

Nursing Home Medication Administration Cost Minimization Analysis

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Objectives: To assess the time it takes nurses to administer medications in the nursing home setting, to calculate nursing cost of medication administration, and to determine whether using extended-release products are justified by decreasing nursing costs.

Design: Cost-minimization analysis using observational data from a time-motion analysis.

Setting: Two 150-bed nursing homes in rural eastern North Carolina.

Participants: Nurses working during first and second shifts.

Measurements: Nurses were timed as they each administered medications to 12 patients. The mean time required to administer each dosage form was calculated. The cost of nursing time was based on the average nursing staff salary of \$20.45 per hour as reported by the directors of nursing. Time and cost to dispense one more medication during an existing medication pass and an additional medication pass are calculated.

Results: The time to administer an additional dose of an oral medication to one patient was 45.01 seconds during an already scheduled medication pass and 63.05 seconds during a new medication pass. The cost of adding an oral medication once a day for a patient will cost \$7.67 per month if administered at the same time as other medications or \$10.74 per month if a new medication pass is required. The administration of other dosage forms, such as crushed, percutaneous enteroscopic gastrostomy, injection, and patch was more time involved and, thus, costlier. Formulas are provided to calculate medication administration cost based on local salary.

Conclusions: Nursing time and costs for medication administration in the nursing home are great and should be considered when selecting a product. This may justify the selection of higher cost extended-release products. (*J Am Med Dir Assoc* 2007; 8: 173–177)

Keywords: Nursing home; medication administration; cost

Our population is aging¹; with increased longevity comes an increased number of residents in long-term care facilities² with more comorbidities and medications. Nursing home residents received on average 7.6 medications each month.³ Nursing salary is a significant factor in the cost of long-term care. While we know of no study that has quantified how much time is spent administering medications to residents, 1 unpublished study cited by Liebel and Watson⁴ showed that

reducing each resident's daily dose from 4.7 to 3.4 saved 8.5 minutes of nurse time per resident per day.

Although drug costs are often considered when choosing a medication or dosage form, administration time for nursing staff is usually not considered. Some studies have quantified the time and cost of nursing home medication administration but have only included oral medications⁵ or specific subgroups of residents⁶ or medications.^{7–9}

Medication administration or "medication pass" in nursing homes is a complex task, requiring many steps. The nurse pushes the cart to the resident's room, finds the resident in the medication administration record (MAR), and pulls the medicines listed. In the preparation of oral medications, the nurse places the medication in a cup and, if necessary, crushes it. For injected medications, the nurse must draw up a measured amount in a syringe. Once all the medicines are prepared and ready to be administered, the nurse takes the medications to

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the resident, checks the identity of the resident, and watches the resident take the medicine. Different dosage forms require specific preparation, which requires time. For example, percutaneous enteroscopic gastrostomy (PEG) tubes have to be flushed before and after medication administration. For injections, the skin has to be prepared with alcohol. After administration, the nurse documents the medications that were administered in the MAR.

Medication administration is one of many nursing duties. During a medication pass, a nurse may answer telephone calls; feed the resident; turn the resident; answer call bells; and talk to the resident, family, and other health care personnel. Reducing medication administration time may decrease staffing needs or allow for more time for other tasks, possibly improving care.

Limited data are available quantifying medication administration cost in nursing homes. Newer medications are often dosed less frequently but at a higher cost than generic equivalents. The objectives of this study were to assess the time it takes nurses to administer medications in the nursing home setting, to calculate nursing cost of medication administration, and to determine if using costlier extended-release products is justified, by decreasing nursing costs to long-term care facilities and ultimately to society.

METHODS

This is a cost minimization analysis using observational data from a time-motion analysis of nurses administering medications. The analysis identifies the cost of administering different dosage forms and regimens of medications, allowing for calculation of product administration costs. The Institutional Review Boards of Campbell University and East Carolina University approved this study.

Sites

In a town of 65,000 within rural eastern North Carolina, 2 nursing homes with 150 beds each were selected from 4 facilities. The selection was one of convenience and provides a representative sample of residents. Permission was obtained from the administrator, the owner, the director of nursing, and the medical director of each nursing home.

Study Sample

An in-service given by one of the authors (C.K.G.) informed the nurses about the study. Each nurse gave permission to be observed in advance. A total of 10 nurses were observed as they administered medications to nursing home residents at these 2 facilities. In each facility, 2 nurses were observed during the 7 AM to 3 PM shift and 3 nurses were observed on the 3 PM to 11 PM shift. The education level and years of experience were recorded for each nurse at the end of the observation so as to not bias the observer.

Task Observation

Nurses were watched by the same pharmacist observer and the observer was supervised by 2 co-investigators during several observations to ensure consistency of time recording. Nurses were timed with a stopwatch as they administered

medications to a maximum of 12 residents. The first 2 residents timed were not included in the analysis to allow time for the nurse to adjust to being watched. Time was recorded on a data sheet from the start of the first resident to the end of the twelfth resident.

Definitions of Times Recorded and Administration Modes

Fixed time (FT) is the time that the nurse takes to move the cart, find the resident in the MAR, walk from the cart to the resident and back, wash hands, lock and unlock the medication cart, and talk to the resident and family as the resident is being given medications. This time is assumed to be the same for each resident as these actions will not depend on the number or type of medications administered.

Variable time not dependent on dosage form (VTN) includes getting the medication out, verifying the medication in the MAR, and documenting medication administration. VTN depends on the number of medications, but not the dosage form.

Variable time dependent on dosage form (VTD) includes preparing the medication and administering the medication. It varies for each dosage form. The time required to administer each dosage form including oral, oral crushed, PEG crushed, liquid, injection, and transdermal patch were recorded. The time required to administer other dosage forms was not noted.

The 2 nursing homes in our study had different medication packaging. Facility A used unit dose packaging, in which each medication is packaged separately in blister cards with each dose in a bubble. Facility B used bingo card packaging, in which the pharmacy combined all medicines for a given medication pass into 1 bubble.

Data Analysis

Quantification of Time

The time it takes to administer an additional medication during an already scheduled medication pass is the sum of the VTN and VTD. When medications need to be administered during a time of the day when the resident does not already receive medications, the time is calculated as the sum of VTN, VTD, and FT. The mean time and standard deviation were calculated separately for each dosage form.

Quantification of Costs

Nurses' salaries were collected from the facility director of nursing or administrator. The salary per hour is reported as the range and median. Labor cost for medication administration was calculated as nursing time multiplied by median salary. Benefits were not taken into consideration as they are very minimal in this region and vary by employer.

A cost minimization analysis was used to determine if administering an extended release product is less expensive. The monthly administration costs can be calculated for each different drug dosage form based on the type and frequency of administration. The monthly drug costs are then added to the monthly administration cost to derive the total cost per month. Differences between administration costs can then be

Table 1. Demographics of Nurses Timed During Medication Administration

Nurse Information	Range	Mean ± SD
Nursing experience, y	2–21	9.6 ± 6.5
Nursing pay/h, \$	15.25–25.64	20.45
Med pass experience, y	2–15	6.30 ± 5.03
No. of residents per med pass	9–12	10.4 ± 1.43
Meds per resident per med pass	1–15	7.27 ± 3.69

calculated, which can help determine how much more could be paid for the more expensive drug with less expensive administration costs to have it rival the administration costs of the cheaper drug.

RESULTS

At each facility the 5 observed nurses administered medications to a total of 51 residents. Of those, we analyzed 41 residents at each facility. Each nurse administered medications to an average of 10.4 ± 1.4 residents per medication pass. Each resident received an average of 7.3 ± 3.7 medications during the observed medication pass. Nursing experience averaged 9.6 years with a range of 2 to 21 years. The average number of years the nurses had administered medications was 6.3 years with a range of 2 to 15 years. The 2 directors of nursing reported a salary range of \$15.25 per hour to \$25.64 per hour for nurses. The median of \$20.45 per hour was used in calculations (Table 1).

The fixed time to administer medications to an additional resident took an average of 29.5 seconds. The time to administer an additional dose of an oral medication to 1 resident was 45.0 seconds during an already scheduled medication pass or 63.1 seconds during a new medication pass; other dosage forms, such as crushed, per PEG, injection, and patches are more time involved (Table 2). Preparing a PEG tube for medication administration took an average of 85.6 seconds. The difference in administrative time between the packaging methods was 8.9 seconds, with single-dose packaging taking longer.

The cost of administering an additional dose once a day to 1 resident was calculated for a month and is shown in Table 3. Adding an oral medication once a day for a resident will cost \$7.67 per month if administered at the same time as other medications or \$10.74 per month if a new medication pass is required.

Table 2. Time to Dispense 1 Medication in Seconds

Type of Med Dispensed	Total No. of Doses Observed	Time to Dispense 1 More Med, s	Time to Dispense 1 Med for 1 New Med Pass, s
Oral	253	45.01 ± 3.21	63.05 ± 4.03
Oral crushed	324	124.04 ± 24.07	185.03 ± 32.54
Oral crushed PEG	102	157.06 ± 24.05	232.43 ± 36.04
Injection	6	63.05 ± 10.76	94.53 ± 15.67
Patch	4	61.05 ± 21.03	80.05 ± 14.06

PEG, percutaneous enteroscopic gastrostomy.

Table 3. Cost Per Month of Adding a Medication Once a Day for 1 Resident

Type of Medication Dispensed	Cost in US \$ of Adding 1 Med/d for 1 mo/pt Based on Local Salary of \$20.45/h	
	Existing Medication Pass	New Medication Pass
Oral	7.67	10.74
Oral crushed	21.14	31.53
PEG	26.77	39.61
Injection	10.74	16.11
Patch	10.40	13.64

PEG, percutaneous enteroscopic gastrostomy; pt, patient.

Using our data, an extended release product administered once a day can be compared to an immediate release drug given 3 times a day for a resident who already gets medications at least 3 times per day. The time saved by the nurse would be 45 minutes per month (45 seconds × 2 administrations per day × 30 days) that can be spent on other responsibilities. The administration costs over 1 month based on the hourly salary of \$20.45 would be \$23.01 (3 × \$7.67) for the immediate release product, compared to \$7.67 for the extended release product. From the perspective of the nursing home, the facility could save \$15.34 (the cost of 2 daily medication passes) per month in nursing time if the resident was switched from immediate release to extended release.

In a different resident who gets 1 medication that is administered orally 3 times daily, while all other medications are once daily, changing the 3 times daily medication to extended release brings greater cost savings because 2 additional medication passes will be dropped. Administration cost of the 3 times a day medication is \$29.15 (\$7.67 for the dose given with the existing med pass and 2 × \$10.74 for the 2 additional medication passes for this medication alone). The savings would be \$21.48 or 63 minutes of nurse time per month. Savings are potentially even greater with more costly administration forms, such as PEG, and going to less frequent administrations, such as weekly pills or patches. To calculate administration costs based on local salaries and to examine other administration forms and dosage frequencies, the reader may replace the numbers as shown in the formula in Figure 1.

In a subset of 72 residents, 39 tasks not related to medication administration were observed during medication admini-

$$\frac{\$23.18}{1 \text{ h}} \times \frac{1 \text{ h}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ s}} \times \frac{45 \text{ s}}{\text{med pass}} \times \frac{30 \text{ med pass}}{1 \text{ mo}} = \frac{\$8.69}{1 \text{ mo}}$$

Fig. 1. Formula deriving medication administration cost for an oral medication given once a day using the national average nursing salary. This can be used to calculate the medication administration cost for local salary information and other administration forms and frequencies by replacing the respective numbers in the numerator. In this example, the hourly salary was replaced with the national average of long-term care nurses of \$23.18.¹⁰ This example uses 45 seconds per medication pass for once daily administration of an oral medication. The 60 seconds and 60 minutes are in the denominator to convert the units of administration time (in seconds) to the salary (in hours). A short version of the equation is as follows: $\$23.18 \times 45 \text{ seconds} \times 30 \text{ days}/3600 = \8.69 .

istration. The most common distraction ($n = 21$) was talking to others, including nurses, residents, or family members. The average time spent on conversations was 66.8 seconds each. Other distractions included getting supplies or juice ($n = 8$), repositioning or transferring the resident ($n = 5$), emptying trash ($n = 3$), and helping the resident with activities of daily living (ADLs) ($n = 2$). In facility A this time of interruptions amounted to 9.2% of the total medication pass time and in facility B this amounted to 3.3%.

DISCUSSION

This is the first study that takes into consideration the cost of administering different dosage forms and the cost when additional medication passes are added for a resident. The reader can calculate the medication pass cost using our data results in conjunction with local nurses' salaries with benefits (Figure 1).

Compared to a previous study,⁵ the time to administer a crushed medication was longer (80.3 versus 124.0 seconds in our study) but the time to administer an oral medication was similar (45.2 versus 45.0 seconds). Another study, by Zlotnick and colleagues,⁷ found an average oral medication administration time of 2.31 minutes. This study included minor interruptions, such as turning the resident, but did not include larger ones, such as phone calls. Our study separated tasks that were not part of medication administration even though they are essential nursing duties.

A previous study found that the nursing time differed in administration of medications from a bingo card (69.86 seconds) and unit dose packaging (93.27 seconds).¹¹ The difference in administration time was small enough to shift the benefit of higher pharmacy cost of bingo cards in regions with high salaries to the lower cost of unit dose packaging in regions with lower salaries. The 2 nursing homes in our study had different medication packaging. Our study did not assess the difference in administration time between the 2 packaging methods. Data from both facilities were averaged to estimate the time required to administer medications in the nursing home setting.

It is important to note that for this cost minimization analysis, drugs can only be compared if they have equal

efficacy and safety.¹² An example would be the same drug given in different dosage forms if there is no difference in efficacy or safety of one dosage form over another. Different drugs can be compared if studies have shown no statistically significant difference between them.

Our study had several limitations. Only a small number of nurses were observed and each nurse was only observed on 1 occasion. While the study attempted to minimize the Hawthorne effect, the observer may have altered the nurse's usual method and speed of medication administration. We tried to adjust for that by eliminating the first 2 observed medications in the analysis, so the nurse could become used to being observed. The observer was not close enough to the nurse to observe medication errors; therefore, errors are not reported. The study only included oral medication, oral medications that were crushed, medication given by PEG tube, injections, and patches. Other dosage forms, such as suppositories and inhalers, were not observed. Only a small number of injections and patches were observed being administered. A study with more observations of injections and patches as well as observations of suppositories and inhalers is needed to determine overall medication administration costs more thoroughly.

CONCLUSION

The cost of medication administration is important to consider in nursing home residents since it requires nursing time and salary. Frequency of dosing should be considered when choosing between otherwise equivalent medications or dosage forms. If extended release products are equally or only slightly more expensive than the immediate release products, then choosing the extended release product would be less costly by saving medication administration costs. The cost differential is dependent on nursing salary, how many medication passes can be saved, and if the resident already receives other medications at a given medication pass.

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