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Factors influencing nursing time spent on administration of medication in an Australian residential aged care home

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Abstract

Aims: To examine nursing time spent on administration of medications in a residential aged care (RAC) home, and to determine factors that influence the time to medicate a resident. Background: Information on nursing time spent on medication administration is useful for planning and implementation of nursing resources.

Methods: Nurses were observed over 12 morning medication rounds using a time-motion observational method and field notes, at two high-care units in an Australian RAC home.

Results: Nurses spent between 2.5 and 4.5 hours in a medication round. Administration of medication averaged 200 seconds per resident. Four factors had significant impact on medication time: number of types of medication, number of tablets taken by a resident, methods used by a nurse to prepare tablets and methods to provide tablets.

Conclusion: Administration of medication consumed a substantial, though variable amount of time in the RAC home. Nursing managers need to consider the factors that influenced the nursing time required for the administration of medication in their estimation of nursing workload and required resources. Implications for nursing management: To ensure safe medication administration for older people, managers should regularly assess the changes in the factors influencing nursing time on the administration of medication when estimating nursing workload and required resources.

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Methods. Nurses were observed over 12 morning medication rounds using a time-motion observational method and field notes, at two high-care units in an Australian RAC home.

Results. Nurses spent between 2.5 and 4.5 hours in a medication round. Medication administration per resident averaged 200 seconds. Four factors had significant impact on medication time: number of types of medication, number of tablets taken by a resident, methods used by a nurse to prepare tablets and methods to provide tablets.

Conclusion. Medication administration consumed a substantial, though variable, amount of time in the RAC home. Nursing managers need to consider the factors that influenced the nursing time required for medication administration in their estimation of nursing workload and required resources.

Implications for nursing management. To ensure safe medication administration for older people, managers should regularly assess the changes in the factors influencing nursing time on medication administration when estimating nursing workload and required resources.

Keywords: Medication administration, nursing home, observation, time, workload

Aim

The aims of this study were to examine the nursing time needed for administration of different types of medication in a morning medication round in a residential aged care (RAC) home; and to determine factors that will influence the time needed for medicating a resident.

Background

Medication administration is prone to errors (Pierson *et al.* 2007). In aged care, it can be hindered by various factors such as residents' intricate health conditions (e.g. swallowing difficulty) (Ellis *et al.* 2012), nurses' high physical and mental load (Cassidy 2005), and the large amount of medication to be administered under time pressure (Vogelsmeier *et al.* 2007, Dilles *et al.* 2011). A three-month observational study in RAC homes found that 90% of residents were exposed to at least one medication error (Szczepura *et al.* 2011).

Time has a great impact on how nurses conduct activities and organize their work processes. Understanding nursing time spent on medication administration is useful for the estimation and allocation of nursing workload so as to ensure resident safety. It is also necessary for evidence-based decisions on staffing levels (Abbey *et al.* 2012), as well as for performance monitoring, strategy development, internal management, and comparisons between aged care systems.

To date, studies examining nursing time spent on medication administration in RAC homes are rare. Dellefield et al. (2012) conducted a work sampling study to investigate how registered nurses (RNs) use their time in day shifts in an RAC home. They found that 31% of the time was spent on direct care, including medication administration. Using the same data collection method, Munyisia et al. (2011) quantified the time spent on activities by four types of nursing staff : RNs, endorsed enrolled nurses (EENs), personal carers (PCs) and

recreation activity officers. The study results showed that RNs and EENs spent 18% of their time on medication administration.

Thomson et al. (2009) 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. They found that preparing medication for a resident required 70 to 105 seconds which was longer than the time for providing medication (40 to 70 seconds).

There is a lack of knowledge about nursing time needed for administration of each type of medication. This information can be important 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, this knowledge is of growing importance.

Methods

Settings

The study was conducted in two units of an Australian RAC home. Unit 1 had 38 beds and Unit 2 had 40 beds. Residents living in the two units had an average age of 83 and an average length of stay of 12 months. The majority (97%) of the residents needed high care. The two units shared one medication room. Each unit had a medication trolley.

Tablets for each resident were pre-packed in small plastic sachets by the pharmacy according to the administration time and date. The sachets were connected one by one in a roll for seven-day use and stored in cabinets in the medication room. A nurse working in the previous night shift was responsible for removing the sachets of tablets that would be administered in

the morning from the roll and organizing them into residents' compartments in the medication trolley.

Medications stored in a refrigerator would be taken out by the nurse working in the morning shifts. The other medications (e.g. puffers) were stored in the medication trolley.

Participants

Seven nurses participated in the study- one RN, four EENs and two medication endorsed PCs. Their average length of work experience in medication administration was 6.3 years (5 months to 13 years). The RN had a Bachelor degree in Nursing. The EENs had a Diploma in Enrolled Nursing obtained from the Australian Technical and Further Education (TAFE) system and completed further medication endorsement. The PCs had Certificate IV level II in medication management awarded by the TAFE.

Data collection

Classification system of activities

Time-motion observation was conducted in this study. It required a pre-defined classification system of nurses' activities. These activities were identified through a preliminary study- 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 system was then validated by three nurses and two managers who worked in the two RAC homes. Activities that occurred in morning medication rounds are presented in Table 1.

Insert Table 1 about here

Time-motion observation

In time-motion observation, an observer follows one participant at a time and records the sequence of activities and time spent on each of these by this person (Gilbreth 1911). In this study, an observer performed data collection from August to September 2013. Twelve

morning medication rounds were observed, six in each of the two units. The commercial software InMotion Pro (Code Studio 2014) was installed on an iPad to record the time-motion observation data.

Structured field notes

In addition to time-motion observation, structured field notes were taken by the observer. For each resident, the observer recorded the methods that a nurse used to prepare and provide tablets, current time, location and code of the resident in a structured field notes taking sheet.

Methods for tablet preparation included: tablets were not crushed or mixed in thickened fluid; tablets were not crushed but mixed in thickened fluid; and tablets were crushed and mixed in thickened fluid. Tablets were crushed directly in their package by a pill crusher, rather than in a vessel.

Methods for tablet provision included: a resident took the tablets by themselves, the nurse did not wait while this was done; a resident took the tablets by themselves, but the nurse waited while this was done; a nurse helped a resident to take the tablets; and a nurse provided tablets via a percutaneous endoscopic gastrostomy (PEG) feed.

These methods were identified in the preliminary study. They were validated in a pilot study- a seven-day observation, as being able to capture all the methods that nurses used for preparing and providing tablets.

Data analysis

Time-motion data were exported to Excel spread sheets, where the data recorded in the structured field notes were entered by matching the activity start time recorded on the iPad and the “current time” recorded in the structured field notes.

The unit of analysis was a resident. IBM SPSS version 19 was used for statistical analysis. The Mann-Whitney U test and the One-way ANOVA test were used for statistical comparisons. 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.

Ethical considerations

Ethical approval (number: HE09/043) was sought and granted by the university's Human Research Ethics Committee after acquiring agreement for the study from 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] = 0.5 hour, ranging from 2.3 hours to 4.5 hours). This is equivalent to 37.5% of nursing time in an 8-hour morning shift.

As shown in Table 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 such as providing medication to a resident and talking with the person at the same time.

Insert Table 2 about here

Average time spent on each type of medication

On average, a resident took nine medications in the morning, seven of which were tablets. As shown in Table 3, tablets and powder medication were the most widely used types of medication observed in this study. Almost all the residents took tablets and more than 30% of them took powder medication. All the medications required less than 60 seconds to prepare or provide, except for providing medication by PEG feed.

The PEG feed took the longest time for both preparation (46 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).

Providing tablets to a resident took 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. showering) to residents.

Insert Table 3 about here

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 conducted by a nurse during this time may include preparation and provision of various types of medication, bringing medication to the resident, chatting with them, walking back to the medication trolley, documentation, and hand wash.

Although residents might take up to four types of medication, 83% of them only took one or two types. 52% 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 their tablets (see Table 4).

No significant difference was found between the two units in the average time a nurse spent on a resident (see Table 4). 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 using different methods for tablet preparation or provision, the average time spent on a resident varied significantly.

Insert Table 4 about here

Figure 1 shows the nursing time spent on preparing and providing different number of tablets to a resident. 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 time than for those who took six or more tablets (46 seconds for 6-10 tablets and 62 seconds for 11-20 tablets).

Insert Figure 1 about here.

Figure 2 shows the nursing time spent on preparing or providing tablets for a resident when different methods were used. When preparing tablets for a resident, crushing and mixing tablets in thickened fluid took an average of 56 seconds, significantly longer than not crushing or mixing (24 seconds) and not crushing but mixing the tablets in the thickened fluid (30 seconds).

There were also significant differences in the time needed for providing tablets when a resident took the tablets by themselves while the nurse waited (30 seconds), when a nurse

helped a resident to take the tablets (45 seconds) and when a nurse provided tablets via a PEG feed (94 seconds).

Insert Figure 2 about here.

Discussion

To our knowledge, this study is the first of its kind undertaken in RAC homes. It adds to the knowledge about nursing time spent on medication administration in this setting. It found that, for each type of medication, both preparation and provision for a resident required less than one minute time, except when PEG feed was involved. The time needed per resident differed significantly by individual medication needs. Four factors influenced the amount of time required for this task: the number of types of medication taken by a resident, the number of tablets taken by this person, the methods used by a nurse to prepare tablets and the methods to provide tablets.

The findings suggest that, when estimating nursing workload on medication administration, nursing managers may need to consider these four factors. Because when resident case mix changes, nursing managers may need to re-assess nursing workload and adjust staffing levels to ensure adequate time is given to nurses for safe medication administration.

As in a time-motion study in a Canadian RAC home (Thomson *et al.* 2009), this study found that medication preparation took more time than medication provision. The medication preparation activity defined in this study was the preparation itself, crushing tablets and/or mixing with thickened fluid. It did not include identification of medication from the medication trolley, review of related information on the 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.

However, the study by Thomson et al. (2009) found that nurses spent more than 60 seconds per resident on medication preparation and 40 to 60 seconds per resident on medication provision. These times are longer than those found in this study, possibly due to different resident case mix.

In a time-motion study in two medical-surgical units in the USA (Cornell *et al.* 2010), nurses spent 4% and 6% of their time on medication preparation and provision, respectively. In a more recent study in two hospitals in Finland (Antinaho *et al.* 2014), nurses self-reported even less time- only 3% of their time on medication preparation and 5% on provision. These findings in hospitals on the proportions of time spent are much less than our findings in an RAC home. This also may be due to the different patient case mixes and to different practice patterns in the hospital setting.

Although all nurse participants were able to complete their work, the time they spent on a medication round ranged from 2.5 hours to 4.5 hours. This variation may be caused by differences in individual practice, such as organization of activities and work sequence. For example, most nurses documented non-medication related information on paper and later transferred it to the electronic documentation system, but the nurse who spent the longest time on the medication round documented such information immediately to the electronic system. The long time spent on this task left her less break time before moving onto the next nursing task. This suggests that improvements can be made to the work processes and that best practices need to be determined and implemented for safe, timely and efficient medication administration.

Compared to previous findings (Munyisia *et al.* 2014, Westbrook *et al.* 2013, Thomson *et al.* 2009), this study showed that nurses spent more time on medication-related tasks. Thomson et al. (2009) found that up to two hours were spent on a morning medication round. A work

sampling study of nurses in an RAC home in Australia reported that 18% of nursing time (less than two hours) was on medication administration in an eight-hour shift (Munyisia *et al.* 2014). A time-motion study in a hospital in Australia reported that nurses spent about two hours per shift on medication-related tasks (Westbrook *et al.* 2013). This variation in times is possibly due to the differences between studies in the duties and workload of the participants, data collection methods and healthcare settings.

In this study, infection control activities included the use of gloves and cleaning hands. The hygiene of nurses' hands is important for the health of residents living in RAC homes (World Health Organization 2012). 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 (Voss *et al.* 1997). We found that nurses spent only 3.5% of their time on infection control, equivalent to 10.8 seconds per resident. The frequency and duration of infection control activities need to be examined to evaluate the effectiveness of the current practice.

Limitations

The study was limited to observations in a single RAC home for a relatively short time. As with any observational study, it might also have had the problem of participants changing their behavior while under observation. To reduce the effect of this problem, the observer explicitly told the participants that the study was not intended to seek fault but to understand time usage in medication administration. The observer also showed the participants which activities would be recorded and how the recording was done.

Conclusion and implications for nursing management

This study provides knowledge of nursing time spent on preparing and providing medications for older people in an Australian RAC home. It found that medication administration consumes a significant amount of nursing time. It also determined four factors which influenced the nursing time spent it: the number of types of medication taken by a resident, the number of tablets taken by this person, the methods used by a nurse to prepare tablets and the methods to provide tablets. These factors may be used to create computer algorithms which can facilitate nursing managers to better determine nursing workload.

The time required per resident varied with individual medication needs. For example, in a high dependent or dementia unit, there may be more residents who need their tablets to be crushed compared to a low-care unit, thus nurses would need more time to conduct medication administration. Therefore, it is important for nursing managers to understand resident population in different units with varying levels of medication needs, and take into account the difference in nursing time required for medication administration when estimating nursing workload for task allocation and staffing so as to ensure medication safety for residents. In addition, the diverse medication needs of residents may imply that models of care in RAC homes need to be person-centered and be intuitive and easy for nursing staff to operate.

Similar studies in other RAC homes are needed to validate and enrich this knowledge. Further investigation can focus on the individual differences between nurses in conducting medication administration, which may contribute to the establishment of best practice for medication administration in RAC homes. It may also be fruitful to understand other factors which may affect medication times such as resident behavior of medication refusal.

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1 **Table 1. Nurses' activities in morning medication rounds.**

Categories	Activities
Medication preparation	prepare a medication trolley (e.g. get spoons, cups, medication administration records, refrigerated medication, a rubbish bag for general waste)
	locate a resident or check if a resident is ready for medications
	identify a medication from the trolley (including checking it with medication administration records)
	prepare tablets (e.g. check the medication, open the plastic package, put tablets into a small plastic cup or mix them in thicken fluid or crush them)
	prepare liquid medications (e.g. check the medication, pouring the liquid medication into a small plastic cup)
	prepare powder medications (e.g. Movical) (e.g. check the medication, open the package, put the powder into a drinking cup, add water, stir)
	prepare eye drops/ointment (e.g. check the expiration date)
	prepare injections (e.g. wipe the insulin bottle cap with an alcohol swab, open the package of the syringe, measure the insulin)
	prepare puffers/inhalers (e.g. get the spacer, attach the inhaler to the spacer)
	prepare nebulizer (e.g. check the expiration date, put nebulizer into the nebulizer equipment)
	prepare patches (e.g. writing the date on the patch)
	prepare topical medications (e.g. lotions and creams)
	prepare resource (i.e. a drink to supply nutrition)
	prepare for percutaneous endoscopic gastrostomy (PEG) feed (e.g. get water which will be used to flush the tube)
	prepare a cup of water/juice
	prepare glucose-monitoring device
	check blood glucose
	bring prepared medications and other supplies (e.g. tissue, spoon) to a resident
	prepare a PRN medication
	prepare a resident for medication administration (e.g. help a resident to sit up)
Medication provision	provide tablets (e.g. feed, verbally encourage, assist)
	provide liquid medications
	provide powder medications
	provide eye drops/ointment
	provide injections
	provide puffers/inhalers
	provide nebulizer
	provide patches
	provide topical medications
	provide nutrition drink
	provide medications via PEG feed
	provide a PRN medication
Cleaning up	travel back to medication trolley
	dispose clinical or general wastes or put medications (e.g. eye drops) back into trolley

Categories	Activities
	bring/collect spoons and cups to/from wash up room
Infection control	alcohol hand wash
	water hand wash
	put on/take off gloves
Verbal communication	verbal communication with a resident
	verbal communication with another nurse
	verbal communication with a PC
	verbal communication with other internal staff (i.e. physiotherapist, kitchen staff)
	verbal communication with an external health professional (e.g. a doctor)
	verbal communication with a visitor
	receive/answer/make a phone call
Documentation	use medication administration record
	use paper notes or handover sheet
Transit	push a medication trolley
	walk/stand in corridor, dining room, etc.
Other	other activities not included above (e.g. turn on a TV for a resident)

1

2

Table 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	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
Other	5.5%	9:54

Table 3. Average time spent on preparing and providing a type of medication to a resident and the percentage of residents needing this type of medication.

Medications	Preparation (seconds)		Provision (seconds)		% of residents	
	Mean	SD	Mean	SD	Unit 1	Unit 2
PEG feed	45.6	29.8	146.9	97.8	6.1	0.0
Injection	37.2	18.2	18.2	9.5	9.6	1.5
Tablet	35.0	26.0	43.5	42.0	97.5	100.0
Powder medication	28.5	21.7	21.4	11.8	31.3	35.9
Puffer/inhaler	24.0	17.5	17.2	12.8	10.1	12.8
Liquid medication	19.9	12.9	28.1	35.2	6.6	13.3
Nebulizer	19.5	12.1	24.9	13.4	3.5	3.6
Patch	17.1	12.2	16.1	16.3	3.0	5.1
Resource drink	14.7	9.9	25.4	28.7	5.6	4.6
Eye drops/ointment	8.7	4.9	23.9	14.9	10.1	18.5

Table 4. The average time a nurse spent on a resident.

Category	% of residents	Time for a resident (seconds)	
		Mean	SD
Unit			
Unit 1	-	198*[a]	122
Unit 2	-	201[a]	115
Number of types of medication taken by a resident			
1 type	42	144[a]	93
2 types	40.6	211[b]	108
3 types	13.8	283[c]	110
4 types	3.6	404[d]	98
Number of tablets taken by a resident			
1-5 tablets	36.5	182[a]	132
6-10 tablets	51.6	210[b]	115
11-20 tablets	11.7	213[b]	83
Methods for preparation of tablets for a resident			
tablets were not crushed or mixed in thickened fluid	61.6	187[a]	108
tablets were not crushed but mixed in thickened fluid	6.4	192[ab]	154
tablets were crushed and mixed in thickened fluid	29.6	229[b]	123
Methods for provision of tablets to a resident			
a resident took the tablets by themselves, a nurse did not wait while this was done	19.1	159[a]	106
a resident took the tablets by themselves, but a nurse waited while this was done	7.6	193[abc]	91
a nurse helped a resident to take the tablets	67.3	205[b]	118
a nurse provided tablets via a percutaneous endoscopic gastrostomy (PEG) feed	2.1	318[c]	123

* The same superscript letter indicates there was no significant difference between the times for the measurement items. Different superscript letters denote a significant difference in the times for the measurement items.

Mann-Whitney U test and One-way ANOVA were used. A statistically significant difference was indicated by $p<0.05$ for comparison of two groups, 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.

Figures

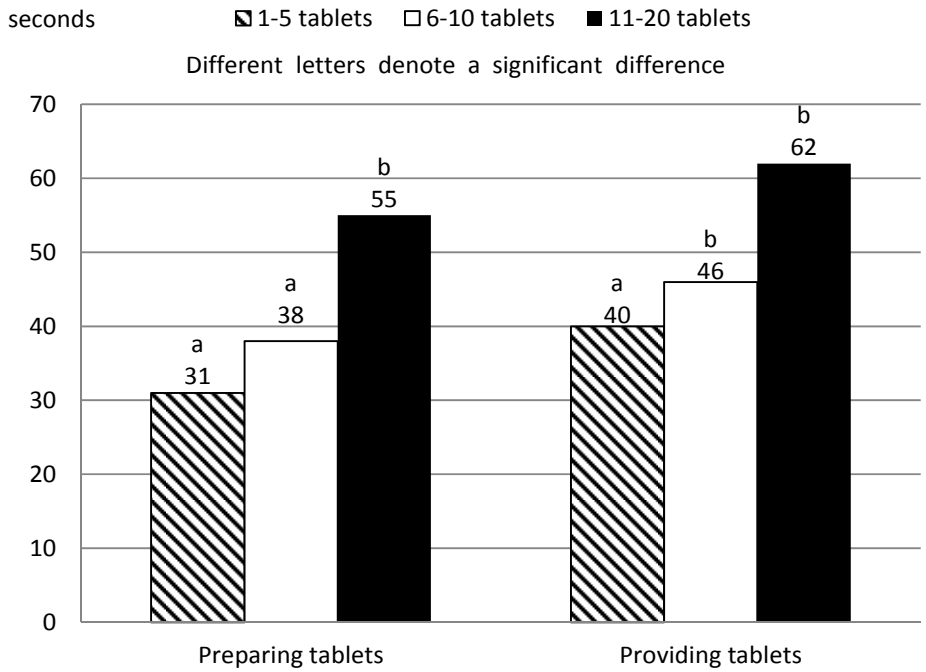

Figure 1. Nursing time spent on preparing and providing tablets when the number of tablets differs.

One-way ANOVA test was used for comparing the time spent on preparing tablets. Mann-Whitney U test was used for comparing the time spent on providing tablets. Significance level is 0.0167.

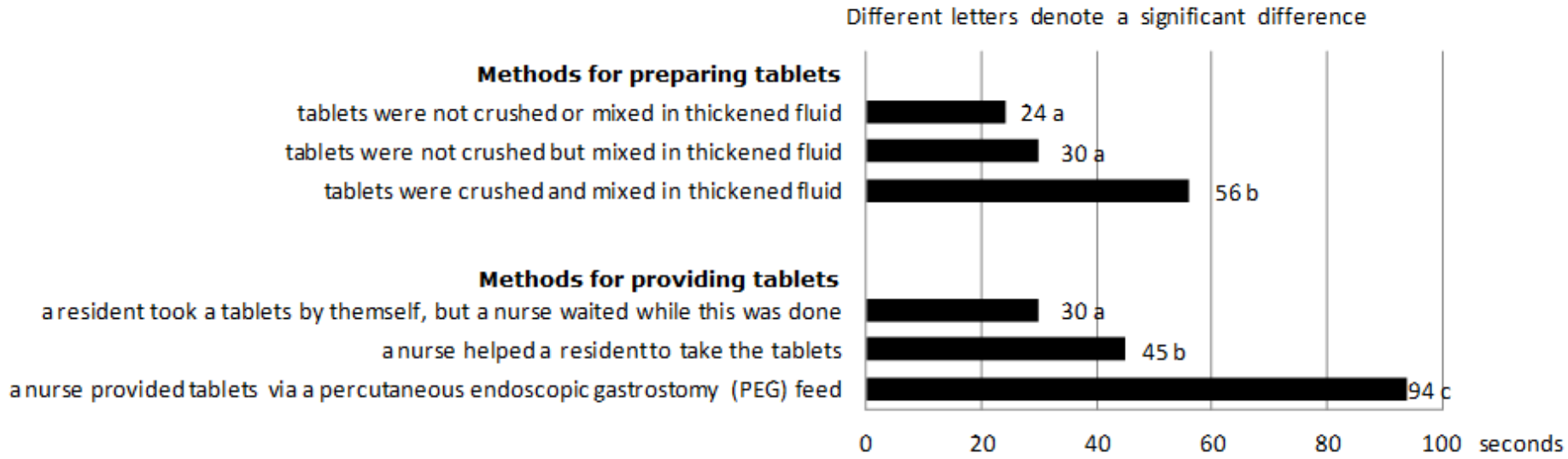

Figure 2. Nursing time spent on preparing or providing tablets for a resident when different methods were used.

One-way ANOVA test was used for comparing the time spent on differing methods for preparing tablets. Mann-Whitney U test was used for comparing the time spent on differing methods for providing tablets. Significance level is 0.0167.