, the nurses were asked by residents to perform non-medication related activities such as getting a cup of water	Quaternary contradiction between the activity system of medication administration and the activity system of assisting residents' ADL	In adequate staffing due to the shortage of nursing staff in Australian RAC homes	Interrupted medication administration activity	There is a need to better understand residents' habits and preferences and develop a strategy to meet these needs in order to reduce residents' non-medication-related demands sent to the medication nurse who needs to concentrate closely on his/her task
Medication administration	Preparing medication for two residents at a time	Secondary contradiction between the subject and the rules which require that medication to be prepared for one resident at a time	<ul style="list-style-type: none"> <li>• Time constraints</li> <li>• The subject was not aware that the behaviour violated the rules</li> </ul>	Wrong medication	Educational program is needed to ensure that nursing staff understand organisational policies and guidelines on medication management, and the potential adverse

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
					<p>consequences (e.g. through wrong medication) of violating the policies and guidelines</p> <p>Time management strategies that can enable nursing staff to complete medication administration following correct rules need to be identified and shared among nursing staff</p>
Medication administration	Not checking whether a resident was in the room or not before preparing medication	Secondary contradiction between the subject and the rules	The subject was not aware of the potential adverse consequences of this work process (e.g. forgetting to medicate the resident)	Forgetting to medicate the resident	Educational program is needed to let nursing staff be aware of the potential adverse consequences of suboptimal work processes
Medication administration	Pouring the liquid medication into a small medication cup on the trolley without measuring	Secondary contradiction between the subject and the rules	Time constraints	Wrong dosage	Time management strategies that can enable nursing staff to complete medication administration

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
	at eye level to ensure accuracy				following correct rules need to be identified and shared among nursing staff
Medication administration	Not waiting at least one minute between puffs of multiple inhalations	Secondary contradiction between the subject and the rules	Time constraints	Affected effectiveness of the medication	
Medication administration	Not asking the RN on duty for permission to administer a PRN medication to a resident	Secondary contradiction between subject and the rules	The subject did not know the rules	Inappropriate medication	Educational program is needed to ensure that nursing staff understand organisational policies and guidelines on medication management
Documentation of medication administration	When using paper-based medication administration records, a nurse documented before providing medication to a resident or documented for several residents at a time	Secondary contradiction between the subject and the rules which required that documentation be done immediately after medicating a resident and before medicating the next resident	Time constraints	Errors in documentation	Time management strategies that can enable nurses to complete medication administration following correct rules need to be identified and shared among nursing staff
Documentation of medication administration	Inadequate information about residents provided by the eMAR system during a medication round	Primary contradiction in physical tool (the eMAR system)	<ul style="list-style-type: none"> <li>The eMAR system designer did not fully understand nursing work processes, what</li> </ul>	Impact on nurses' decision making about medication administration	System designer's knowledge about nursing work activities need to be enriched. This can be done

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
			<p>information was needed at what time</p> <ul style="list-style-type: none"> <li>• Nursing staff did not enter the information</li> </ul>		<p>by involving nursing staff on the floor when system analyst collects end user requirements or collecting staff feedback for updating the system</p> <p>Useful information needs to be entered into the eMAR system to share among nursing staff</p>
Documentation of medication administration	Delayed addition of a new resident's medication profile in the eMAR system by the pharmacy, causing potential adverse consequences of a nurse forgetting to medicate this resident or documenting for this person during a medication round	Quaternary contradiction between the activity system of medication administration documentation in the RAC home and the activity system of adding a new resident's data to the eMAR system in the pharmacy	Inefficient work processes in the pharmacy	Potential adverse consequences of a nurse forgetting to medicate this resident or documenting for this person during a medication round	Effective use of the eMAR system is affected by the associated work processes outside the RAC home
Documentation of medication	Nurses' forgetting to medicate a resident due to	Primary contradiction in the physical tool (the	The low-battery message prompted by the portable	Forgetting to medicate a resident	Important messages such as low-battery message

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
administration	power outage of the portable device	portable device)	device did not get the subject's attention		prompted by the portable device need to get the attention of the busy nurse who concentrates on medication administration and may not notice the message  Effective use of the eMAR system is affected by the function of the portable device
Documentation of medication administration	Inefficient free-text data entry	Primary contradiction in physical tool (the portable device)	The touch screen was not sensitive or the lack of a keyboard	Inefficient documentation	Effective use of the eMAR system is affected by the quality and the availability of associated devices
Documentation of wound care	The lack of portable devices to allow nurses to access the EHR system at the point-of-care, causing double documentation on paper and the EHR system	Secondary contradiction between the tool and the object of documenting in the EHR system	Resource constraints in the RAC home	<ul style="list-style-type: none"> <li>• Inefficient documentation</li> <li>• Transcription errors</li> </ul>	Effective use of the EHR system in wound care may require portable devices
Documentation of	The lack of functions to	Primary contradiction in	The EHR system designer	Inefficient documentation	Effective use of the EHR

Activity system	Problems	Contradictions	Possible causes	Potential impacts	Implications
wound care	remind a nurse about the existence of a wound chart, causing duplicated charts in the EHR system	physical tool (the EHR system)	did not fully understand what information was needed by nurses at what time in their documentation processes		system requires that the system's processes to align with nurses' documentation processes
Documentation of wound care	The lack of availability of an existing function when a nurse needed it, causing unnecessary processes for nurses to complete the documentation task				
Documentation of wound care	The lack of sufficient detail in the information available for nurses, causing the nurses manually screening each wound chart in the EHR system in order to locate the right chart				

## **10.5. Conclusion**

This chapter has given a general discussion about the research findings, conceptualised nursing work activities and their associated problems, and explained possible causes, potential impacts and implications of these problems. The activity systems in personal care provision included direct care, indirect care, documentation and infection control. The direct care activity system was the central activity system in a day shift. The activity systems in nursing care provision included medication administration, wound care, physical review, documentation and infection control. The role of medication administration, wound care, physical review and documentation as the central activity system changed at different periods during a day shift.

Problems identified in these activity systems were grouped into four categories: direct care, medication administration, documentation of medication administration and documentation of wound care. They were conceptualised to three levels of contradictions: primary, secondary and quaternary levels. No tertiary contradiction was identified. Primary contradictions were all in the tools used by nursing staff in care provision, including physical tools such as the medication trolley, the eMAR system, the EHR system and the portable device and psychological tools such as verbal communication among care team members.

Secondary contradictions were between the nurse subject and the organisational guidelines about medication management and documentation, and between the availability of a portable device to access the EHR system at the point-of-care and the object of documenting in the EHR system. Quaternary contradictions were between the activity system of medication administration and the activity system of assisting residents' with ADL, and between the activity system of medication administration in the RAC home and the activity system of adding a new resident's medication profile in the pharmacy.

Possible causes of these contradictions were multi-faceted. They were in regard to 1) nursing staff; 2) maintenance of tools and the management of RAC homes; 3) an activity system that was outside the RAC home but interacted with the activity system inside the home; and 4) the electronic information system designers' insufficient

understanding about the nursing work activities. Potential impacts of these contradictions included inadequate verbal communication among care team members, interrupted medication administration process, medication errors and inefficient documentation.

Providing quality aged care services requires nursing managers to pay attention to the physical and psychological tools used by nursing staff in RAC homes, such as the capability and availability of the tools and how nursing staff use these tools. It also requires that the activity systems that are outside the RAC homes but have interactions with the activity systems inside the RAC homes are effective. These activity systems include the activity systems in the pharmacy and the activity system of the design of an electronic information system in an IT company.

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## **Chapter 11. General Conclusion**

The aims of this research were to explore and describe nursing work activities in Australian RAC homes, to identify problems associated with these activities, and to explain the possible causes and potential impacts of these problems. The research approaches taken to achieve the aims were time-motion observational study, field notes and review of organisational policies and guidelines. This chapter summarises the key findings of this research, presents research limitations, highlights research contributions and provides implications for practice. It also recommends future research directions.

### **11.1. Summary of key findings**

Nursing work activities in Australian RAC homes included personal care and nursing care activities. Personal care was provided by PCWs and nursing care was provided by nursing care staff including RNs, EENs and PCWs with Certificate IV Level II in medication management. This research started with an investigation of personal care, then nursing care.

#### **11.1.1. The personal care activity system**

Chapter 3 describes the results of the study which investigated the work pattern of PCWs in conducting personal care activities in two high-care units in two Australian RAC homes. Fifty-eight activities conducted by PCWs were grouped into eight categories: direct care, indirect care, infection control, documentation, transit, staff breaks, verbal communication and others. This activity classification system was used for time-motion observations of PCWs in providing personal care to residents. Each activity was measured by the time, frequency and duration. The switch between activities was also measured.

The study found that the PCWs spent 70% of their time in a shift, consistently at both units, on direct care (30.7%), indirect care (17.6%), infection control (6.4%) and staff breaks (15.2%). They spent only 3% of their time on documentation at the end of a shift. The majority of the activities were of less than 60 seconds duration. Frequent switches were observed between direct care, indirect care and verbal communication activities.

The PCWs spent more than 50% of their time on verbal communication with residents and with other care team members. It was found that the care unit with the majority of PCWs who were non-native English speakers spent significantly less time on communicating with other care team members working in the same shift than those in the care unit where the majority of PCWs were native English speakers.

#### **11.1.2. Time spent on direct care activities by personal care workers**

Chapter 4 reports the results of the study focusing on direct care because it is the most time-consuming activity after verbal communication. Twenty-three direct care activities defined in the activity classification system were further grouped into eight sub-categories that were directly involved with the residents: assessment, personal hygiene, toileting, continence, mobility, medication, nutrition and verbal communication. The study measured the time, frequency and duration of each of the 23 activities. It found no significant difference between the two units in the time PCWs spent on personal hygiene, continence and verbal communication activities. The PCWs spent two hours on communicating with the residents in an eight-hour shift, with one and half hours on concurrent verbal communication.

#### **11.1.3. The nursing care activity system**

Chapter 5 presents the study which investigated the work pattern of nursing care staff in providing nursing care to residents in two high-care units in an RAC home. One hundred and sixteen activities conducted by the nursing care staff were identified and classified into ten categories: medication administration, wound care, physical review, infection control, verbal communication, documentation, print and fax, transit, staff breaks and others.

No significant difference between the two units was found in the time nursing care staff spent on these categories of activities. The three most time-consuming activities were verbal communication (28% of staff time in a shift), medication administration (25.9%) and documentation (19.4%). Four fifths of verbal communication time was spent purely on that activity and one fifth was spent concurrently with the conduct of another activity. Verbal communication, medication administration and documentation activities were

frequently conducted in the same period of time, indicating frequent switching among them. The majority of the activities were of less than 60 seconds duration.

A common work process followed by the nursing care staff in a morning shift was depicted. The nursing care staff first conducted morning medication administration, then wound care, physical review and lunchtime medication administration. They conducted documentation during the provision of these types of nursing care and also at the end of the shift.

#### **11.1.4. The medication administration and associated problems**

Chapter 6 presents the results of the study focusing on the medication administration process followed by the nursing care staff and the problems associated with it. The results showed that there was a common work process followed by the nursing care staff to conduct a medication round and administer medication to a resident. Problems were identified with this process. These were documenting before medicating a resident or after medicating several residents when using the paper-based medication administration records; preparing medication for two residents at a time; and missing steps in the process of administering medication. The occurrence of these problems may be linked to time constraints.

#### **11.1.5. Time spent on medication administration**

Chapter 7 reports results of the study which examined the time spent by nursing care staff on administering each type of medication. It also determined whether the time needed for a resident would differ by individual medication needs in morning medication rounds. Administering medication to a resident includes activities of medication preparation and provision, cleaning up, infection control, verbal communication, documentation and transit. On average, the time spent on administering medication to a resident was 200 seconds.

Types of medication were classified into tablet, liquid medication, powder medication, eye drops/ointment, injection, puffer/inhaler, nebuliser and patch. Among them, in preparation of medications, an injection took the longest time (37.2 seconds), followed

by tablet (35 seconds). In provision of medications, providing tablets to a resident took the longest time (43.5 seconds), followed by liquid medication (28.1 seconds).

On average, a resident took nine medications, seven of which were tablets. 3.6% of the residents took up to four types of medication and 83% of them took one or two types of medication. More than 97% of residents took tablets. Among them, 52% took six to ten tablets, 62% needed their tablets to be crushed or mixed in thickened fluid and 67% needed a nurse's help to take the tablets. These medication needs significantly impacted on the time required by a nurse to administer medication to a resident.

#### **11.1.6. The impacts of an eMAR system**

Chapter 8 reports the impacts of an eMAR system. In the two high-care units where the observations were conducted, one unit used the eMAR system on both portable devices and desktop computers and the other used a paper-based system. By comparing the two systems, the study found that the use of an eMAR system did not impact on the total amount of time spent on documentation during a medication round. The problem of documenting before medicating a resident or after medicating several residents found with the use of a paper-based system was not observed with the use of the eMAR system. In addition, the eMAR system can prevent the error of signing twice; reduce the possibility of nurses' forgetting to medicate a resident or to sign on medication charts; facilitate recording the time of medicating a resident; and increase documentation space.

Although the eMAR system had these benefits, it also created unintended adverse consequences. These included inadequate information about residents provided by the eMAR system; delayed addition of a new resident's medication profile in the eMAR system by the pharmacy; nurses' forgetting to medicate a resident due to power outage of the portable device; and inefficient free-text data entry on the portable device.

#### **11.1.7. Wound care and its documentation**

Chapter 9 describes wound care and its documentation processes. The results showed that wound care and its documentation were complex processes with the use of both paper-based charts and the EHR system. During a wound care round, a nurse used a wound summary sheet to brief him or herself about who needed wound care and what

wounds were to be cared for. The nurse also used paper-based wound charts printed from the EHR system for information about a resident's wounds and a paper note for documentation of wound care.

After completing the wound care round, the nurse transcribed all the data from the paper note to the EHR system. In this transcription process, the nurse entered data to an electronic wound chart in the EHR system, printed the updated wound chart and replaced the old chart with the new one. Several hindrances generated by the EHR system were identified. They were: 1) the lack of functions to remind a nurse about the existence of a wound chart, causing the creation of a duplicated chart; 2) the lack of availability of the print function when the nurse needed it, causing an unnecessary process of relocating the chart in the system in order to print it; and 3) the lack of sufficient detail in the information provided to the nurse when relocating the chart, causing the nurse manually opening each chart listed by the EHR system to identify the right one. The whole data transcription process may be attributed to a lack of a portable device for the nurse to access the EHR system during a wound care round.

#### **11.1.8. Nursing work activities and associated problems through the lens of cultural-historical activity theory**

Chapter 10 presents the conceptualisation of nursing work activities and the associated problems observed through the lens of cultural-historical activity theory. Cultural-historical activity theory provided a framework to conceptualise nursing work activities as activity systems with six components: subject, object, tools, rules, community and division of labour. Nursing work activities in RAC homes could be viewed as two interactive activity systems of personal care and nursing care. The two systems were underpinned by the same community and were classified according to the division of labour based on qualifications and skill levels. Registered nurses, EENs and PCWs with medication management qualifications provided nursing care and acted as team leaders. General PCWs provided personal care.

In the personal care activity system, the subject was one or two PCWs who worked on the object of assisting a resident with activity of daily living. The relationship between the subject and the object was mediated by the tools (e.g. mechanical lifter and language)

and governed by rules (i.e. organisational policies and guidelines on personal care provision). In the nursing care activity system, the subject was one RN, EEN or PCW with medication management qualifications. The object was providing nursing care. Tools used by the subject included physical tools (e.g. medical equipment) and psychological tools (e.g. verbal communication, documentation skill). Rules were the organisational policies and guidelines on nursing care provision. The two systems shared a collective object of taking care of the residents living in the RAC home.

Sub-activity systems included direct care, indirect care, documentation, infection control, medication administration, wound care and physical review. Verbal communication was an important tool which facilitated the operation of these activity systems. In personal care provision, the central activity system was direct care. In nursing care provision, the central activity system was medication administration, wound care, physical review or documentation, according to the time of day.

Cultural-historical activity theory also provided a way to conceptualise problems identified in nursing work activities to four levels of contradictions. Primary contradictions appear within a component of an activity system. Secondary contradictions appear between two components of an activity system. Tertiary contradictions appear between the object of a dominant activity system and the object of a culturally more advanced activity system. Quaternary contradictions appear between two interacting activity systems.

Using this framework of four levels of contradictions, the identified problems, which were manifestations of contradictions in the activity systems of nursing work, were conceptualised into primary, secondary and quaternary levels. No tertiary contradictions were identified. Primary contradictions were all within the tools used by nursing staff, for example, functional deficiencies in the EHR system. Secondary contradictions were mainly between the nursing staff and the rules and also between the documentation tools and the object of documenting care. Quaternary contradictions were between the activity system of medication administration and the activity system of assisting residents with ADL within the RAC home, and between the activity system of

medication administration in the RAC home and the activity system of adding a new resident's medication profile in the pharmacy.

Possible causes of these contradictions were related to the nursing skill and knowledge about organisational policies and procedures, maintenance of tools and management of the RAC home, the activity system outside the RAC home and the workflow of the electronic information systems that did not really support nursing work processes. Potential impacts of these contradictions included inadequate verbal communication among care team members, interrupted medication administration process, medication errors and inefficient documentation.

### **11.2. Research limitations**

One concern about the observational research method is the "Hawthorne effect" [1] which means that the participants will change their behaviour during observations, for example, better compliance. This effect was minimised through establishing rapport and familiarity between the observer and the nursing staff before the actual observation, such as training of the observer, a preliminary study and a pilot study at the participant RAC homes. Two other factors helped to reduce this effect were: the busy nature of nursing work reduced the ability of nursing staff to sustain significant change in their work activities and nursing staff were comfortable with being followed because they had a similar experience in which they were observed by nursing students to provide training.

A relatively small number of nursing staff was observed in this research due to limited resources and time frame. However, the unit of statistical analysis was activity, of which large numbers were recorded. The nursing staff observed in this research routinely worked in the observed shifts, therefore the research findings can reflect the work patterns in providing personal care and nursing care services in the RAC homes studied.

As the data were collected from four care units, two for personal care and two for nursing care data, the generalisability of the research findings might be limited by the

cultural-historical context of the RAC homes. Caution should be taken when applying the findings to a different RAC home or other healthcare settings.

### **11.3. Research contributions**

This research contributes to the body of knowledge of nursing work activities in Australian RAC homes. It provides useful reference material for researchers in the similar topic area, such as nursing work activities in nursing homes in Europe or long-term care in the USA. To our knowledge, this is the first comprehensive and thorough study of this kind undertaken in Australian RAC homes.

Specifically, for the first time, this study provides two detailed classification systems of nursing work activities, one for personal care and the other for nursing care. They can be used adapted and used by similar studies for measuring nursing workload and efficiency in RAC homes or other healthcare settings.

The study provides useful insight into the work patterns of nursing staff in providing personal care and nursing care services. To describe the work patterns, activity time, frequency, duration and the work processes were examined. Similar work patterns were found in the provision of each care service between the participant high-care units in terms of time usage and work processes of the nursing staff.

The study produces significant findings which demonstrate the benefits and unintended adverse consequences of an eMAR system in an RAC home. In addition, it also identified other problems in nursing work activities such as problems in wound care documentation. All of these problems were conceptualised into three levels of contradictions using CHAT to provide a deeper and systematic understanding of them.

### **11.4. Implications for practice**

From the research findings, implications can be drawn for nursing management, investment in an electronic information system and system design.

#### **11.4.1. Implications for nursing management**

Verbal communication is important to both personal care and nursing care provision. However, communication among nursing staff may be affected by the language proficiency of the staff.

Medication administration is the major type of nursing care provided by nursing staff. Because timeliness is important for medication administration, understanding what impacts the time spent on this nursing activity will be useful for decisions on staffing to ensure this timeliness. This research found that the nursing time spent on medication administration was impacted by individual resident's medication needs. These include the number of types of medications, the number of tablet medications and the methods used for preparing and providing tablet medications. Nursing managers can consider these factors when estimating nursing workload and making decisions on staffing.

#### **11.4.2. Implications for investment in an electronic information system**

When considering investment in an electronic information system, managers need to be clear about what their expected outcomes are and whether the system under consideration can produce these outcomes. The literature shows that the expected outcomes include improving quality of care, improving efficiency and reducing documentation time. The findings of this research have indicated that the use of an electronic information system may not lead to a reduction in documentation time.

To improve the quality and efficiency of care, an RAC home should aim for a good understanding of what is effective use of an electronic information system, what impacts on its effective use and what additional cost is associated with achieving the effective use. This research identified some problems associated with the use of two electronic information systems including an eMAR system and an EHR system. Understanding these problems may provide some insights into what impacts on the effective use. The research findings showed that problems that hindered the use of the system during care provision were in the design of the system and in the work processes that interfaced with the system.

#### **11.4.3. Implications for the design of an electronic information system for use in RAC**

The problems in the design of the electronic information systems indicate that system designers need to improve their understanding about nursing work activities. This includes information about the care processes of nursing staff, the documentation processes and what, when, where and how a piece of information is needed by nursing staff. To do this, the frontline nursing staff should be involved when a system analyst is collecting end user requirements. Also, feedback about the system to the supplier should be provided.

#### **11.5. Recommendations for future research**

This research found that personal care and nursing care are two interactive activity systems. Future research may systematically analyse the interactions between the two activity systems to provide insights into the management of care for residents in RAC homes.

This research provided insights into the nursing work activities. Future research may develop strategies to address the problems identified in these activities, redesign these activities, re-allocate tasks or improve work processes in order to improve RAC services.

Future research may investigate verbal communication during the conduct of nursing work activities. Verbal communication is an important psychological tool for nursing staff to provide quality care. Little research has been done to understand who initiates a conversation with whom, when and where it is conducted, or the content of the conversation.

This research found that the activity system outside an RAC home may have an impact on the effective use of an electronic information system and hinder care provision inside the RAC home. The scope of this research is within RAC homes. Future research may investigate activity systems that are outside RAC homes but interact with the RAC home activity system.

## References

1. Finkler SA, Knickman JR, Hendrickson G, Lipkin MJ, Thompson WG: **A comparison of work-sampling and time-and-motion techniques for studies in health services research.** *Health Serv Res* 1993, **28**(5):577-597.

## Appendix A

**Supplementary Table 1. The time, frequency and duration of personal care activities at Unit 1.**

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 14 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
Direct care 30.85% 95% CI=(28.70, 33.00)	Physical Assessment.	00:01:03	7	0.50	90.43	58.06	36.73	144.12
	Routine hygiene (e.g. daily shower or wash).	00:21:01	157	11.21	80.46	92.06	65.95	94.97
	Continence related hygiene (e.g. shower or wash following pad change).	00:01:57	13	0.93	90.00	43.82	63.52	116.48
	Oral Care.	00:00:20	7	0.50	29.00	13.06	16.92	41.08
	Shave or grooming.	00:01:14	6	0.43	123.00	77.70	41.45	204.55
	Toileting - prompted by a resident.	00:05:29	51	3.64	64.63	46.32	51.60	77.65
	Toileting - prompted by a personal care worker.	00:01:09	11	0.79	62.73	51.19	28.34	97.11
	Pad check.	00:00:36	9	0.64	39.56	45.88	4.29	74.82
	Pad change.	00:08:19	88	6.29	56.76	44.86	47.26	66.27
	Scheduled toileting.	00:00:39	6	0.43	64.67	61.85	-0.24	129.57
	Dressing a resident.	00:17:49	139	9.93	77.06	64.71	66.20	87.91
	Resident mobility; passive & active exercises; turning a resident in bed.	00:02:26	23	1.64	63.70	68.04	34.27	93.12
	Medication administration.	00:01:42	20	1.43	50.95	39.87	32.29	69.61
	Specimen collection; urine collection.	00:00:31	4	0.29	76.50	18.12	47.67	105.33

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 14 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Assisting a resident with eating and drinking (include feeding systems).	00:34:54	189	13.50	111.00	162.12	87.74	134.26
	Assisting a resident with food (e.g. cutting up food, uncovering food or delivery of food).	00:04:22	48	3.43	54.71	60.65	37.10	72.32
	Assisting a resident with hand washing following the use of toilet.	00:00:58	12	0.86	48.75	35.98	25.89	71.61
	Assisting a resident with transfer to and from a bed, a chair, etc.	00:19:46	177	12.64	67.11	67.12	57.15	77.06
	Transferring a resident to or from dining room or board room.	00:12:13	141	10.07	52.05	39.63	45.45	58.65
	Weighing a resident.	00:01:06	5	0.36	133.00	122.36	-18.93	284.93
	Attending to a resident call for assistance.	00:10:32	64	4.57	98.86	488.49	-23.16	220.88
	<b>Total</b>	<b>02:28:05</b>	<b>1177</b>	<b>84.07</b>	<b>75.62</b>	<b>143.45</b>	<b>67.41</b>	<b>83.82</b>
Indirect care 16.65% 95% CI=(15.45, 17.85)	Equipment set up (e.g. sling set up, shower chair set up).	00:31:23	386	27.57	48.87	39.32	44.93	52.80
	Resident shower set up (e.g. preparing shampoo, towel or body lotion).	00:07:33	86	6.14	52.71	57.55	40.37	65.05
	Bed making routine.	00:12:25	72	5.14	103.58	89.15	82.63	124.53
	Changing a bed following an incontinent episode.	00:01:18	8	0.57	97.87	86.29	25.74	170.01
	Cleaning up spills following an incontinent episode.	00:00:09	2	0.14	45.00	31.11	-234.54	324.54

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 14 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Re-stocking supplies to a trolley.	00:01:36	10	0.71	96.30	130.11	3.22	189.38
	Transporting linen to and from laundry.	00:00:22	7	0.50	30.86	17.95	14.26	47.46
	Transporting clinical waste for disposal.	00:02:04	11	0.79	113.36	109.52	39.79	186.94
	Emptying a resident's meal plate.	00:08:27	94	6.71	54.06	52.88	43.23	64.90
	Collecting pads from a storage cupboard.	00:04:45	64	4.57	44.53	28.38	37.44	51.62
	Collecting a resident's clothes from his or her cupboard; put clothes back to the cupboard.	00:09:53	116	8.29	51.22	41.31	43.63	58.82
	<b>Total</b>	<b>01:19:55</b>	<b>856</b>	<b>61.14</b>	<b>56.11</b>	<b>54.52</b>	<b>52.45</b>	<b>59.76</b>
Infection control 5.92% 95% CI=(5.21, 6.63)	Putting on personal protective equipments.	00:10:23	153	10.93	40.81	37.94	34.75	46.87
	Taking off personal protective equipments.	00:07:25	152	10.86	29.33	81.25	16.31	42.35
	Alcohol hand washing (related to toileting or pad change).	00:00:59	6	0.43	99.17	175.46	-84.96	283.30
	Alcohol hand washing (unrelated to toileting or pad change).	00:01:04	16	1.14	40.19	26.29	26.18	54.20
	Water hand washing (related to toileting or pad change).	00:04:23	52	3.71	50.62	30.22	42.20	59.03
	Water hand washing (unrelated to toileting or pad change).	00:04:11	46	3.29	54.59	51.86	39.19	69.99
	<b>Total</b>	<b>00:28:25</b>	<b>425</b>	<b>30.36</b>	<b>40.20</b>	<b>61.46</b>	<b>34.34</b>	<b>46.06</b>

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 14 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
Documentation 4.07% 95% CI= (3.38, 4.76)	Locating or collecting a resident's records.	00:05:00	103	7.36	29.22	45.45	20.34	38.11
	Reviewing or writing resident's clinical information; reading notes; viewing results.	00:13:50	150	10.71	55.46	98.47	39.57	71.35
	Putting records back to filing area.	00:00:40	5	0.36	81.00	102.06	-45.72	207.72
	<b>Total</b>	<b>00:19:31</b>	<b>258</b>	<b>18.43</b>	<b>45.48</b>	<b>82.41</b>	<b>35.38</b>	<b>55.58</b>
Transit 3.44% 95% CI= (2.99, 3.89)	Standing or walking in the corridor between activities.	00:16:29	240	17.14	41.29	46.73	35.35	47.23
Staff breaks 14.64% 95% CI= (10.91, 18.38)	Personal errands (off unit chores; meal break; making personal telephone call).	01:10:17	48	3.43	880.06	817.54	642.67	1117.45
*Verbal communication 47.29% 95% CI= (39.29, 55.29)	Asking for assistance from another personal care worker.	00:00:46	6	0.86	33.33	18.27	14.16	52.51
	Assisting another personal care worker to do their work.	00:00:56	5	0.71	49.60	48.81	-11.00	110.20
	Communication of information about resident (external).	00:00:59	12	1.71	21.75	19.53	9.34	34.16
	Communication of information about resident (internal).	01:53:10	309	44.14	96.46	156.20	78.97	113.94
	Communicating with a resident.	01:50:55	326	46.57	89.60	129.29	75.51	103.69
	Receiving a phone call; making a phone call.	00:00:14	1	0.14	62.00	.	.	.

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 14 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	<b>Total</b>	<b>03:47:00</b>	<b>659</b>	<b>94.14</b>	<b>90.72</b>	<b>140.88</b>	<b>79.95</b>	<b>101.50</b>
Others 0.50% 95% CI= (0.30, 0.70)	Other tasks not included	00:02:24	15	1.07	96.33	69.95	57.59	135.07

**\*Analysis concerning verbal communication is based on the last seven days of observation at Unit 1.**

**Supplementary Table 2. The time, frequency and duration of personal care activities at Unit 2.**

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 16 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
Direct care 30.65% 95% CI= (28.08, 33.22)	Physical Assessment.	00:00:06	2	0.13	35.50	26.16	-199.56	270.56
	Routine hygiene (e.g. daily shower or wash).	00:16:45	132	8.25	87.79	122.10	66.76	108.81
	Continence related hygiene (e.g. shower or wash following pad change).	00:02:40	29	1.81	63.66	62.10	40.03	87.28
	Oral Care.	00:00:08	3	0.19	32.00	14.42	-3.83	67.83
	Shave or grooming.	00:00:07	2	0.13	39.50	17.68	-119.33	198.33
	Toileting - prompted by a resident.	00:09:26	122	7.63	53.52	40.98	46.17	60.86
	Toileting - prompted by a personal care worker.	00:06:21	78	4.88	56.28	50.43	44.91	67.65
	Pad check.	00:02:58	53	3.31	38.83	35.39	29.08	48.59
	Pad change.	00:09:02	115	7.19	54.37	35.91	47.73	61.00
	Scheduled toileting.	00:01:52	27	1.69	47.93	30.06	36.04	59.82
	Dressing a resident.	00:22:45	232	14.50	67.82	57.17	60.43	75.22
	Resident mobility; passive & active exercises; turning a resident in bed.	00:05:22	53	3.31	70.00	62.19	52.86	87.14
	Medication administration.	00:00:20	4	0.25	58.25	34.03	4.10	112.40
	Specimen collection; urine collection.	00:00:02	1	0.06	18.00	.	.	.
	Assisting a resident with eating and drinking (include feeding systems).	00:06:18	46	2.88	94.83	103.32	64.14	125.51

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 16 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Assisting a resident with food (e.g. cutting up food, uncovering food or delivery of food).	00:09:34	133	8.31	49.75	47.06	41.68	57.82
	Care of the deceased; laying out.	00:00:01	1	0.06	9.00	.	.	.
	Assisting a resident with hand washing following the use of toilet.	00:00:46	14	0.88	38.29	20.11	26.68	49.89
	Assisting a resident with transfer to and from a bed, a chair, etc.	00:28:45	353	22.06	56.34	40.85	52.06	60.62
	Transferring a resident to or from dining room or board room.	00:19:15	272	17.00	48.96	33.50	44.96	52.95
	Weighing a resident.	00:00:08	2	0.13	47.50	33.23	-251.10	346.10
	Assisting a resident to receive a phone call.	00:00:17	6	0.38	32.67	17.20	14.62	50.72
	Attending to a resident call for assistance.	00:04:08	123	7.69	23.21	18.58	19.90	26.53
	<b>Total</b>	<b>02:27:07</b>	<b>1803</b>	<b>112.69</b>	<b>56.45</b>	<b>56.74</b>	<b>53.83</b>	<b>59.07</b>
Indirect care 18.41% 95% CI= (16.65, 20.17)	Equipment set up (e.g. sling set up, shower chair set up).	00:37:39	560	35.00	46.52	34.02	43.70	49.34
	Resident shower set up (e.g. preparing shampoo, towel or body lotion).	00:06:50	99	6.19	47.72	45.41	38.66	56.77
	Bed making routine.	00:10:31	79	4.94	92.08	83.52	73.37	110.78
	Changing a bed following an incontinent episode.	00:01:50	13	0.81	98.00	89.68	43.81	152.19
	Re-stocking supplies to a trolley.	00:00:22	7	0.44	35.43	22.35	14.76	56.10

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 16 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Transporting linen to and from laundry.	00:02:57	43	2.69	47.44	48.57	32.50	62.39
	Transporting clinical waste for disposal.	00:02:54	40	2.50	50.15	54.42	32.75	67.55
	Using or cleaning up bed pans.	00:05:07	65	4.06	54.43	33.48	46.13	62.73
	Emptying a resident's meal plate.	00:04:29	78	4.88	39.73	33.54	32.17	47.29
	Collecting pads from a storage cupboard.	00:03:22	67	4.19	34.70	29.58	27.49	41.92
	Collecting a resident's clothes from his or her cupboard; put clothes back to the cupboard.	00:05:52	100	6.25	40.64	34.67	33.76	47.52
	Sorting and putting a resident's clothes to his or her room.	00:06:29	59	3.69	76.05	78.22	55.67	96.43
	<b>Total</b>	<b>01:28:22</b>	<b>1210</b>	<b>75.63</b>	<b>50.52</b>	<b>46.81</b>	<b>47.88</b>	<b>53.16</b>
Infection control 6.83% 95% CI= (6.06, 7.59)	Putting on personal protective equipments.	00:11:24	254	15.88	31.05	22.17	28.31	33.79
	Taking off personal protective equipments.	00:06:47	254	15.88	18.47	27.16	15.11	21.83
	Alcohol hand washing (related to toileting or pad change).	00:03:03	70	4.38	30.16	24.95	24.21	36.11
	Alcohol hand washing (unrelated to toileting or pad change).	00:01:43	41	2.56	28.90	20.39	22.47	35.34
	Water hand washing (related to toileting or pad change).	00:06:21	123	7.69	35.70	19.33	32.25	39.15

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 16 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Water hand washing (unrelated to toileting or pad change).	00:03:29	63	3.94	38.24	21.03	32.94	43.53
	<b>Total</b>	<b>00:32:46</b>	<b>805</b>	<b>50.31</b>	<b>28.17</b>	<b>24.52</b>	<b>26.47</b>	<b>29.86</b>
Documentation 2.34% 95% CI= (1.66, 3.02)	Locating or collecting a resident's records.	00:03:11	60	3.75	36.67	39.10	26.57	46.77
	Reviewing or writing resident's clinical information; reading notes; viewing results.	00:07:57	68	4.25	80.96	101.54	56.38	105.53
	Putting records back to filing area.	00:00:05	4	0.25	14.25	10.40	-2.31	30.81
	<b>Total</b>	<b>00:11:13</b>	<b>132</b>	<b>8.25</b>	<b>58.80</b>	<b>80.65</b>	<b>44.92</b>	<b>72.69</b>
Transit 5.53% 95% CI= (4.46, 6.61)	Standing or walking in the corridor between activities.	00:26:34	274	17.13	67.06	84.44	57.02	77.11
Staff breaks 15.71% 95% CI= (10.99, 20.42)	Personal errands (off unit chores; meal break; making personal telephone call).	01:15:24	64	4.00	815.00	845.38	603.83	1026.17
Verbal communication 63.47% 95% CI= (56.57, 70.37)	Asking for assistance from another personal care worker.	00:02:48	46	2.88	42.17	58.26	24.87	59.48
	Assisting another personal care worker to do their work.	00:01:01	34	2.13	20.79	18.80	14.23	27.35
	Participating in-service training.	00:08:25	1	0.06	5825.00	.	.	.
	Communication of information about resident (external).	00:00:41	7	0.44	67.00	123.79	-47.48	181.48

Category	Activity	Equivalent 8 hours	Frequency		Duration (seconds)			
			Total frequency during 16 days	Average frequency on each observational day	Mean	SD	95% Confidence interval	
							Lower Bound	Upper Bound
	Communication of information about resident (internal).	02:42:27	1105	69.06	101.70	139.86	93.45	109.96
	Communicating with a resident.	02:04:17	1111	69.44	77.38	118.09	70.43	84.33
	Communicating with a resident's family.	00:04:27	64	4.00	48.14	71.10	30.38	65.90
	Receiving a phone call; making a phone call.	00:00:34	4	0.25	97.00	108.77	-76.08	270.08
	<b>Total</b>	<b>05:04:40</b>	<b>2372</b>	<b>148.25</b>	<b>88.85</b>	<b>173.39</b>	<b>81.87</b>	<b>95.84</b>
Others 1.83% 95% CI= (1.12, 2.53)	Other tasks not included	00:08:46	55	3.44	110.27	118.47	78.25	142.30

**Supplementary Table 3. The total number of observations of each nursing care activity and its duration.**

Categories	Activities	N	Duration (seconds)	
			Mean	SD
Medication administration	<b>Preparation</b>			
	preparing a medication trolley (e.g. put packed medication on to the trolley)	111	61.5	74.6
	locating or identifying a resident (e.g. look for a resident in a dining room, check if a resident is ready for medication)	133	7.7	7.5
	identifying an S8 drug (Schedule 8 drugs of addiction) (e.g. open the locked cabinet, find a drug)	4	19.8	9.7
	preparing/assisting preparation of S8 drugs tablet	2	16.2	8.2
	preparing/assisting preparation of S8 drugs liquid	2	38.6	11.7
	preparing/assisting preparation of S8 drugs injection	3	57.3	22.2
	preparing/assisting preparation of S8 drugs patch	-	-	-
	preparing/assisting preparation of S8 drugs via PEG (percutaneous endoscopic gastrostomy) feeding tubes	-	-	-
	identifying an ordinary medication from the trolley	727	11.8	10.2
	preparing ordinary tablet medication	774	22.8	19.7
	preparing liquid medication	52	17.7	8.4
	preparing powder medication (e.g. movicol)	167	23.1	18.4
	preparing eye drops/ointment	18	7.3	4.4
	preparing injection (e.g. B12, insulin)	35	27.2	13.6
	preparing puffer/inhaler	38	19.3	15.0
	preparing nebuliser	33	21.3	15.9
	preparing patch	14	17.1	12.2
	preparing topical medication (e.g. cream)	2	37.4	1.9
	preparing resource (i.e. nutrition drink)	34	12.1	8.3
	preparing for PEG feeding	33	27.0	21.3
	preparing a cup of water/juice	125	10.3	10.9
	preparing equipment for BGL (blood glucose level) checking	73	19.8	15.0
	checking BGL	47	24.1	17.0
	bringing prepared medication and other supplies (e.g. tissue) to a resident	477	11.3	9.1
	preparing PRN medication	8	37.9	40.6
	preparing a resident for medication provision	60	14.8	11.5
	<b>Provision</b>			
	providing/assisting provision of S8 drugs tablet	3	105.0	118.3
	providing/assisting provision of S8 drugs liquid	-	-	-
	providing/assisting provision of S8 drugs injection	1	44.7	-
	providing/assisting provision of S8 drugs patch	2	25.5	7.6
	providing/assisting provision of S8 drugs via PEG feeding tubes	-	-	-

Categories	Activities	N	Duration (seconds)	
			Mean	SD
	providing ordinary tablet medication	476	33.0	32.5
	providing liquid medication	19	21.9	29.5
	providing powder medication (e.g. movicol)	11	33.9	47.7
	providing eye drops/ointment	94	19.6	12.2
	providing injection (e.g. B12, insulin)	25	16.9	8.8
	providing puffer/inhaler	44	15.1	9.8
	providing nebuliser	22	22.5	11.6
	providing patch	13	16.1	16.3
	providing topical medication (e.g. cream)	2	51.4	48.8
	providing resource (i.e. nutrition drink)	13	20.6	16.9
	providing medications via PEG feeding tubes	19	111.4	54.8
	providing a PRN medication	5	39.6	35.6
	<b>After provision</b>			
	travelling back to medication trolley	412	5.6	6.6
	disposing clinical waste and general waste/put medication (e.g. eye drops) back on to trolley	508	8.2	6.8
	bringing/collecting spoons and cups to/from the wash up room or washing them	33	38.9	28.5
<b>Wound care</b>	preparing wound care trolley	26	36.4	34.6
	preparing for wound care (e.g. put supplies on to the trolley, prepare dressing)	121	45.8	39.0
	wound care for a resident	143	49.8	45.2
	cleaning wound care trolley	41	20.9	17.6
<b>Physical review</b>	preparing/organising physical review equipment	12	16.1	13.9
	physical review for a resident (i.e. assessment)	10	64.5	40.2
<b>Infection control</b>	alcohol handwash (medication-related)	362	8.0	14.9
	alcohol handwash (non-medication-related)	71	11.6	14.1
	water handwash (medication-related)	22	22.9	12.1
	water handwash (non-medication-related)	33	29.0	26.2
	putting on/taking off gloves (medication-related)	180	10.1	7.5
	putting on/taking off gloves (non-medication-related)	122	14.1	14.2
<b>Verbal communication</b>	<b>Pure verbal communication</b>			
	verbal communication with a resident (medication-related)	433	13.1	16.8
	verbal communication with a resident (non-medication-related)	1077	19.2	72.1
	verbal communication with another nurse (medication-related)	61	60.0	162.9
	verbal communication with another nurse (non-medication-related)	261	51.2	78.1
	verbal communication with a personal care worker (medication-related)	20	18.1	11.7
	verbal communication with a personal care worker (non-medication-related)	359	24.6	34.4
	verbal communication with other internal staff (e.g. physiotherapist)	1	0.7	-

Categories	Activities	N	Duration (seconds)	
			Mean	SD
	(medication-related)			
	verbal communication with other internal staff (e.g. physiotherapist) (non-medication-related)	56	20.1	18.3
	verbal communication with an external health professional (e.g. a doctor) (medication-related)	-	-	-
	verbal communication with an external health professional (e.g. a doctor) (non-medication-related)	7	43.3	46.1
	verbal communication with a visitor (medication-related)	6	22.4	17.4
	verbal communication with a visitor (non-medication-related)	94	40.8	63.6
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(medication-related)	4	32.0	19.2
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(non-medication-related)	54	44.4	50.3
	shift handover	26	592.3	420.0
	<b>Concurrent verbal communication</b>			
	verbal communication with a resident (medication-related)	187	11.6	19.3
	verbal communication with a resident (non-medication-related)	481	19.1	34.1
	verbal communication with another nurse (medication-related)	10	54.3	88.0
	verbal communication with another nurse (non-medication-related)	56	17.5	25.5
	verbal communication with a personal care worker (medication-related)	3	7.5	5.7
	verbal communication with a personal care worker (non-medication-related)	145	17.4	46.7
	verbal communication with other internal staff (e.g. physiotherapist) (medication-related)	-	-	-
	verbal communication with other internal staff (e.g. physiotherapist) (non-medication-related)	30	7.7	9.9
	verbal communication with an external health professional (e.g. a doctor) (medication-related)	-	-	-
	verbal communication with an external health professional (e.g. a doctor) (non-medication-related)	1	3.6	.
	verbal communication with a visitor (medication-related)			
	verbal communication with a visitor (non-medication-related)	23	10.3	12.0
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(medication-related)	-	-	-
	receiving/answering/making a phone call (to another staff, doctor, pharmacy, etc.)(non-medication-related)	4	10.9	13.9
	shift handover	-	-	-
Documentation	<b>Paper-based documentation</b>			
	collecting/putting a documentation book from/back to a filing area	42	24.5	27.3
	flipping an S8 drug documentation book	34	3.1	2.5
	reading an S8 drug documentation book	4	2.9	1.2
	writing in an S8 drug documentation book	45	20.2	12.6
	flipping medication administration records	519	10.2	9.4
	reading medication administration records	106	8.8	7.7

Categories	Activities	N	Duration (seconds)	
			Mean	SD
	writing in medication administration records	450	11.7	9.8
	reading a daily medication orders	1	22.7	-
	writing on a daily medication orders	3	8.7	6.8
	reading/writing on a paper note, handover sheet	243	21.4	23.9
	flipping a wound care book/form	112	19.1	17.6
	reading a wound care book/form	127	18.2	16.7
	writing in a wound care book/form	123	40.8	71.8
	flipping a physical review book/form	5	6.2	5.5
	reading a physical review book/form	5	11.4	12.9
	writing in a physical review book/form	18	29.9	26.5
	flipping other documentation books (e.g. diary)	39	15.7	16.5
	reading other documentation books (e.g. diary)	21	45.3	55.7
	writing in other documentation books (e.g. diary)	53	30.9	43.7
	filing a document in a filing tray or filing book	12	37.8	34.4
	<b>Electronic documentation</b>			
	<b>Portable device</b>			
	logging in/out of the electronic system	24	23.7	22.3
	locating a resident's record in the electronic system on the portable device (medication-related)	392	7.2	6.0
	locating a resident's record in the electronic system on the portable device(non-medication-related)	11	7.4	11.4
	reading in the electronic system on the portable device(medication-related)	24	7.8	7.9
	reading in the electronic system on the portable device (non-medication-related)	1	8.5	-
	ticking/entering medication-related information in the electronic system on the portable device	418	8.9	10.4
	non-medication-related activities in the electronic system on the portable device	10	14.9	5.4
	<b>Desktop computer</b>			
	logging in/out a desktop computer	23	12.1	13.6
	login/out the electronic system on a desktop computer	55	23.0	24.8
	locating a form in the electronic system on a desktop computer (medication-related)	11	10.4	15.5
	locating a form in the electronic system on a desktop computer (non-medication-related)	258	24.6	23.1
	reading data in the electronic system on a desktop computer (medication-related)	1	65.8	-
	reading data in the electronic system on a desktop computer (non-medication-related)	40	23.2	33.7
	entering data in the electronic system on a desktop computer (medication-related)	8	28.9	64.3
	entering data in the electronic system on a desktop computer (non-medication-related)	227	62.3	53.2
<b>Print and fax</b>	preparing a fax cover sheet (either type on computer or handwrite on a piece of paper)	1	86.4	-

Categories	Activities	N	Duration (seconds)	
			Mean	SD
	faxing documents (e.g. stamp "faxed" on a faxed document, file a faxed document)	3	103.9	92.3
	printing/photocopying a document (e.g. form for transferring a resident to hospital )	25	38.0	40.1
Transit	pushing a medication trolley	576	18.5	12.9
	pushing other trolley or pulling a trailer (e.g. wound care trolley)	125	22.9	15.4
	walking/standing in corridor, dining room, etc.	357	26.7	28.8
Staff breaks	staff breaks (e.g. lunch break)	34	455.3	630.8
Other	other activities not included above	270	69.4	136.1

N: total number of observations

SD: standard deviation

## **Statement of Contribution of Others**

This thesis is prepared in the style of Thesis by Compilation by the University of Wollongong. Seven articles are included in this thesis. I am the first author of all these papers. Six co-authors are involved in the publications. They are Ping Yu, David Hailey, Ning Wang, Zhenyu Zhang, Pamela Davy, Mark Nelson. Their percentage of contribution is indicated in the publications listed below. This is followed by the signed co-author contribution declaration forms.

Published peer-reviewed journal articles:

1. Siyu Qian (74%), Ping Yu (10%), Zhenyu Zhang (5%), David Hailey (5%), Pamela Davy (3%), Mark Nelson (3%). The work pattern of personal care workers in two Australian nursing homes: A time-motion study. *BMC Health Services Research* 2012, 12(1):305.
2. Siyu Qian (74%), Ping Yu (10%), David Hailey (5%), Zhenyu Zhang (5%), Pamela Davy (3%), Mark Nelson (3%). Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. *Australian Health Review* 2014, 38(2):230-237.

Articles in 2<sup>nd</sup> round revision as requested by peer-reviewed journals:

3. Siyu Qian (85%), Ping Yu (10%), David Hailey (5%). The impact of electronic medication administration records in a residential aged care home. *International Journal of Medical Informatics*.
4. Siyu Qian (80%), Ping Yu (10%), David Hailey (5%), Ning Wang (5%). Nurses' time spent on administering each type of medication in a residential aged care home. *Journal of Nursing Management*.

Articles under review by peer-reviewed journals:

5. Siyu Qian (85%), Ping Yu (10%), David Hailey (5%). Nursing staff work patterns in a residential aged care home: A time-motion study. *Australian Health Review*.

6. Siyu Qian (80%), Ping Yu (10%), David Hailey (5%), Ning Wang (5%). Medication administration process and procedural problems in a residential aged care home: An observational study. Australian Health Review.

Published peer-reviewed conference paper:

7. Siyu Qian (90%), Ping Yu (10%). Fitting clinical workflow: The case for wound care in a residential aged care home. Published on Australian Health Informatics Conference 2014. Collected by Studies in Health Technology and Informatics; Melbourne, Australia. Edited by Grain H, Martin-Sanchez F, Schaper LK. IOS press; 2014:130-136.

### Co-author Contribution Declaration

I, *Siyu Qian*, am the first author to the following journal papers and conference paper:

#### Journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.  
My contribution to this paper is 74%.
2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2):230-237.  
My contribution to this paper is 74%.
3. Siyu Qian, Ping Yu, David Hailey. Nursing staff work patterns in a residential aged care home: A time-motion study. Under review by Geriatric Nursing. Submitted on 23 Feb. 2015.  
My contribution to this paper is 85%.
4. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Medication administration process and procedural problems in a residential aged care home: An observational study. Under review by Journal of Nursing Administration. Submitted on 12 Dec. 2014.  
My contribution to this paper is 80%.
5. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Nurses' time spent on administering each type of medication in a residential aged care home. Under review by Journal of Nursing Management. Submitted on 5 Jan. 2015.  
My contribution to this paper is 80%.
6. Siyu Qian, Ping Yu, David Hailey. The impact of electronic medication administration records in a residential aged care home. Under review by International Journal of Medical Informatics. Submitted on 2 Feb. 2015.  
My contribution to this paper is 85%.

#### Conference paper:

7. Siyu Qian, Ping Yu. Fitting clinical workflow: The case for wound care in a residential aged care home. Published on Australian Health Informatics Conference 2014. Collected by Studies in Health Technology and Informatics 2014, 204:130-136.  
My contribution to this paper is 90%.

Signature: \_\_

Date: 18 Mar. 2015

### Co-author Contribution Declaration

I, *Ping Yu*, am one of the authors to the following journal papers and conference paper:

#### Journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.  
My contribution to this paper is 10%.
2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2):230-237.  
My contribution to this paper is 10%.
3. Siyu Qian, Ping Yu, David Hailey. Nursing staff work patterns in a residential aged care home: A time-motion study. Under review by Geriatric Nursing. Submitted on 23 Feb. 2015.  
My contribution to this paper is 10%.
4. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Medication administration process and procedural problems in a residential aged care home: An observational study. Under review by Journal of Nursing Administration. Submitted on 12 Dec. 2014.  
My contribution to this paper is 10%.
5. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Nurses' time spent on administering each type of medication in a residential aged care home. Under review by Journal of Nursing Management. Submitted on 5 Jan. 2015.  
My contribution to this paper is 10%.
6. Siyu Qian, Ping Yu, David Hailey. The impact of electronic medication administration records in a residential aged care home. Under review by International Journal of Medical Informatics. Submitted on 2 Feb. 2015.  
My contribution to this paper is 10%.

#### Conference paper:

7. Siyu Qian, Ping Yu. Fitting clinical workflow: The case for wound care in a residential aged care home. Published on Health Informatics Conference 2014. Collected by Studies in Health Technology and Informatics 2014, 204:130-136.  
My contribution to this paper is 10%.

Signature: \_\_\_\_\_

Date: 17/03/2015

### Co-author Contribution Declaration

I, *David Hailey*, am one of the authors to the following journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.  
My contribution to this paper is 5%.
2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2):230-237.  
My contribution to this paper is 5%.
3. Siyu Qian, Ping Yu, David Hailey. Nursing staff work patterns in a residential aged care home: A time-motion study. Under review by Geriatric Nursing. Submitted on 23 Feb. 2015.  
My contribution to this paper is 5%.
4. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Medication administration process and procedural problems in a residential aged care home: An observational study. Under review by Journal of Nursing Administration. Submitted on 12 Dec. 2014.  
My contribution to this paper is 5%.
5. Siyu Qian, Ping Yu, David Hailey, Ning Wang. Nurses' time spent on administering each type of medication in a residential aged care home. Under review by Journal of Nursing Management. Submitted on 5 Jan. 2015.  
My contribution to this paper is 5%.
6. Siyu Qian, Ping Yu, David Hailey. The impact of electronic medication administration records in a residential aged care home. Under review by International Journal of Medical Informatics. Submitted on 2 Feb. 2015.  
My contribution to this paper is 5%.

Signature: \_

Date: 17/3/15

### Co-author Contribution Declaration

I, *Zhenyu Zhang*, am one of the authors to the following journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.

My contribution to this paper is 5%.

2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2): 230-237.

My contribution to this paper is 5%.

Signature: 

Date: 16/03/2015

### Co-author Contribution Declaration

I, *Pamela Davy*, am one of the authors to the following journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.

My contribution to this paper is 3%.

2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2):230-237.

My contribution to this paper is 3%.

Signature: \_

Date: 17/3/2015

### Co-author Contribution Declaration

I, *Mark Nelson*, am one of the authors to the following journal papers:

1. Siyu Qian, Ping Yu, Zhenyu Zhang, David Hailey, Pamela Davy, Mark Nelson. The work pattern of personal care workers in two Australian nursing homes: A time-motion study. BMC Health Services Research 2012, 12(1):305.

My contribution to this paper is 3%.

2. Siyu Qian, Ping Yu, David Hailey, Zhenyu Zhang, Pamela Davy, Mark Nelson. Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: A time-motion study. Australian Health Review 2014, 38(2):230-237.

My contribution to this paper is 3%.

Signature: \_\_\_\_\_

Date: 8.03.15

## Co-author Contribution Declaration

I, *Ning Wang*, am one of the authors to the following journal papers:

- Siyu Qian, Ping Yu, David Hailey, Ning Wang. Medication administration process and procedural problems in a residential aged care home: An observational study. Under review by Journal of Nursing Administration. Submitted on 12 Dec. 2014.

My contribution to this paper is 5%.

- Siyu Qian, Ping Yu, David Hailey, Ning Wang. Nurses' time spent on administering each type of medication in a residential aged care home. Under review by Journal of Nursing Management. Submitted on 5 Jan. 2015.

My contribution to this paper is 5%.

Signature: \_\_\_\_\_

Date: 16/3/2015

RESEARCH ARTICLE

Open Access

# The work pattern of personal care workers in two Australian nursing homes: a time-motion study

Si-Yu Qian<sup>1</sup>, Ping Yu<sup>1\*</sup>, Zhen-Yu Zhang<sup>1</sup>, David M Hailey<sup>1</sup>, Pamela J Davy<sup>2</sup> and Mark I Nelson<sup>2</sup>

## Abstract

**Background:** The aim of the study is to describe the work pattern of personal care workers (PCWs) in nursing homes. This knowledge is important for staff performance appraisal, task allocation and scheduling. It will also support funding allocation based on activities.

**Methods:** A time-motion study was conducted in 2010 at two Australian nursing homes. The observation at Site 1 was between the hours of 7:00 and 14:00 or 15:00 for 14 days. One PCW was observed on each day. The observation at Site 2 was from 10:00 to 17:00 for 16 days. One PCW working on a morning shift and another one working on an afternoon shift were observed on each day. Fifty-eight work activities done by PCWs were grouped into eight categories. Activity time, frequency, duration and the switch between two consecutive activities were used as measurements to describe the work pattern.

**Results:** Personal care workers spent about 70.0% of their time on four types of activities consistently at both sites: direct care (30.7%), indirect care (17.6%), infection control (6.4%) and staff break (15.2%). Oral communication was the most frequently observed activity. It could occur independently or concurrently with other activities. At Site 2, PCWs spent significantly more time than their counterparts at Site 1 on oral communication (Site 1: 47.3% vs. Site 2: 63.5%,  $P=0.003$ ), transit (Site 1: 3.4% vs. Site 2: 5.5%,  $P<0.001$ ) and others (Site 1: 0.5% vs. Site 2: 1.8%,  $P<0.001$ ). They spent less time on documentation (Site 1: 4.1% vs. Site 2: 2.3%,  $P<0.001$ ). More than two-thirds of the observed activities had a very short duration (1 minute or less). Personal care workers frequently switched within or between oral communication, direct and indirect care activities.

**Conclusions:** At both nursing homes, direct care, indirect care, infection control and staff break occupied the major part of a PCW's work, however oral communication was the most time consuming activity. Personal care workers frequently switched between activities, suggesting that looking after the elderly in nursing homes is a busy and demanding job.

## Background

The growing ageing population has resulted in an increasing number of residents, especially the very old and frail, in residential aged care facilities (RACFs) [1]. This requires an increase in the number and intensity of the aged care services. The situation is worsened by a chronic shortage of direct care workers, on whom these people rely to live [2]. All of this represents a big challenge to the delivery of aged care services in RACFs.

An important strategy to address this challenge is to effectively design work activities to optimally deliver

aged care services. This requires a basic knowledge about which work activities are currently undertaken by direct care workers and how much time each activity actually takes to meet a resident's care needs.

Personal care workers (PCWs) make up the largest proportion (70%) of the direct care workers in RACFs. Because of the challenge of attracting registered nurses (RNs), the number of PCWs is increasing steadily in Australia [3]. Personal care workers have a minimum qualification of Certificate III in Aged Care awarded by the Technical and Further Education (TAFE) college system in Australia. They are the major providers of personal care to residents, especially the activities of daily living (ADL) which are one of the important care needs supported by the Aged Care Funding Instrument (ACFI)

\* Correspondence: ping@uow.edu.au

<sup>1</sup>School of Information Systems and Technology, University of Wollongong, New South Wales 2522, Australia

Full list of author information is available at the end of the article

[4]. The ACFI assesses the day-to-day core care needs of a resident to determine the level of subsidy.

Work sampling and time-motion techniques have been applied extensively to measure the work pattern in healthcare settings [5-12]. The former has a relatively small cost, but is not able to capture some important information such as the duration of an activity because the observation is not continuous [13]. The latter allows precise time to be recorded for each activity, but this is labor-intensive and costly [14].

Previous studies have investigated the work pattern in hospital settings [6-8,10,11]. For example, Cornell *et al.* [7] inspected nurses' workflow and their computer use in two acute care medical-surgical units in a general hospital in the USA. They found that nurses frequently switched between activities and the duration of most of the activities was very short and highly variable. A recent study described the work activities of bedside intensive care unit nurses in a private hospital in Australia [11]. Nurses spent most of their time on direct care and indirect care and they undertook two activities simultaneously for almost half of their time.

Although there has been much research on the work pattern in hospital settings, few such studies have been undertaken in RACFs. Among the studies undertaken in RACFs, some only focused on particular activities (e.g. bathing-related care) [5,12,15]. Munyisia *et al.* [9] examined the time expenditure on different types of activities performed by direct care workers by conducting a work sampling study in a high-care house and a low-care house of an RACF. They found that in both houses, oral communication was the most time-consuming activity (32.4%-51.9%). This study provides a comprehensive overview of what the direct care workers do and how they spend their working time, however it was confined to a single RACF and because it is a work sampling study, the duration of each activity or the switches which occur between activities could not be determined.

This study aims to accurately describe the work pattern of PCWs in two high-care RACFs. These are similar to nursing homes in the USA in terms of the level of care provided to residents. Previous studies used different measurements to describe the work pattern [7,10,11,16,17]. The commonly used measurements are activity time, frequency, duration and the switch between two consecutive activities.

Activity time is expressed by two parameters: (1) the time an activity takes over an eight-hour shift and (2) the percentage of time used to complete an activity in relation to the total amount of time for all activities. Activity frequency is the number of occurrences of an activity during a set period of time (e.g. an hour). Activity duration, usually assessed in seconds, is the length of time continuously spent on an activity. It is presented as

a mean with standard deviation to indicate its variability. The switch between two consecutive activities includes the number of occurrence of a switch and the direction of this switch. These four measurements were used in this study to describe a PCW's work pattern.

## Methods

### Settings

A time-motion observational study was conducted at two nursing homes. The first nursing home was located in Sydney and was owned by a not-for-profit organization which operates 23 RACFs. The observation was conducted in a 32-bed high-care wing (Site 1) staffed by one half-time and four full-time PCWs and one RN. The other nursing home was a stand-alone, not-for-profit facility in Newcastle with 108 beds. The observation was conducted in a 25-bed high-care wing (Site 2) in which three PCWs and one RN took care of 23 residents (two beds were empty at the time of the study).

### Classification of personal care workers' activities

The observational study requires a predefined classification of activities. Our research team has developed and applied an activity classification system of direct care workers in a longitudinal work sampling study conducted in an Australian nursing home [9,18-20]. This work activity classification system was further developed and revised through three focus group discussions with three researchers (including the researchers who developed it) and three RNs who had extensive experience working in aged care.

The final classification system contains 58 activities grouped into eight categories: direct care, indirect care, infection control, documentation, transit, staff break, oral communication and other activities not included in the previous categories. The activities in each category are presented in Table 1.

### Ethical approval

Ethical approval was granted by the Human Research Ethics Committee of the University of Wollongong based on written approval given by the two participant aged care organizations which run the two nursing homes.

### Inter-rater reliability

Our observation was conducted by a single observer. To ensure the reliability of the observation process, our observer and a second observer, who has extensive experience in conducting observational studies, independently observed and recorded the same activities of four PCWs for a period of four hours. Then a comparison of two hours of their records was conducted and discussed. A

**Table 1 Classification of personal care workers' activities**

Category	Activities
Direct care	Physical Assessment.
	Routine hygiene (e.g. daily shower or wash).
	Continence related hygiene (e.g. shower or wash following pad change).
	Oral Care.
	Shave or grooming.
	Toileting - prompted by a resident.
	Toileting - prompted by a personal care worker.
	Pad check.
	Pad change.
	Scheduled toileting.
	Dressing a resident.
	Resident mobility; passive & active exercises; turning a resident in bed.
	Medication administration.
	Specimen collection; urine collection.
	Assisting a resident with eating and drinking (include feeding systems).
	Assisting a resident with food (e.g. cutting up food, uncovering food or delivery of food).
	Care of the deceased; laying out.
	Assisting a resident with hand washing following the use of toilet.
	Assisting a resident with transfer to and from a bed, a chair, etc.
	Transferring a resident to or from dining room or board room.
	Weighing a resident.
	Assisting a resident to receive a phone call.
	Attending to a resident call for assistance.
Indirect care	Equipment set up (e.g. sling set up, shower chair set up).
	Resident shower set up (e.g. preparing shampoo, towel or body lotion).
	Bed making routine.
	Changing a bed following an incontinent episode.
	Cleaning up spills following an incontinent episode.
	Re-stocking supplies to a trolley.
	Re-stocking supplies to a resident's cupboard.
	Transporting linen to and from laundry.
	Transporting clinical waste for disposal.
	Using or cleaning up bed pans.
	Emptying a resident's meal plate.
	Collecting pads from a storage cupboard.
	Collecting a resident's clothes from his or her cupboard; putting clothes back to the cupboard.
	Sorting and putting a resident's clothes to his or her room.
Infection control	Putting on personal protective equipment.
	Taking off personal protective equipment.

**Table 1 Classification of personal care workers' activities (Continued)**

	Alcohol hand washing (related to toileting or pad change).
	Alcohol hand washing (unrelated to toileting or pad change).
	Water hand washing (related to toileting or pad change).
	Water hand washing (unrelated to toileting or pad change).
Documentation	Locating or collecting a resident's records.
	Taking a photo of a resident.
	Reviewing or writing resident's clinical information; reading notes; viewing results.
	Putting records back to filing area.
Transit	Standing or walking in the corridor between activities.
Staff break	Personal errands (off unit chores; meal break; making personal telephone call).
Oral communication	Asking for assistance from another personal care worker.
	Assisting another personal care worker to do his or her work.
	Participating in-service training.
	Communication of information about a resident (external).
	Communication of information about a resident (internal).
	Communicating with a resident.
	Communicating with a resident's family.
	Receiving a phone call; making a phone call.
Others	Other tasks not included.

minimum agreement of more than 95% was achieved in the two records, suggesting the inter-rater reliability is adequate according to Pelletier and Duffield [21].

## Data collection

The observation was performed in 2010. Before the observation, the nursing manager at each site introduced the observer to the RNs and the PCWs. On each observational day, the observer arrived at the site 15 minutes before the start of the observation to identify one of the PCWs for observation, using convenience sampling. The observer tried to observe different PCWs on different days to maximize the number of participants. At the start, the observer explained the purpose and procedure of the observation to the PCW. Only after written consent was given by the participant, was the observation conducted. A clinical handheld was used to record the observational data on an Excel spreadsheet.

For the first seven days of data collection at Site 1 only the start time was recorded for the observed activities.

Because the start time of the current activity is the end time of the previous activity, it was not necessary to record the end time. The observer noticed that a PCW might only be speaking or might be performing some other activity concurrently. In order to correctly record oral communication time, the data collection protocol was modified to include both the start time and end time of an oral communication activity, and the concurrently performed activity. At Site 2, both start and end times of oral communication activities were recorded from the beginning.

At Site 1, a total of 11 PCWs were observed over a period of 14 days (three of the PCWs were observed twice). The observation was between the hours of 7:00 and 14:00 or 15:00 on each day, depending on the observed PCW's finishing time.

At Site 2, a total of 27 PCWs were observed over 16 days (five were observed twice). The observation was from 10:00 to 17:00. On each day, a morning shift PCW was observed first. After this individual finished work at 14:00 or 15:00, an afternoon shift PCW was observed.

# Data analysis

The data were analyzed in Microsoft Excel 2007, SPSS version 18.0 (SPSS inc., Chicago, IL, USA) and R version 2.12.1 [22]. The duration of each activity was calculated in Excel. Analysis concerning oral communication at Site 1 was based on the last seven days of observation since the end time was not recorded during the first seven observational days. A Z test was used to compare the percentage of time spent on each category of activities between the two sites. A Pearson's chi square test was used to determine the difference between the two sites in the number of activities which fell into different duration groups. Statistical significance was assumed when  $P < 0.05$ .

# Results

Fifty-one of the designated 58 activities were observed at Site 1. The seven activities which were not observed are: 'care of the deceased or laying out', 'assisting a resident to receive a phone call', 're-stocking supplies to a resident's cupboard', 'using or cleaning up bed pans', 'sorting and putting a resident's clothes to his or her room', 'participating in-service training' and 'taking a photo of a resident'. Fifty-five of the designated activities were observed at Site 2. The three activities which were not observed are: 'cleaning up spills following an incontinent episode', 're-stocking supplies to a resident's cupboard', and 'taking a photo of a resident'.

A total of 173 hours of observation and 11,283 events were recorded. Table 2 shows the time spent on each category of activities, combining data from the two sites. The percentages do not sum to 100% because oral

**Table 2 Time spent on each category of activities, combining the two sites**

Categories	Time (%)	95% Confidence intervals	
Direct care	30.7	28.7	32.8
Indirect care	17.6	16.3	18.8
Infection control	6.4	5.8	7.1
Documentation	3.1	2.5	3.7
Transit	4.6	3.9	5.2
Staff break	15.2	11.8	18.6
Oral communication	59.2	53.7	64.6
Others	1.2	0.8	1.6

communication may occur either by itself or simultaneously with an activity from one of the other seven categories. This means that the percentage of time spent on oral communication has overlaps with the other categories.

# Activity time

At Site 1, 81 hours of observation were recorded and at Site 2, 92 hours were recorded. Table 3 presents the time, frequency and duration by activity category at each site.

At Site 1, the most time-consuming direct care activity was 'assisting a resident with eating and drinking (include feeding systems)' at 35 minutes over an eight-hour shift. At Site 2, however, 'assisting a resident with transfer to and from a bed, a chair, etc.' was the most time-consuming direct care activity, taking 29 minutes over an eight-hour shift. At both sites, 'equipment set up (e.g. sling set up, shower chair set up)' took the most indirect care time (Site 1: 31 minutes, Site 2: 38 minutes). Most of the oral communication time was spent on 'communication of information about a resident (internal)' (Site 1: 1 hour and 53 minutes, Site 2: 2 hours and 42 minutes) and 'communicating with a resident' (Site 1: 1 hour and 51 minutes, Site 2: 2 hours and 4 minutes).

No statistically significant difference between the two sites was found in the time spent on direct care, indirect care, infection control or staff break, and these activities took approximately 70.0% of the working time (Site 1: 68.1%, Site 2: 71.6%). As shown in Table 3, PCWs at Site 2 spent significantly more time than their counterparts at Site 1 on oral communication (Site 1: 47.3% vs. Site 2: 63.5%,  $P = 0.003$ ), transit (Site 1: 3.4% vs. Site 2: 5.5%,  $P < 0.001$ ) and others (Site 1: 0.5% vs. Site 2: 1.8%,  $P < 0.001$ ). They spent less time, however, on documentation (Site 1: 4.1% vs. Site 2: 2.3%,  $P < 0.001$ ).

# Activity frequency

In one hour, 56 events occurred at Site 1 and 73 events occurred at Site 2. The most frequently occurring

**Table 3 Time, frequency and duration by activity category at Site 1 and Site 2**

Category	Site	Time				Frequency per hour	Duration (seconds)			
		%	95% Confidence intervals		8-hour shift (h:m:s)		Mean	Standard deviation	95% Confidence intervals	
Direct care	1	30.9	28.7	33.0	2:28:05	14.5	75.6	143.5	67.4	83.8
	2	30.7	28.1	33.2	2:27:07	19.6	56.5	56.7	53.8	59.1
Indirect care	1	16.7	15.5	17.9	1:19:55	10.6	56.1	54.5	52.5	59.8
	2	18.4	16.7	20.2	1:28:22	13.2	50.5	46.8	47.9	53.2
Infection control	1	5.9	5.2	6.6	0:28:25	5.3	40.2	61.5	34.3	46.1
	2	6.8	6.1	7.6	0:32:46	8.8	28.2	24.5	26.5	29.9
Documentation	1	4.1 <sup>a</sup>	3.4	4.8	0:19:31	3.2	45.5	82.4	35.4	55.6
	2	2.3 <sup>b</sup>	1.7	3.0	0:11:13	1.4	58.8	80.7	44.9	72.7
Transit	1	3.4 <sup>a</sup>	3.0	3.9	0:16:29	3.0	41.3	46.7	35.4	47.2
	2	5.5 <sup>b</sup>	4.5	6.6	0:26:34	3.0	67.1	84.4	57.0	77.1
Staff break	1	14.6	10.9	18.4	1:10:17	0.6	880.1	817.5	642.7	1117.5
	2	15.7	11.0	20.4	1:15:24	0.7	815.0	845.4	603.8	1026.2
Oral communication	1	47.3 <sup>a</sup>	39.3	55.3	3:47:00	18.8	90.7	140.9	80.0	101.5
	2	63.5 <sup>b</sup>	56.6	70.4	5:04:40	25.8	88.9	173.4	81.9	95.8
Others	1	0.5 <sup>a</sup>	0.3	0.7	0:02:24	0.2	96.3	70.0	57.6	135.1
	2	1.8 <sup>b</sup>	1.1	2.5	0:08:46	0.6	110.3	118.5	78.3	142.3

<sup>a,b</sup>Indicate significant difference between the two sites in the percentage of time spent on this category of activities ( $P < 0.05$ ).

activity was oral communication, followed by direct care and indirect care (Table 3).

### Activity duration

From the mean and standard deviation shown in Table 3, the activity duration was very short and varied dramatically. The short activity duration is also shown in Figure 1. Of the 3,679 events recorded at Site 1 (excluding the 889 oral communication events which occurred in the first seven days), 9.0% were completed in less than 10 seconds, which was significantly less than at Site 2 (12.4% of 6,715 events,  $P < 0.001$ ). 15.5% of the events recorded at Site 1 and 14.5% at Site 2 took between 10 and 19 seconds. Overall, more than two-thirds of the observed events at both sites had a duration of less than 1 minute.

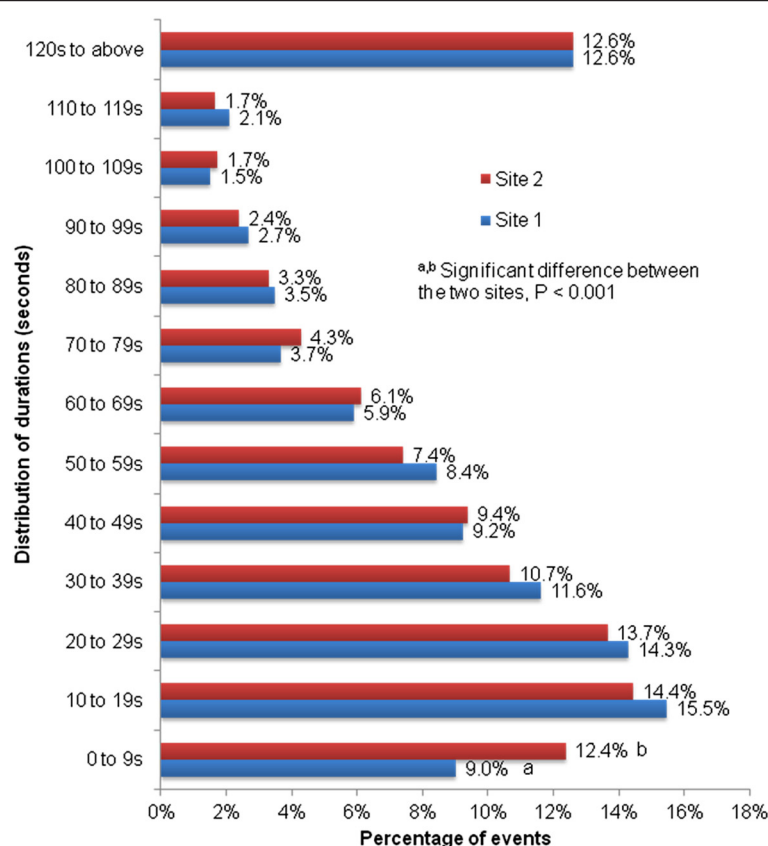
### Switch between two consecutive activities

A PCW frequently switched from one activity to another. On average, 49.8 switches between two consecutive activities were observed in an hour at Site 1 and 62.5 switches were observed at Site 2. A PCW switched from one activity to another at a rate of one per minute. Most of the switches were within or between oral communication activities, direct care activities and indirect care activities. The directions of the most frequently observed switches were similar, as were the number of these switches at both sites (Table 4).

### Discussion

In this study 56 out of the 58 designated activities performed by PCWs at two Australian nursing homes were measured. The activities were classified into eight categories: direct care, indirect care, infection control, documentation, transit, staff break, oral communication and others. In comparison with a previous study in a single nursing home [9], this study provides a much more accurate and complete picture of how PCWs spend their time on work activities described in the following terms: actual time taken over an eight-hour shift, the time spent on it as a percentage of the time consumed by all of the observed activities, the activity frequency and duration. It also provides data on the switches between two consecutive activities. Our findings will be useful for nursing managers to understand how PCWs work and what the workload actually is in looking after residents with high-care needs in nursing homes. Although the care needs of the residents represented an uncontrolled variable in what was a natural setting, it appeared that a PCW's workload looking after residents and meeting their care needs was high in both nursing homes.

Personal care workers spent 30.7% of their time on direct care. This is less than the finding (40.2%) from a previous study by Munyisia *et al.* [9] which was also conducted in an Australian nursing home. Indirect care consumed 17.6% of PCWs' time, which is almost twice as the time (8.9%) obtained in the study by



**Figure 1** Distribution of duration at Site 1 and Site 2.

Munyisia. The difference in time may be caused by the different study design. For example, our study used time-motion technique to collect data while their study used a work sampling technique. The other possibility is that the differences are due to differences in care systems and practices in different nursing homes. Furthermore, in this study the percentage of time was calculated from the actual duration of activities, whereas their results were based on the frequency of occurrence of activities.

Further analysis needs to be conducted to understand how indirect care activities support direct care. It is also necessary to examine how direct care activities distributed throughout a shift and whether the direct care activities were spread out evenly over an hour or performed in quick succession, for example, at the beginning of the hour. This can make a significant difference to residential care, as was also mentioned in a previous study [10].

Communication with a resident and communication of information about a resident are the prime oral

**Table 4** Direction and number of the most frequently observed switches between two consecutive activities

First activity	Second activity	Number of switches per hour
Communicating with a resident.	Communication of information about a resident (internal).	1.6
Communication of information about a resident (internal).	Communicating with a resident.	1.6
Equipment set up (e.g. sling set up, shower chair set up).	Assisting a resident with transfer to and from a bed, a chair, etc.	1.1
Communicating with a resident.	Communicating with a resident.	0.9
Taking off personal protective equipment.	Water hand washing (related to toileting or pad change).	0.8
Communicating with a resident.	Equipment set up (e.g. sling set up, shower chair set up).	0.6
Assisting a resident with transfer to and from a bed, a chair, etc.	Equipment set up (e.g. sling set up, shower chair set up).	0.9

communication activities. This may be an indication that the PCWs had made an effort to spend time interacting with residents (e.g. explaining the care to a resident in order to receive cooperation from the resident) and co-operate with the working partners to provide care. The content of the oral communication and the way it is conducted may be among the critical elements which most affect the quality of care.

Personal care workers not only spent a great deal of time on oral communication, but also frequently switched between oral communication, direct care and indirect care activities. This may indicate that oral communication is one of the important activities which support direct care and indirect care.

Although the observational time periods at the two nursing homes were different (Site 1: 7:00 to 14:00 or 15:00, Site 2: 10:00 to 17:00), no statistically significant difference was found in the time spent on direct care, indirect care, infection control or staff break. These activities account for about 70.0% of a PCW's working time. This suggests that apart from the unavoidable breaks which all staff must take, these activities represent the core of PCWs' workload. Nursing managers need to consider this finding carefully when allocating tasks, staff number and skill mix on a shift.

Personal care workers at Site 1 spent significantly less time on oral communication than their counterparts at Site 2. This may be associated with the age and ethnicity of the PCWs. Most of those at Site 1 were 20 to 30 years old and from a non-English speaking background, whereas PCWs at Site 2 were local and aged between 35 and 55. As the PCWs at Site 2 had the same language and cultural background as the residents, oral communication was less of a challenge than it was for the PCWs at Site 1.

The often short duration of activities and the quick and frequent switching between activities caused extreme busyness and some stress. The practical routine and familiarity with the residents and their individual needs help the PCWs arrange their work to cope with this. This routine and familiarity with the residents can facilitate the work. This was also found in a previous study [23].

Although routine and familiarity may support their work, a PCW does have to think about what to do next while performing the task at hand. Working in such a busy environment may lead to a cognitive overload, which may cause job fatigue and contributing, in turn, to nursing burn out. Therefore, nursing managers may need to consider which level of workload is appropriate for a PCW working in a nursing home.

Among the designated 58 work activities of PCWs, 56 were observed, suggesting that our activity classification system reflects a PCW's work activities in Australian

nursing homes and provides a good reference for other studies of work activities in nursing homes.

### Limitations

The benefit of using a single observer is the potential consistency of the observations [24], however it may also cause systematic errors in observation. We addressed this potential limitation through an inter-rater reliability comparison study, which provided satisfactory results. There may be a 'Hawthorn effect' [13] (the participants might change their work behavior under the observation) from PCWs being observed continuously, however we found that in the busy nursing home working environment, PCWs had to focus on their job and very soon ignored the existence of the observer. This was also found in previous studies [25,26].

### Conclusions

We described the work pattern of PCWs in two Australian nursing homes. The work activities were examined using the following measurements: activity time, frequency, duration, and the switch between two consecutive activities. Fifty-six out of 58 designated work activities grouped into eight categories were observed. We found that direct care, indirect care, infection control and staff break were the major part (70.0%) of the work and there was no statistically significant difference between the two nursing homes in the time spent on these activities. More than two-thirds of the observed activities at both sites had a very short duration-- less than 1 minute. Personal care workers frequently switched within or between oral communication, direct care and indirect care activities.

Our findings are useful for nursing managers for staff performance appraisal, task allocation, scheduling and cost estimation. The information may also help to design effective aged care services and provide possible research directions in nursing homes. Furthermore, it provides evidence for the government in funding allocation by accurately measuring the amount of time needed in conducting each category of care activities to meet a resident's relevant care needs. Further research on how indirect care activities support direct care and how oral communication supports other types of care are needed.

### Abbreviations

RACFs: Residential aged care facilities; PCWs: Personal care workers; RNs: Registered nurses; TAFE: Technical and Further Education; ADL: Activities of daily living; ACFI: Aged Care Funding Instrument.

### Competing interests

The authors declare that they have no competing interests.

### Authors' contributions

PY was responsible for the study conception and design. ZYZ performed data collection. SYQ, PD and MN were responsible for data analysis. SYQ drafted the manuscript. PY, DH, PD and MN made critical revisions to the

paper for important intellectual content. All authors read and approved the final manuscript.

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# Author details

<sup>1</sup>School of Information Systems and Technology, University of Wollongong, New South Wales 2522, Australia. <sup>2</sup>School of Mathematics and Applied Statistics, University of Wollongong, New South Wales 2522, Australia.

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## Time spent on daytime direct care activities by personal carers in two Australian residential aged care facilities: a time–motion study

Siyu Qian<sup>1</sup> BMgmt, PhD Candidate

Ping Yu<sup>1,3</sup> PhD, Associate Professor

David M. Hailey<sup>1</sup> PhD, Professor

Zhenyu Zhang<sup>1</sup> MInfoTech-Res, Research Assistant

Pamela J. Davy<sup>2</sup> PhD, Senior Lecturer

Mark I. Nelson<sup>2</sup> PhD, Associate Professor

<sup>1</sup>School of Information Systems and Technology, University of Wollongong, Northfields Avenue, Wollongong, NSW 2522, Australia. Email: sq992@uowmail.edu.au; dhailey@ozemail.com.au; zhenyu52@hotmail.com

<sup>2</sup>School of Mathematics and Applied Statistics, University of Wollongong, Northfields Avenue, Wollongong, NSW 2522, Australia. Email: pjd@uow.edu.au; mnelson@uow.edu.au

<sup>3</sup>Corresponding author. Email: ping@uow.edu.au

### Abstract

**Objective.** To examine the time, frequency and duration of each direct care activity conducted by personal carers in Australian residential aged care homes.

**Methods.** A time–motion study was conducted to observe 46 personal carers at two high-care houses in two facilities (14 days at Site 1 and 16 days at Site 2). Twenty-three direct care activities were classified into eight categories for analysis.

**Results.** Overall, a personal carer spent approximately 45% of their time on direct care, corresponding to 3.5 h in an 8-h daytime shift. The two sites had similar ratios of personal carers to residents, and each resident received 30 min of direct care. No significant differences between the two sites were found in the time spent on oral communication, personal hygiene and continence activities. Personal carers at Site 1 spent significantly less time on toileting and mobility activities than those at Site 2, but more time on lunch activity. Although oral communication took the longest time (2 h), it occurred concurrently with other activities (e.g. dressing) for 1.5 h.

**Conclusions.** The findings provide information that may assist decision makers in managing the operation of high-care residential aged care facilities, such as planning for task allocation and staffing.

**What is known about the topic?** Overall, 30%–45% of the care staff's time is spent on direct care in residential aged care facilities.

**What does this paper add?** This paper adds knowledge about how much time is required to conduct each direct care activity and the frequency and duration of conducting these activities to meet residents' day-to-day care needs in two high-care houses in two aged care facilities.

**What are the implications for practitioners?** On average, a resident with high-care needs requires 30 min direct care. There may exist a basic minimum desirable ratio of personal carers to residents in high-care facilities. Residents' toileting needs are high after meals. Communication with residents represents an essential role in providing care.

**Additional keywords:** activity, long-term care, nursing home, observation, personal care.

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# Fitting clinical workflow: The case for wound care in a residential aged care home

Siyu QIAN and Ping YU

*School of Information Systems and Technology, University of Wollongong,  
New South Wales, Australia*

**Abstract.** Residential aged care homes have, or are in the process of implementing, electronic health record (EHR) systems to improve quality of care and reduce cost. For the system to deliver benefits, it must support nursing tasks and be seamlessly integrated into the nursing workflow. To identify whether and how an EHR system can do this most effectively, direct observation was conducted in a residential aged care home on nurses' use of EHR for wound care. The work processes of wound care and its documentation were investigated. Problems in the use of EHR were identified: 1) functional deficiencies of the EHR system which included a lack of functions to remind nurses of the existence of a wound chart, unavailability of an existent function when needed and a lack of sufficient detail in the information provided; 2) a lack of mobile devices to allow nurses to access the EHR system at the point-of-care, resulting in nurses using paper for point-of-care documentation. The findings suggest that continuous improvement in both the EHR system and its management is required to achieve integration of people, task, process and technology for the optimal benefits of EHR.

**Keywords.** EHR, design, integration, long-term care, nursing home, paper, software engineering, workflow, work process, wound care

## Introduction

Many residential aged care homes (RACHs) have implemented electronic health record (EHR) systems in order to improve quality of care, resident safety, efficiency and reduce costs [1]. However, to date, there is little understanding of how EHR systems support nurses in the delivery of care, such as wound care, palliative care or pain management to residents. To fill this knowledge gap, this study investigated the processes of nurses' use of EHR for wound care in an RACH.

The integration of an EHR system into an existing work environment involves people, tasks, work processes and technology [2-4]. People complete a task by following relevant work processes. The role of an EHR system in this process is to facilitate task completion by providing needed functions.

For an EHR system to bring optimal benefits to nursing care, the system has to support nurses in their task completion. For example, to help a nurse complete the task of documenting vital signs (e.g. blood pressure) of a resident, an EHR system needs to provide the electronic chart of vital signs and a search function for a nurse to locate this chart in the system. In addition to providing adequate functional support [2], EHR systems need to be seamlessly integrated into the work processes to ensure quality of

care and resident safety [3], which means that it must provide appropriate support for a user whenever the support is needed.

To achieve the optimal benefits of EHR, the system needs to both meet users' needs and fit in with their work processes and the users need to adjust or redesign their work processes to accommodate the use of the system [2, 5]. For example, Baron et al. reported their experience in integrating EHR into a primary care setting in the USA [6]. To accommodate the use of the EHR system, they redesigned the workflow for the delivery of care. Although this process was extremely stressful and increased patient waiting time at the beginning, the situation improved six months later when staff became more confident with the new work processes and the use of the EHR system. The final benefit was reduced patient waiting time.

Wound care is one of the essential nursing tasks to maintain patients' skin integrity. Several wound care management systems have been developed. For example, Mobile Personalized Woundcare System™ (Mobile PWS™) [7], WoundRight [8] and WoundRounds® [9]. All three systems were used on mobile devices, but the first two did not require internet connectivity. All provided functions to document wound assessment information, track wound progress and generate a report. Uniquely, Mobile PWS™ allowed a nurse to order wound dressings and set alerts for future care actions. WoundRounds® provided wound image taking function. Both systems also provide a function to create a treatment plan.

Despite these systems developed specifically for wound care, the process of providing wound care and related documentation using an electronic system in RACHs have received very little research attention. One study was found which assessed WoundRounds® in an American RACH [9]. It used a questionnaire survey to evaluate the system's ease-of-use and effectiveness for wound management. It found that within two months, the system was easier for nurses to use. The effectiveness for wound management was also improved. In order to understand whether and how an EHR system supports nursing care in the context of Australian RACHs, our study focuses on investigating nurses' wound care processes and their use of EHR for documentation.

## **1. Methods**

Direct observation was conducted in a non-profit, aging-in-place RACH from June to September 2013. A single observer followed nurses and recorded their wound care and how they documented it, either in an EHR system or on paper in morning shifts. Informal conversations were conducted whenever questions arose. Field notes were also taken. The research was approved by the ethics committee of the University of Wollongong. Access to the facility was given by the management of the aged care organisation. Written consent was obtained from each participant before the observation started. Four nurses worked in a morning shift, with each of them looking after about 35 residents. Nurses who participated in the study were registered nurses, endorsed enrolled nurses and personal carers with Certificate IV Level II.

A web-based EHR system was implemented in 2009. All nursing staff received a 30-minute one-on-one training three months before the implementation of the system. Staff who were newly employed after the introduction of the system was trained by their peers. A comparison of the time nursing staff spent on documentation before and after the implementation could be found in [10]. In terms of wound care, the EHR system provided wound charts which allowed nurses to document the wound

assessment information, wound dressing and frequency of care. It also provided a function to enable a nurse to search for previous wound charts. The information documented in a wound chart was useful for a nurse to provide the right care to the right wound for the right resident at the right time. The facility did not provide mobile devices (e.g. iPads) for point-of-care documentation.

To depict real work processes of how nursing staff document wound care, as-is work process diagrams were drawn using a workflow mapping technique proposed by Kmetz [11]. The diagram was validated by a registered nurse and two endorsed enrolled nurses.

## **2. Results**

### *2.1. Wound Care Process*

The process of providing wound care is described in Figure 1. Before providing wound care to residents, a nurse prepares paper-based documents and a wound care trolley in a nursing station. Then the nurse pushes the trolley to the room of each resident needing wound care and provides the wound care. Paper is used for point-of-care documentation. After completing wound care for all the residents, the nurse comes back to the nursing station and documents the care in the EHR system. In general, a nurse spent one and a half hour on wound care for about two to six residents in a morning shift. The number of wounds on each resident might vary from one to five.

### *2.2. Documentation of Wound Care*

Both paper and the EHR system were used for documentation of wound care. As shown in Figure 1, three types of paper-based documents were used during the process. These were a wound care book, a wound summary sheet and a paper note. The wound care book was the main information source for wound care. It consisted of wound charts that were printed off from the EHR system. The wound summary sheet summarised who needed wound care, his or her room/bed number, the location of the wound and scheduled dates for changing the wound dressing or reviewing the wound. It was colour-coded for a nurse to distinguish the time for wound care, either in the morning shift or in the afternoon shift. Wounds to be cared for in the morning shift were listed by a nurse on the paper note before starting wound care. The paper note was used for point-of-care documentation. All the data recorded on the paper note would be transcribed into the EHR system after completing the wound care. The process of transferring data from paper to the EHR system is depicted in Figure 2.

### *2.3. Problems in the Use of the EHR System*

Problems related to the use of the EHR system were identified and classified into two categories: functional deficiencies in the EHR system and lack of mobile devices to allow users to access the EHR system at the point-of-care. Functional deficiencies included the lack of functions to remind a nurse about the existence of a wound chart, the lack of availability of an existent function when a nurse needed it and the lack of sufficient detail in the information available for nurses.

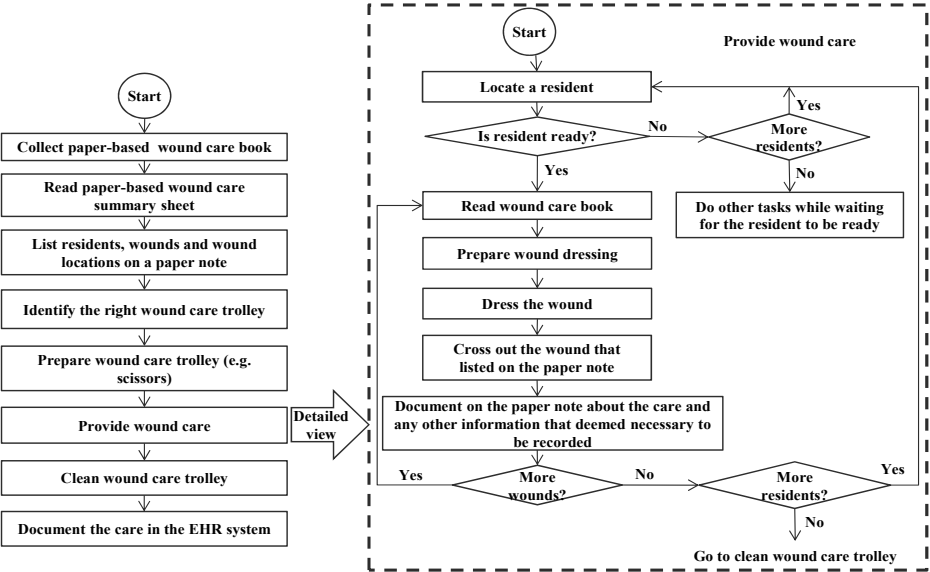


Figure 1. Wound care processes

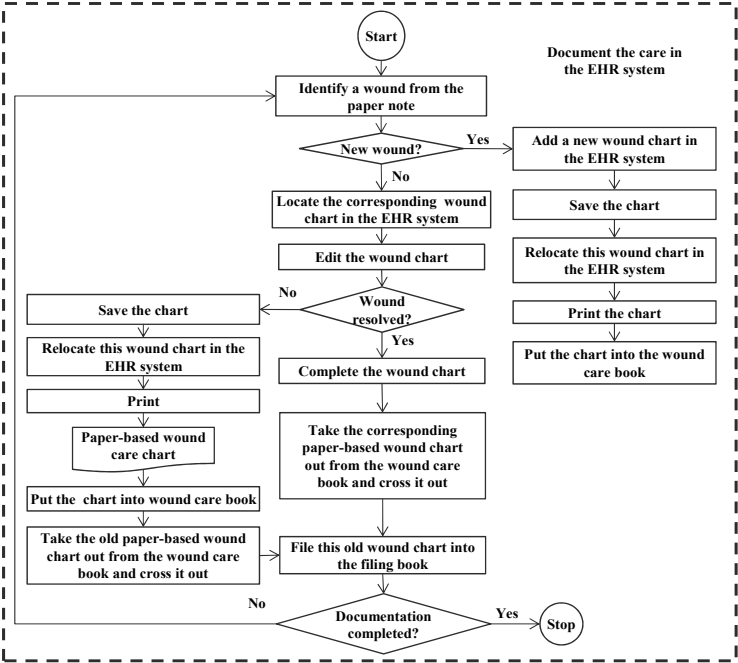


Figure 2. Transcribing data from paper to the EHR system

2.3.1. The Lack of Functions to Remind a Nurse About the Existence of a Wound Chart

The EHR system did not provide feedback about the existence of a wound chart. A nurse who had no knowledge of the existence of the chart might create a second one.

This duplication in wound charts caused further confusion for other nurses who needed to retrieve information.

### *2.3.2. The Lack of Availability of the Existent Function When a Nurse Needed It*

Although the EHR system had a print function, this function was not readily accessible to a nurse when updating the chart. This forced the nurse to relocate the chart by clicking into the section 'View Forms & Charts', selecting the wound chart from a dropdown box and then the name of the resident from another dropdown box. A list of wound charts for this resident would then be displayed. The nurse needed to identify the right wound chart from this list. Finally, the person could open and print the chart.

### *2.3.3. The Lack of Sufficient Detail in Information Provided to a Nurse*

In the example given above about relocating a wound chart, a nurse needed to identify the right chart from a list of wound charts. Although each wound chart in the EHR system had a brief description including resident name, chart name (i.e. wound chart), name of the nurse who created the chart and the creation date of the chart, critical information such as the location of a wound, which the nurse needed to identify the right chart was not available. This critical information was recorded inside each chart, causing the nurse to manually open each chart in order to identify the right one.

## **3. Discussion**

This study investigated nurses' use of an EHR system for wound care to learn whether and how the system supports nurses in their task completion. Our direct observation identified three functional deficiencies in the EHR system which appeared to add unnecessary processes for nurses to complete a documentation task, instead of shortening this process and saving time. This finding suggests that system development should not stop at the roll-out stage, but must be an on-going, iterative process of redesign to support end users' work. System designers need to continue to work with users to fully understand their work processes and information needs for task completion and the characteristics of the tasks. This knowledge needs to be captured as requirements and be integrated into a redesigned system to improve the capability of the system to support task completion. Only through this continuous process of redesigning the system to fit in with the evolving task requirements, can the benefits of a successfully implemented EHR system be continuously maintained.

One of the original expectations of RACHs when introducing an EHR system was to use it to replace paper [12], however paper was still used by nurses. This was because there was a lack of mobile devices (e.g. iPad) to enable electronic point-of-care documentation. Therefore, the RACH may need to consider introducing mobile devices to allow nurses to access the system at the point-of-care. In addition, electronic wound charts provided by the current EHR system could only support documentation and information retrieval. This had little help with the management of wounds (e.g. integrated view of wound healing history). Although the current EHR system was not designed specifically for wound management, some features of aforementioned specialised wound care management systems such as Mobile PWS™ [7], WoundRight [8] and WoundRounds® [9] could be considered to be integrated into an updated version of the EHR. For example, tracking wound progress, generating a report

and ordering wound dressings [7]. A wound image capture capability offered by the system will also be useful for an accurate documentation of a wound [9]. These improvements in devices and the EHR system will be likely to lead to improvements in the process of nursing documentation (e.g. saving half of the current wound care documentation time by using a mobile device to eliminate paper-based documentation).

#### 4. Conclusion

This study investigated the process of wound care and its documentation. Problems in the use of the EHR system in this process were identified. These included three functional deficiencies of the system: the lack of functions to remind a nurse of the existence of a wound chart, the unavailability of an existent function when needed and the lack of sufficiently detailed information. Another problem was the lack of mobile devices to allow nurses to access the system at the point-of-care, which resulted in nurses' use of paper for point-of-care documentation and the inefficient, error-prone process of double data entry. Further research may investigate medication administration process as a case to examine the impact of an electronic medication management system.

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