Common Errors in Using Analgesics by Home-Based Nonprofessional Hospice Caregivers

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Effective management of pain in hospice is hindered when home (nonprofessional) caregivers do not adhere to prescribed analgesics. The purposes of this study, conducted in home settings, were (1) to identify the quality of the patient's prescribed analgesic medication regimen, (2) to identify the types of as-needed (PRN) analgesic medication errors made by nonprofessional caregivers and the relationship between type of error and patient pain, and (3) to examine the relationships between caregiver adherence to PRN analgesic medication regimens and the patient's reported pain. A 3-day longitudinal design was used. Patient/nonprofessional caregiver dyads (n = 46) were recruited from one home hospice agency. The worst pain experienced on average over 3 days was 6.8 on an 11-point scale, although most patients (87.0%) received adequate analgesics for their pain. At the time the pain was reported, there were analgesic medication errors 49.1% of the time. Giving a sedative rather than the prescribed analgesic and nonadherence to the prescribed PRN analgesic regimens were both related to higher patient pain. To improve pain management outcomes, health care providers need to identify the types of errors made by nonprofessional caregivers and provide them with the tools to help reduce errors.

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O ver the past decade, deaths in the United States have shifted from hospital to home. The proportion of people dying in acute care hospitals has dropped 33%, and the utilization of hospice care has increased 95% from 2000 to 2009.[1] As utilization of hospice care has increased, nonprofessional caregivers (family, friends, and hired nonprofessionals) have taken a more active role in managing patient pain, including the administration of analgesics.[2]

These nonprofessional caregivers can find managing medications at home challenging because they lack medical training and skills in managing complex regimens with multiple pharmacological agents.[3,4]

Hospice nurses have identified the failure of these nonprofessional caregivers to implement or maintain recommended regimens as the most common barrier to effective pain management in the home.[5,6] This failure to maintain recommended regimens can lead to medication errors. According to the Institute of Medicine report, medication error is defined as any error that occurs during the use of medications such as failure to give a medication and wrong dosage administered.[7] The Institute of Medicine estimates that in the United States there are at least 400 000 preventable adverse drug events per year.[8] Poor adherence to analgesic regimens among caregivers and hospice patients has been associated with higher pain intensity,[9] and among cancer patients, it has been associated with depression and poor quality of life.[10] The physical consequences of errors made by caregivers in a home setting have been reported in the pediatric population. Walsh and colleagues[11] found that medication errors by parent caregivers of children with cancer incurred prolonged pain, agitation, and suffering. By observing 39 patients on 92 occasions, they identified and classified six common medication errors made by the parent caregivers.[11] However, no published study has created a similar taxonomy of as-needed (PRN) analgesic medication errors in the home hospice setting.

Once the underlying types of medication errors are identified, it is possible to define medication nonadherence. In this study, adherence is defined as an absence of any errors in PRN analgesic medication. Once errors have been identified and adherence estimated, clinicians can provide targeted interventions, including appropriate skill and education; and aids can be developed to assist nonprofessional caregivers in administering analgesics at home.

The purposes of this study were (1) to identify the patient's analgesic medication regimen and the quality of the regimen, which was determined using the Pain Management Index (PMI); (2) to identify the types of PRN analgesic medication errors made by nonprofessional caregivers and the relationship between type of error and patient pain; and (3) to examine the relationships between caregiver adherence to PRN analgesic medication regimens and the patient's reported pain.

METHODS

Study Design
This was a 3-day longitudinal study of a convenience sample of home hospice patients and their nonprofessional caregivers.

Sample and Settings
Participants in the study were patients and their nonprofessional caregivers who received services from one not-for-profit hospice program located in the metropolitan Chicago area. Inclusion criteria for patients were as follows: (a) received services from the hospice program, (b) received prescribed analgesics for pain, (c) were able to speak and understand English, (d) were 18 years or older, and (e) had a nonprofessional caregiver. Inclusion criteria for nonprofessional caregivers were as follows: (a) able to understand and respond in English, (b) identified by the patient as a primary caregiver, and (c) 18 years or older. The nonprofessional caregivers included unpaid family members, friends, and hired nonprofessional caregivers.

The nurse case managers at the hospice identified patients who received PRN analgesic medications for their pain from a nonprofessional hospice caregiver. During a routine visit, the patient and nonprofessional caregiver received a study flyer from the nurse case manager. The patient and caregiver consented orally to the nurse case manager that the investigator called them. The nurse investigator contacted the patient-caregiver dyad by phone and further explained the study. Of the 62 dyads contacted by the investigator, one declined after the study was explained. Another declined because one of the family members opposed. One could not participate because of a rapidly deteriorating condition. Consequently, a total of 59 patient-caregiver dyads provided written consent to participate in the study and were scheduled for a home visit. Of the

59 patients, 46 had prescriptions for PRN administration of pain medications and were included in this analysis.

Measures

Demographics
Demographic information for patients and nonprofessional caregivers included age, gender, ethnicity, and education level. For the patient, it included the diagnosis. For the caregiver, it also included the caregiver's relationship to the patient and employment status.

Patient Pain and Medication Diary
The nonprofessional caregivers were given a pain/medication diary for recording pain the patient experienced and analgesic medications the patient took over 3 consecutive days. Each time the patient reported pain, the caregiver was instructed to ask the patient to rate his/her pain intensity on a scale from 0 (no pain at all) to 10 (pain as bad as one can imagine). Then the caregiver was asked to record the pain intensity, drug name, dosage, time of administration, and date of administration of each analgesic medication in the diary. Caregivers also were asked to record if no medication was given. In addition, at the end of each day (for 3 days), the nonprofessional caregiver was instructed to ask the patient to recall the worst pain he/she experienced in the past 24 hours and to rate its intensity on the same 0-to 10-point pain scale. These data were recorded in the pain and medication diary. These pain assessment questions were adapted from the Brief Pain Inventory, which is one of the most commonly used pain assessment tools in clinical research.[12,13] The overall diary format was adapted from the *Daily Pain Management Diary* developed by Miaskowski and her colleagues.[14] The diary format has been successfully used in populations of patients with advanced cancer. For example, a total of 98% of the patients with advanced cancer in a cancer outpatient setting completed the diary for 6 weeks with the help of a research assistant.[14] Furthermore, 92% of 144 individuals with knee osteoarthritis and their spouses completed at least 1 day of a 22-day pain diary in the home.[15]

Quality of Analgesic Prescription
Data from the hospice record and pain and medication diary were used to calculate the quality or appropriateness of prescriptions for analgesic medication, using the PMI.[16] The PMI assesses the adequacy of prescribed analgesics by comparing the most potent analgesic used by a patient to the levels of pain intensity experienced by the patient. First, analgesic medications were collected from the patient's hospice records. The prescribed medications were categorized using the World Health Organization definitions and were scored as 1 = nonopioids (eg, over-the-counter aspirin, Tylenol), 2 = mild opioid (eg, codeine), and 3 = strong opioids (eg, morphine).[17]

When two analgesic medications were prescribed, the stronger medication was scored. Next, the maximum 24-hour "worst pain" score over the 3 daily reports in the pain and medication diary was recoded into three intensity levels: no pain remained 0; a pain score of 1 to 4 was recoded to 1, a pain score of 5 to 6 was recoded to 2, and a pain score of 7 to 10 was recoded to 3. Then the pain level (0-3) was subtracted from the most potent level of analgesic drugs prescribed (1-3).[18]

The resulting PMI scores ranged from negative −2 to +3. A negative score indicated an inadequate or unacceptable prescription for analgesic drugs; a score of 0 or higher was considered acceptable. The PMI was then dichotomized to represent two levels of quality of analgesic medication prescription: 1 = inadequate pain management (−2 to −1) and 2 = adequate pain management (0-3). Validity of the measure was demonstrated by a predicted relationship between negative PMI scores and high pain interference with daily life[16] and poor quality of life.[18]

Analgesic Medication Errors

Each pain entry and corresponding medication entry in the diary was assessed based on the analgesic medication regimen prescribed by the patient's health care provider. Medication errors were defined as any type of deviation made by caregivers when they administered analgesics. The errors included giving the wrong medication and/or giving the wrong dose. One researcher identified the errors and coded them into the different error types until no new types were discovered. Using these codes, a second researcher then coded the data a second time. The two researchers came together, discrepancies were discussed, and consensus on the final error codes was thus reached.

Analgesic Medication Adherence

To obtain the percentage of adherence to the PRN analgesic medication regimen, the researcher summed the number of times a caregiver had no medication errors over all 3 days and divided by the total number of times pain. For example, if a patient reported pain 3 times and received analgesic medication only once, we considered that the caregivers adhered 1 of 3 times. Adherence was then calculated as 1 divided by 3, which is 33.3%.

Data Collection Procedures

The study was approved by the University of Illinois at Chicago Institutional Review Board. Data collection consisted of two visits to the patient's home, 3 days apart, and a review of the patient's hospice record to identify the prescribed analgesic medication regimen. Data were collected by a certified hospice and palliative nurse with a master's degree in nursing who was not involved in the care of these patients. At the first home visit, the nurse further explained the study to the patient and nonprofessional

caregiver and obtained written consent from both. The nurse administered the study questionnaires to the caregivers and instructed them to record all analgesics administered to the patient in the pain diary for the 3 days following the visit. The nurse returned to the homes 3 days later and collected the diaries.

Statistical Analysis

Descriptive statistics were determined for all study variables, including frequencies, means, and SDs. The χ^2 and t tests were done to determine the demographic differences in caregiver characteristics. Pearson correlation coefficients were completed to determine if there was an association between percent adherence to the PRN analgesic regimen and mean worst pain score (mean over 3 days). A multilevel linear analysis was conducted, using a mixed procedure from SPSS Statistics for Windows, version 19.0 (IBM Corp, Armonk, New York), to evaluate the association between pain score and type of identified medication error. The use of multilevel modeling corrects for the fact that pain scores are generated by each patient and thus are specific to that patient. As a consequence, these models "nest" the pain scores to examine scores within a particular patient. This is referred to as a "level 1" effect. A multilevel model also examines overall differences between the patients. This is referred to as a "level 2" effect. One great advantage of using these models is that they can estimate levels 1 and 2 at the same time.

RESULTS

Sample Description

Of the 46 dyads, all nonprofessional caregivers completed day 1 of the diary, 42 completed day 2, and 41 completed day 3. The mean caregiver age was 56.2 years, and half were white (Table 1). The majority (82.6%) of the caregivers were women, had less than a college education, and were family or friends of the patient. Of the family caregivers, 40% were employed full time or part time in an outside position. The only significant difference between the family/friend versus hired caregivers was in education. Hired caregivers had higher educational levels than did family caregivers (χ^2_1 = 3.97, P = .046). The mean patient age was 74.6 years. Most patients were female and white and had a cancer diagnosis (63.0%).

Prescribed Analgesic Medication Regimen and Quality of Analgesic Medication Regimen

The most common analgesic medication prescription was a strong opioid (78.2%; Table 2). Of these prescriptions, most patients were prescribed a single strong opioid. The average of the worst pain intensity experienced over 3 days was 6.8 (SD, 1.9), representing moderate to severe pain. The maximum pain intensity level experienced in 3 days for 76.1% of the patients was in the severe range (pain score 7-10).

TABLE 1 Demographic Characteristics of Caregivers and Patients

		Nonprofessional Caregiver Type		
	Caregiver Total (n = 46)	Family or Friend (n = 35)	Hired (n = 11)	Patient (n = 46)
Age, mean (SD), y	56.2 (15.1) [24, 84]	55.7 (15.8)	57.8 (13.1)	74.6 (15.8) (range, 38-95)
Gender, n (%)				
Female	38 (82.6)	28 (80.0)	10 (90.9)	29 (63.0)
Male	8 (17.4)	7 (20.0)	1 (9.1)	17 (37.0)
Ethnicity,[a] n (%)				
White	22 (47.8)	20 (57.1)	2 (18.2)	32 (69.6)
African American	12 (26.1)	11 (31.4)	1 (9.1)	9 (19.6)
Asian	9 (19.6)	2 (5.7)	7 (63.6)	2 (4.3)
Other	3 (6.5)	2 (5.7)	1 (9.1)	3 (6.5)
Education,[b] n (%)				
Some college or less	32 (69.6)	27 (77.1)	5 (45.5)	42 (91.3)
College degree or more	14 (30.4)	8 (22.9)	6 (54.5)	4 (8.7)

[a]Hired caregivers were much more likely to be Asian.
[b]Hired caregivers were more likely to have attended some college ($c2 = 3.97$, $df = 1$, $p = .046$).

The majority of patients (87.0%) had positive PMI scores, which indicated that they were prescribed adequate analgesics for their pain. Despite being prescribed adequate analgesics, patients experienced severe pain.

Types of Analgesic Medication Error and Pain
In the 3-day study period, 46 patients reported pain to their nonprofessional caregivers for a total 422 times, which ranged from 1 to 24 times per patient (mean, 9.17 [SD, 6.09]). Medication errors by the nonprofessional caregivers, at the time of the pain reporting, were made 49.1% of the time (Table 3). There were a total of seven types of PRN analgesic medication errors. The prevalence of errors was highest for "giving no analgesic" and "giving too low a dose of a prescribed analgesic." The least common error was "giving a discontinued prescribed strong opioid instead of the prescribed analgesic."

Multilevel analysis was used to evaluate the difference in pain by the seven different medication errors (Table 3). Overall, PRN analgesic medication errors were related to higher levels of a patient's reported pain ($F_{7,68.6} = 2.18$, $P = .046$). Based on post hoc contrasts, pain scores were significantly higher for 1 of the 7 types of errors, "gave sedatives instead of prescribed analgesics" ($t_{78.4} = 2.31$, $P = .024$).

Adherence to Analgesic Regimen and Pain
Next, we examined the percentage of times the nonprofessional caregivers were adherent to the PRN analgesic medication regimen (Table 4). Approximately a third (37%) of the caregivers were always adherent, whereas 21.7% of the caregivers were never adherent. Caregiver adherence to the medication regimen correlated significantly with mean worst pain score: 0.37 ($P \leq .001$). When caregivers did not adhere to the prescribed analgesics medication regimen, patients were more likely to experience higher pain intensity. There was no significant relationship between the number of patient pain incidences reported and percent adherence to prescribed medications.

DISCUSSION
In this study, we identified common errors nonprofessional hospice caregivers made in administering PRN analgesic medications and determined the effect of caregiver errors on patient pain. Identification of the errors made by nonprofessional hospice caregivers in the home is essential to reducing barriers to effective pain management. Pain management in hospice, however, continues to be challenging. Pain experienced by the study participants was even higher than the pain intensity reported in another study of 65 patients newly admitted to community-based hospice services (6.8 vs 3.94, respectively).[9] However, pain was comparable to that among 76 oncology patients recruited from a university medical oncology clinic (7.0).[19] It is possible that patients newly admitted to hospice may be showing the benefit of initial pain assessment and aggressive pain intervention.

TABLE 2 Prescribed Analgesic Medication Regimen, Pain Intensity, and Quality of Analgesic Medication Regimen (n = 46)			
	Total (n = 46), n (%)	Family (n = 35), n (%)	Hired (n = 11), n (%)
Types of prescribed analgesics			
Nonopioid	1 (2.2)	0 (0)	1 (9.1)
Mild opioid			
One middle opioid	6 (13.0)	4 (11.4)	2 (18.2)
Nonopioid and mild opioid	3 (6.5)	3 (8.6)	0 (0.0)
Strong opioid			
One strong opioid	29 (63.0)	23 (65.7)	6 (54.5)
Nonopioid and strong opioid	4 (8.7)	3 (8.6)	1 (9.1)
Mild opioid and strong opioid	2 (4.3)	1 (2.9)	1 (9.1)
Two strong opioids	1 (2.2)	1 (2.9)	0 (0.0)
Daily maximum pain intensity level (3-d average)			
1 (Score 1-3)	2 (4.3)	2 (5.7)	0 (0.0)
2 (Score 5-6)	9 (19.6)	7 (20.0)	2 (18.2)
3 (Score 7-10)	35 (76.1)	26 (74.3)	9 (81.8)
Adequacy of prescribed PRN analgesic regimen	40 (87.0)	33 (94.3)	7 (63.6)

Abbreviation: PRN, as the circumstances occur.
There was no significant difference in prescribed analgesics and pain intensity and frequency between family and hired caregivers.

The types of error made by nonprofessional caregivers in administering PRN analgesics provide some insight into why patients experience poor pain relief. This study revealed that medication errors are common among nonprofessional hospice caregivers who care for patients at home. At home, nonprofessional caregivers bear the heavy burden of managing pain, often at a time when they are experiencing fatigue and emotional distress.[20]

Analysis of the diaries suggests that even though hospice nonprofessional caregivers are diligent in addressing patient pain (frequent recording of the intensity in pain diary), approximately half of the incidences (49.1%) of administering analgesics resulted in errors. Most notably, close to a quarter (21.3%) of the time the nonprofessional caregivers gave no medication when the patient reported pain. Understanding this failure to medicate is vital so that interventions can be designed to help reduce the prevalence of pain. It is important to note that there were also a number of errors in administering medications. We found that use of sedatives instead of analgesics was not only common (12.1% of identified errors), but it also resulted in higher patient pain (8.4 vs 6.8 overall). Because many opioids have similar sedative effects, it is possible that nonprofessional caregivers believe that being sedated is to be pain-free. To address this issue, health care providers need to emphasize that sedatives are rarely useful in treating pain, and most importantly, they can interfere with effective pain management by masking pain symptoms.[21]

Another common error and patient safety concern is nonprofessional caregivers' use of weaker analgesics. Many hospice caregivers are afraid of the harmful effects of opioids[4] and may prefer to use less potent analgesics. However, many of these weaker analgesics contain acetaminophen and can have severe adverse effects when overused.[22] For example, in a study of 500 adults seeking primary care, 23.8% demonstrated that they would overdose on one or more over-the-counter acetaminophen products.[23] Caregivers, unaware of risks associated with over-the-counter drugs, might overuse them, thinking they are safer than opioids.

The limitations of this study include potential selection bias and caregiver self-report of analgesic use. Selection bias may have occurred because the nurse case managers at the hospice selected potential subjects for this study. They were instructed to avoid bias and refer subjects based on the provided inclusion and exclusion criteria. However, the severe

TABLE 3	Prevalence of Specific Analgesic Medication Errors and Mean Patient-Rated Pain by Type of Medication Error Over 3 Days (n = 422)			
		Error Frequency		Patient-Rated Pain
	n	%	Mean	SE
Type of medication error				
Gave no analgesic	90	21.3	5.45	0.57
Gave too low a dose of prescribed analgesic	36	8.5	7.35	0.70
Gave an over-the-counter nonopioid medication instead of a prescribed analgesic	26	6.2	5.54	0.86
Gave a sedative instead of the prescribed analgesic	25	5.9	8.43[a]	0.81
Gave too high a dose of prescribed analgesic	14	3.3	4.04	2.06
Gave a discontinued, prescribed mild opioid analgesic instead of the prescribed analgesic	12	2.8	8.00	2.07
Gave a discontinued, prescribed strong opioid instead of the prescribed analgesic	4	0.9	3.75	2.16
No medication errors (reference category)	215	50.9	6.39	0.36

[a]Estimated marginal means from multilevel model, P < .05.

worst pain intensity reported by this study population suggests that they may have selected patients who were actively in pain rather than patients whose pain was controlled with prescribed regimens. It is also true that patients with the most severe pain may not have been able to participate in the study. Use of caregiver self-reporting may have impacted the study findings because caregivers sought social desirability. Caregivers might have been afraid to fully disclose their analgesic management details, especially if they were intentionally deviating from the regimen.

Another limitation is that we could not determine whether the deviations from prescribed regimen were intentional or not. For example, if the caregivers intentionally withheld analgesics from a patient, it may not be appropriate to call the behavior an "error." In such cases, health care providers may need to address the reasons caregivers are motivated to deviate, and this approach would be totally different from the approach used for a caregiver who used the wrong medication because he/she misunderstood the instructions. A better definition of the term "medication error" may help differentiate the intentions behind the caregiver behaviors.

To prevent and reduce errors in administering analgesics, it is important to establish and maintain trusting partnerships between caregivers and hospice teams. A first step toward

TABLE 4	Caregiver Percentage of Adherence to Analgesic Medication Regimen (Correctly Administered Medication [No Medication Error] Divided by Total Times Pain Reported) Over 3 Days (n = 46)		
Percentage Adherence	Total (n = 46)	Family/Friend (n = 35)	Hired (n = 11)
100	17 (37.0)	13 (37.1)	4 (36.4)
80-99	1 (2.2)	1 (2.9)	0 (0.0)
60-79	3 (6.5)	2 (5.7)	1 (9.1)
40-59	3 (6.5)	3 (8.6)	0 (0.0)
20-39	11 (23.9)	7 (20.0)	4 (36.4)
1-19	1 (2.2)	1 (2.9)	0 (0.0)
0	10 (21.7)	8 (22.9)	2 (18.2)

partnership is addressing caregiver barriers by listening to their concerns. Another critical step is promoting caregiver support through caregiver education. Assessment of caregiver health literacy and repeated training is especially important to support nonprofessional hospice caregivers. It is also important to create a system for sharing the information regarding patient pain and PRN analgesic administration. The use of the analgesic diary was an easy and simple way to capture the nature of analgesic management by hospice caregivers. Not only did the diary provide adherence data, but it also identified the different types of errors caregivers made when administering analgesics. This information should help in tailoring caregiver education to reduce medication errors in hospice.

Finally, continuous efforts should be made by health care providers to reduce caregiver burden associated with analgesic administration. Conscious effort should be made to simplify analgesic regimens for nonprofessional caregivers. A Web-based digital device to report patient pain is available for home hospice use[24] and may provide additional support for nonprofessional caregivers to safely deliver PRN analgesics.

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