Caregivers’ Time Utilization before and after the Introduction of an Electronic Nursing Documentation System in a Residential Aged Care Facility

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Keywords
Electronic nursing documentation, electronic health record, impact, nurse, residential aged care, nursing home

Summary
Background: Despite increasing research on caregivers’ interaction with technology, there has been no attempt to investigate how the introduction of an electronic system in a residential aged care facility (RACF) may affect caregivers’ use of their time.
Objective: To assess how caregivers use their time before and after the introduction of an electronic documentation system in an RACF.
Methods: An observational work sampling study was undertaken with caregivers at two months before, and at 3, 6, 12 and 23 months after the implementation of an electronic documentation system.
Results: During the first 12 months after implementation, the proportion of time spent by personal carers on documentation increased, that on direct care reduced, and the proportion on communication remained unchanged. At 23 months, the proportion on documentation and direct care had returned to pre-implementation levels. The percentage of time spent on these activities by recreational activity officers remained unchanged at most measurement periods after implementation. Changes in proportions of time on other activities were not directly associated with the introduction of the electronic system.
Conclusion: It may take over a year for some caregivers in an RACF to integrate the use of a newly introduced electronic documentation system into their daily work. Organisations implementing such systems should develop strategies that support and accelerate the caregivers’ integration of the new documentation practice into their routine activities. The electronic documentation system may not however, replace the role of verbal communication between caregivers in aged care service.

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1. Introduction

Electronic systems are increasingly being introduced into Australia’s residential aged care facilities (RACFs). These facilities care for older people, who because of frailty and other age-related conditions, are unable to live independently in their own homes and require care from others in an institution. The care provided to the older people ranges from personal care to nursing care [1].

The use of electronic systems in RACFs could significantly improve quality, safety and efficiency of care service delivery. In a recent study, we found that a computerized documentation system reduced repetitions in data entry and enhanced accessibility, accuracy, and legibility of nursing records [2]. Another study found that an electronic system improved management decision-making by facilitating quick access to residents’ records [3].

Despite growing evidence and mandates to implement health information technology (health IT), computer use in RACFs to support delivery of quality care and improve management of residents’ records is still uncommon [4]. Most aged care managers are reluctant to introduce computers into caregivers’ daily work. Reasons range from high cost of implementation to uncertainty of how this technology will impact on caregivers’ practice [5, 6]. Some leaders in aged care fear that caregivers may take a long time to learn the new workflow in an electronic system, a situation that may impact resident care. Others believe the new system may improve caregivers’ efficiency and accuracy of documentation [6]. This demonstrates the need for a clear understanding of the changes in caregivers’ work following the introduction of an electronic system in an RACF.

This goal could be achieved by exploring caregivers’ time on activities [7, 8]. Previous investigations of time spent on activities after the introduction of an electronic system in nursing practice have mainly been undertaken in hospitals [9–11]. For example, seven months after the implementation of an electronic system in the
Intensive Care Unit (ICU) of a surgical ward, Bosman et al. [9] found that caregivers took much less time on registration of patients (documentation) and more time on patient care (direct care) compared with the time associated with paper-based documentation practice. These authors found no difference between paper-based and electronic documentation systems in time spent on personal (i.e., meal breaks) and unit-related (i.e., ordering supplies) activities. To our knowledge, there are no studies providing this kind of information in the setting of an RACF.

Understanding how time on activities may change after the introduction of an electronic system is essential in both promoting acceptance of the systems by caregivers and in motivating the aged care providers to invest in innovative health IT applications to optimize care services. In addition, the information can be used to redesign caregivers' activities and work flow to enhance productivity. This paper presents the results of a 25-month longitudinal study on caregivers' time utilization before and after the introduction of an electronic documentation system in a low care section of an RACF.

2. Objective

The objective of this study is to assess how caregivers use their time before and after the introduction of an electronic nursing documentation system in an RACF. The study specifically explores changes in proportion of time spent on activities by personal carers (PCs) and recreational activity officers (RAOs) before and after the introduction of the electronic system.

3. Methods

3.1 Design

An observational work sampling technique was used in this study. Details of this technique have been reported by Munyisia et al. [12].

3.2 Study Setting

This work is part of a larger project on changes in caregivers’ work following the introduction of an electronic system in an RACF in Australia. This study was specifically conducted in a low care section of the RACF. This section has 64 beds. On a typical morning shift, care of the residents is provided by four PCs and one RAO.

Prior to the implementation of the electronic system, residents’ information was handwritten as free-text or entered into standardized nursing forms provided by the facility’s management. In 2009, after implementation, residents’ demographics, incident and accident reports, forms and charts, progress notes and assessments were entered and maintained on a computer. The electronic system was also used to prepare care plans, shift handover reports and the funding of care.

During the electronic documentation period, information on continence was documented either on paper or on a computer. Information on blood pressure, weight and blood sugar level was documented on paper and on a computer from six months after implementation. Information on medication management and recreational activities was recorded and maintained on paper throughout the study.

In preparation for implementation, the electronic system was installed on a laptop and four desktop computers. Each caregiver received a 30-minute one-on-one training session. Newly employed caregivers learned to use the electronic system from the facility’s IT support officer or from colleagues with experience in working with the new system.

3.3 Participants

Participants in the study were PCs and RAOs working on a morning shift (6.45 am to 3.15 pm). The caregivers working on afternoon or night shifts, allied healthcare staff, and registered nurses (RNs) assigned to administrative tasks or supervision of the PCs were excluded from the investigation.

![Figure 1](image-url) The five periods of work activity measurement

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3.4 Roles of the PCs and RAOs

Personal carers in Australian RACFs provide basic care to the residents, for example, showering and toileting. They also re-stock supplies and aid residents in their mobility. They are responsible for performing documentation duties for their activities in a work-shift. The PCs in this study were also involved in the activity of medication administration [13, 14].

Recreational activity officers have the responsibility of planning, implementing and evaluating leisure and recreational programs for individual residents in a RACF [15]. The RAOs at the RACF were also involved in direct care of the residents, for example, feeding. They also documented on all their work activities.

3.5 Data Collection

Data collection was carried out between 2009 and 2011 on a morning shift at five separate measurement periods (Figure 1). Each period lasted for five days (Monday, Tuesday, Wednesday, Saturday and Sunday).

3.6 Procedures

Two weeks prior to the first period of data collection, the observer (ENM) was introduced by the residential service manager to the caregivers in their shift handover meetings. The observer talked to the caregivers and reassured them that the investigation was not meant to identify flaws in their work, but to understand any changes in their time expenditure following the introduction of an electronic documentation system. At the end of each meeting, the observer invited caregivers to participate in the study. They all accepted by signing consent forms.

Before the start of observations on each morning shift, the observer (ENM) obtained a list of the caregivers scheduled to work during that shift, re-arranged the list by replacing caregivers’ names with code numbers, and noted names of new caregivers in the study. During observations, when the observer met the new caregiver, she introduced herself, explained the purpose and method of the study, and requested the caregiver to participate.

Observations were made every five minutes. Starting from a fixed location in the house and following the same route on each round of observation, the observer recorded all activities being performed by each caregiver on a tabular data collection tool. When a caregiver was not found on a given round of observation, a dash (–) was recorded to denote missing. But if another caregiver on the floor indicated that his or her colleague, for instance was on break, then this activity was recorded accordingly. These procedures were followed at all measurement periods of the study.

At 6 months and 12 months after implementation, structured interviews were held with the caregivers to assess their experiences with the electronic system. The criterion for participating in the interviews was that caregivers had to have some experience using the electronic documentation system in their daily work and were willing to discuss this. It was assumed that with this experience, a caregiver understood the operations related to the use of the electronic system and would have formed some opinions about using it. In total, six PCs and two RAOs participated during the two interview periods. Each interview was audio-taped and then transcribed verbatim.

3.7 Caregivers’ Activities

The work sampling tool was designed to include all possible activities performed by the PCs and the RAOs on a morning shift. A detailed account of the procedures followed in identifying the activities, validation of these activities and assessment of inter-rater reliability are presented by Munyisia et al. [16]. The final instrument contained 48 activities grouped into eight categories (Table 1).

3.8 Ethical Considerations

The study was approved by the Human Research Ethics Committee of the University of Wollongong, Australia. The purpose and method of the study were explained to the caregivers. Caregivers were given information sheets about the study to read, understand and ask any questions before signing informed consent forms. Each participant was assigned a code number to ensure anonymity of the records.

3.9 Data Analysis

The main outcome of analysis was the proportion of time spent in each activity category before and after the introduction of the electronic documentation system. To
obtain the proportion of time, the total number of snapshots in a category was divided by the total number of snapshots recorded during the entire work sampling period. Data in MS Excel 2003 were converted to SPSS, version 18.0 (SPSS Inc., Chicago, IL, USA) for statistical analysis using descriptive statistics. The proportion of time spent in documentation category after implementation includes the time spent on paper-based and on computer-based documentation tasks.

Differences in proportions of time spent in each category before and after the implementation of the electronic system were identified using Pearson’s chi-square test. A significance level for each test was set to 0.05. However, given the multiple comparisons in this study (32 independent comparisons for the PCs and 16 for the RAOs), we used the Bonferroni correction to adjust for the multiplicity. Thus, results from these comparisons are presented as adjusted p-values. Hence, a p-value less than 0.002 for the PCs and a p-value less than 0.003 for the RAOs were considered to be statistically significant.

3.10 Interview Data Analysis

Data were analysed using an inductive content analysis method as described by Elo and Kyngas [17]. First, transcripts were open-coded, line-by-line. Each transcript was then thoroughly reviewed to identify terms or events that appeared frequently. Categories emerged from these terms and events. The categories from different transcripts were then compared and grouped into broader higher order categories. Finally, the content of these categories was used to abstract major themes from which to draw conclusions on the caregivers’ experiences with the electronic system.

4. Results

A total of 109 observations of caregivers were made, 92 (84%) of PCs and 17 (16%) of RAOs. In total, 10,947 activities were recorded for the PCs and 1,500 for the RAOs.

### Table 2

<table>
<thead>
<tr>
<th>Activities</th>
<th>% (number of observations)</th>
<th>Chi-square test between measurement periods (α = 0.002)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measurement periods a</td>
<td>2–3</td>
</tr>
<tr>
<td></td>
<td>n = 2549</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>42.6 (1086)</td>
<td>0.088</td>
</tr>
<tr>
<td>Indirect care</td>
<td>6.3 (161)</td>
<td>0.194</td>
</tr>
<tr>
<td>Direct Care</td>
<td>14.9 (381)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Documentation</td>
<td>11.8 (300)</td>
<td>0.136</td>
</tr>
<tr>
<td>Personal</td>
<td>5.3 (134)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Medication management</td>
<td>9.3 (237)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>In-transit</td>
<td>9.4 (239)</td>
<td>0.004</td>
</tr>
<tr>
<td>Others</td>
<td>0.4 (11)</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

*The five measurement periods of the study are denoted by the numbers 2, 3, 6, 12 and 23; 2 = 2 months before the implementation of the system; 3 = 3 months after implementation; 6 = 6 months after implementation; 12 = 12 months after implementation; and 23 = 23 months after implementation.

bComparison of the proportion of time spent on each category of activities before and after the implementation of the electronic system. For instance, a comparison of the proportion of time spent on activities 2 months before and 3 months after the implementation of the system is denoted by ‘2–3’.

Statistically significant outcome of chi-square test. A p-value less than 0.002 was considered statistically significant. For example, in the row for communication, there is a notable difference in proportion of time spent between 2 months before and 6 months after the implementation of the system (p = 0.001).

n = total observations

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recorded at 6 and 12 months post-implementation. At 23 months, the proportion was not much different from that recorded when using the paper-based system.

The percentage of time on personal duties increased significantly at all measurement periods after implementation. In contrast, there was a reduction in the percentage of time on medication management in these periods (p < 0.001).

There were no major changes in the proportion of time spent in-transit between task before and after 3 and 12 months into electronic documentation. At 6 and 23 months, the proportion of time spent was considerably more than in the period when the paper-based system was used.

Finally, the percentage of time on other nursing duties increased at 3 and 12 months after implementation (p < 0.001); however, at 6 and 23 months, the percentage of time was not much different from that recorded in the paper-based system.

4.2 Changes in the RAOS’ Proportion of Time on Activities

Table 3 presents RAOS’ activities before and after the implementation of the electronic documentation system. The percentage of time the RAOS spent on communication remained unchanged after the introduction of the electronic system, except at 23 months where the percentage recorded was significantly lower than in the pre-implementation period.

The proportion of time spent on direct care work reduced (p < 0.001) and that on documentation increased (p < 0.001) at three months after the introduction of the electronic system. From six months through to 23 months, the proportion of time on these activities was not much different from that recorded when using the paper-based system.

The percentage of time in-transit between tasks increased significantly at all measurement periods after implementation apart from six months where the proportion was not much different from that recorded in the period prior to implementation.

4.3 Interview Results

Only relevant interview discussions that explain the recorded changes in the caregivers’ proportion of time on activities after the implementation of the electronic system are presented here. Most of the changes described by the caregivers were positive including ease of data entry, distribution, storage and access to the residents’ records.

With the ease of access to the records, the PCs were able to complete their documentation tasks that were sometimes forgotten or inadequately performed in the paper-based system. For example, during the electronic documentation periods, caregivers documented the care provided to each resident more frequently than in the period when the paper-based system was used. One caregiver interviewed stated that:

“We are charting a lot more on each resident, for example, we are up-to-date with their continence charts. I think it is because the charts are there and easy to use and it does not take long to get in and out.”

A more comprehensive and systematic description of the benefits of electronic documentation has been reported by Zhang et al. [18]. The unintended positive and negative consequences are in the process of being reported by other members of the research group.

Some activities remained unchanged after the introduction of the electronic system including the role of verbal communication for the caregivers. One PC said:

“Verbal communication is just part of our work, it is what we do routinely. Basically, we get verbally 50% of the information required for care of the residents.”

In addition, no matter whether using manual or electronic documentation systems, a number of the caregivers prefer verbal to written communication about a resident’s care needs. One RAO stated that:

“I prefer the personal approach because there is no time to access a resident’s notes either on paper or computer. I guess I would say to one of the staff members, what happened with so-and-so, where is she, how is she going, that sort of thing. There is always that pressure for the time.”

After implementation, the RAOS’ documentation practice remained unchanged to a large extent. They were unable to fully utilize the electronic system in documenting or reading about the residents’ participation in leisure and recreational activities. This is because, they shared a computer with visiting caregivers and hence, their access to the electronic system was limited. As stated by one RAO:

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Table 3  RAOS’ proportion of time on activities before and after the implementation of the electronic system

<table>
<thead>
<tr>
<th>Activities</th>
<th>% (number of observations)</th>
<th>Measurement periods a</th>
<th>Chi-square test between measurement periods (a = 0.003) b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 n = 379</td>
<td>3 n = 305</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>54.6 (207)</td>
<td>46.4 (136)</td>
</tr>
<tr>
<td>Direct Care</td>
<td></td>
<td>36.1 (137)</td>
<td>20.7 (63)</td>
</tr>
<tr>
<td>Documentation</td>
<td></td>
<td>4.7 (18)</td>
<td>18.7 (57)</td>
</tr>
<tr>
<td>In-transit</td>
<td></td>
<td>4.5 (17)</td>
<td>16.1 (49)</td>
</tr>
</tbody>
</table>

Only those activities recorded five times or more at each measurement period are presented. a The same explanation for measurement periods as in Table 2. b The same explanation as in Table 2. c Statistically significant outcome of chi-square test. A p-value less than 0.003 was considered statistically significant. n = total observations.
“Well, we all use this one computer. We share between doctors, podiatrists, three recreation activity officers and a physiotherapist. We are unable to use the electronic system very much.”

Some caregivers were disappointed with spending longer time to complete some forms in the electronic system. For example, to complete a resident’s continence chart using the paper-based system, a caregiver only needed to place a single entry in the chart and then flip-over to complete another resident’s chart. In the electronic system, a caregiver needed to go through a minimum of three structured drop-down menus, selecting appropriate continence information from a list. To access another resident’s chart, the caregiver needed to close the screen with the previous resident’s chart by inputting a username and password. Caregivers perceived the many clicks and switches among screens to be much more time consuming than the procedures they followed when using the paper-based system. One PC said:

“The only real problem I have is with the continence charts, it takes so long to enter everyone’s information in the electronic system. It can take up to one hour to enter continence data and when using the paper system, it is just a 5-minute job. I am able to go from one resident to the next using the electronic system, but when I have 35 residents, that is a lot of clicking and switching screens.”

5. Discussion
5.1 Study Limitations

Observations for this study were made in a single RACF with a particular electronic nursing documentation system. As such, our results may not be directly generalizable to other RACFs and systems. However, they clearly demonstrate the dynamics in caregivers’ proportion of time spent on activities at various periods after the introduction of the electronic documentation system. In addition, the results provide long term follow-up data that has not been found in the literature.

The study was not conducted on all work-shifts in a day due to limitation of resources. Thus, it is impossible to ascertain how the findings on the proportion of time caregivers spent on various activities might have been affected by the inclusion of afternoon and night shifts. Further studies would be needed to address this.

This was a longitudinal study that included different care staff members over the 25 months. It is possible that the way work was conducted differed between staff members. Some caregivers might fail to adhere to their work patterns or overlook certain procedures in performing duties. In addition, the way computers were used may differ between staff members. This is possible particularly in RACFs which often have a high turnover rate of caregivers [19]. Hence, during any work shift, there was a likelihood of having both novice and experienced users of the electronic system.

Further, since a number of the caregivers in an RACF have poor computer skills [5], their usage of the electronic system might differ from those experienced users. However, organisational policies and protocols such as clear work patterns and job description for each type of caregivers might have reduced these variations. In addition, the caregivers underwent similar training on how to use the electronic system.

The study however, did not collect data on the variations amongst the caregivers. This data would have provided information to explain the observed proportions of time on activities. For example, obtaining a detailed account of the caregivers’ experience in using the electronic system would provide information about novice and experienced users of the system at various periods after implementation. This information might be used to explain the dynamics in the proportion of time spent on documentation activity after the introduction of the electronic system.

Our study had no control group and hence, any changes in the caregivers’ proportion of time on activities may not only be attributed to the electronic documentation system, but also to changes that occurred during the study period. For example, retirement or resignation of some caregivers and operational reforms for some duties like medication management. However, our discussion with management of the RACF and our experiences during data collection suggest there were no external factors to which the changes might be attributed.

We used work sampling study design in this investigation. Although this technique is useful in obtaining data for a whole care team in a short period, it provides an estimate, but not the real time needed to complete an activity as reported in this study.

Further, it is possible that caregivers changed their work behaviours after sight- ing the observer (the Hawthorne effect). To minimize the impact of the effect in this study, the observer talked to the caregivers in an effort to relieve any anxiety. In addition, during this study, the caregivers appeared to concentrate on their work and ignore the presence of the observer. Such behaviour was reported in a work sampling study by Ampt et al. [20] who found that the presence of researchers was hardly noticed by the nurses during their work.

5.2 The Caregivers’ Time Utilization before and after the Introduction of an Electronic Nursing Documentation System

The results indicate that in comparison to the paper-based practice, there were changes in the caregivers’ time distribution at most measurement periods after the implementation of the electronic system. For the RAOs, the distribution of the proportion of time on activities during the pre-implementation period was similar to the distribution at 3 months, but not at 6, 12, and 23 months post-implementation. For the PCs however, there were no similarities in the distribution of the proportion of time on activities before and after the implementation of the electronic system. This finding was expected because an electronic system may force the use of correct procedures and even adherence to policies that are often overlooked or missed when using a manual system [21].

The proportion of time spent on documentation by the PCs increased at most measurement periods during the first 12 months after implementation. This increase may be a result of the changes in the PCs’ documentation practice. Instead of them documenting on care provided to each resident at least once in a week as per...
the policy of the RACF, the frequency of
documentation increased after implemen-
tation. Moreover, procedures involved in
completing certain documentation on a
computer such as a resident’s continence
chart, may also account for the recorded
increase in proportion of time on docu-
mentation.

At 23 months, the proportion of time on
documentation had gone back to the origi-
nal levels recorded when using the paper-
based system. This finding suggests that it
takes over a year for the PCs in an
RACF to completely integrate an electronic
documentation system into their daily
work.

However, the RAOs’ proportion of time
on documentation remained unchanged at
most measurement periods after the intro-
duction of the electronic system. Our find-
ing may be attributed to the RAOs’ inade-
quate access and use of the electronic sys-
tem as reported in the interviews. This
finding may also be a result of the RAOs’
preferred mode of obtaining information
about a resident in a work-shift. According
to the interviews, the RAOs prefer oral
communication to written nursing notes
regardless of the documentation system in
use.

The caregivers’ proportion of time on
communication activities remained un-
changed at almost all the measurement
periods after the implementation of the
electronic system. This finding may be at-
tributed to a lack of change in the role of
verbal communication between caregivers
in aged care. In the interviews, it was re-
vealed that for a caregiver to have all in-
formation about the care needs of a resident,
he or she is required to obtain half of the
information from interacting with fellow
caregivers. In a previous study, we found
that caregivers in an RACF highly valued
their face-to-face interaction for successful
care delivery [12].

The proportion of time the caregivers
spent on direct care activities reduced at
three months after system introduction.
This result may be associated with the in-
creased time needed to learn how to use
the electronic system. The proportion
settled back to the baseline levels obtained
with the paper-based system at six months
after implementation for the RAOs and at
12 months after implementation for the
PCs. This suggests that the learning process
had come to an end. However, our finding
is contrary to that by Cherry et al. [22]. The
authors found that some caregivers in the
study perceived they spent longer time on
direct care duties after the introduction of
an electronic system into their daily work.
This variation in the findings may be at-
dtributed to differences in the study design,
measurement periods, and the electronic
system in use.

Some of the other changes in time spent
on activities appear not to be associated
with the introduction of the electronic sys-
tem. For example, the reduction in the pro-
portion of time on medication manage-
ment at all periods after implementation
may be a result of the change in medication
management. Prior to implementation, a
PC was required to search through a cup-
board with medication that was often not
arranged in a particular order, identify the
medication, and arrange it on a medication
trolley. After implementation, however, the
trolley became the medication storage area.

The increased proportion of time in-
transit between tasks after implementation
may in part be associated with changes in
the caregivers’ work. For example, prior to
implementation, there were designated
caregivers who worked in the low care sec-
tion of the RACF. However, after imple-
mentation, this arrangement changed be-
cause a number of the caregivers either re-
tired or resigned. To fill the gap, some care-
givers in a different section of the RACF
were occasionally re-deployed to work in
the low care section. They had no experi-
ence with the residents or how to obtain
their care information from a computer,
and were often observed stopping one ac-
tivity, walking along the corridor to find a
more experienced caregiver to consult or
confirm certain aspects of a resident’s care
needs.

6. Conclusion

This study gives insight into the dynamics
in caregivers’ use of their time at various
periods after the implementation of an
electronic documentation system in an
RACF. Findings suggest that it may take
over 12 months for some caregivers in an
RACF to completely integrate an electronic
documentation system into their daily
work. Thus, organisations implementing
such systems need to develop strategies
that support and accelerate the caregivers’
integration of the new documentation
practice into their work activities. The find-
ings also suggest that an electronic docu-
mentation system may not replace the role
of verbal communication between care-
givers in aged care service.

Thus, there is need to investigate the ef-
fect of this kind of communication on the
quality of care provided to the residents.
Longitudinal studies in other RACFs are
also needed to validate the findings of the
current study. In addition, there is need to
understand how caregivers use their time
in the afternoon and night shift after the
introduction of an electronic system in an
RACF.

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