

Can a Pain Management and Palliative Care Curriculum Improve the Opioid Prescribing Practices of Medical Residents?

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BACKGROUND: Although opioids are central to acute pain management, numerous studies have shown that many physicians prescribe them incorrectly, resulting in inadequate pain management and side effects. We assessed whether a case-based palliative medicine curriculum could improve medical house staff opioid prescribing practices.

DESIGN: Prospective chart review of consecutive pharmacy and billing records of patients who received an opioid during hospitalization before and after the implementation of a curricular intervention, consisting of 10 one-hour case-based modules, including 2 pain management seminars.

MEASUREMENTS: Consecutive pharmacy and billing records of patients who were cared for by medical residents ($n = 733$) and a comparison group of neurology and rehabilitative medicine patients ($n = 273$) that received an opioid during hospitalization in 8-month periods before (1/1/97 to 4/30/97) and after (1/1/99 to 4/30/99) the implementation of the curriculum on the medical service were reviewed. Three outcomes were measured: 1) percent of opioid orders for meperidine; 2) percent of opioid orders with concomitant bowel regimen; and 3) percent of opioid orders using adjuvant nonsteroidal anti-inflammatory drugs (NSAIDs).

MAIN RESULTS: The percentage of patients receiving meperidine decreased in the study group, but not in the comparison group. The percentages receiving NSAIDs and bowel medications increased in both groups. In multivariate logistic models controlling for age and race, the odds of an experimental group patient receiving meperidine in the post-period decreased to 0.55 (95% confidence interval [95% CI], 0.32 to 0.96), while the odds of receiving a bowel medication or NSAID increased to 1.48 (95% CI, 1.07 to 2.03) and 1.53 (95% CI, 1.01 to 2.32), respectively. In the comparison group models, the odds of receiving a NSAID in the post-period increased significantly to 2.27 (95% CI, 1.10 to 4.67), but the odds of receiving a bowel medication (0.45; 95% CI, 0.74 to 2.00) or meperidine (0.85; 95% CI, 0.51 to 2.30) were not significantly different from baseline.

CONCLUSIONS: This palliative care curriculum was associated with a sustained (>6 months) improvement in medical residents' opioid prescribing practices. Further research is needed to understand the changes that occurred and how they can be translated into improved patient outcomes.

KEY WORDS: pain management; palliative care; curriculum; medical education; medical residency.

J GEN INTERN MED 2002;17:625-631.

Despite new clinical practice guidelines, cancer patients experiencing pain are often undermedicated or untreated.¹ Opioids are critical to the effective management of severe acute pain and, in some cases, chronic pain.²⁻⁵ Physicians are often reluctant to utilize opioids when they are needed.^{1,6-8} They may also exhibit poor opioid prescribing practices,^{2,3} such as inadequate dosing, failure to use nonsteroidal anti-inflammatory drugs (NSAIDs) for additive effect, and failure to anticipate and treat potential side effects of opioids.^{1-3,6,9} Among the reasons cited for poor pain management practices are outdated attitudes, a lack of knowledge about opioid pharmacology, and concerns about addiction.^{4,10-13}

These problems may, in part, stem from deficiencies in medical education and training.¹⁴⁻¹⁸ Recent studies have documented deficiencies in U.S. medical schools' education about pain management in both the clinical and preclinical years.^{14,18} These data, along with greater public and professional awareness and mandates from organizations such as the American Council of Graduate Medical Education and the American Association of Medical Colleges, have led residency programs and medical schools to either initiate or improve teaching about pain management education.^{18,19}

The current literature does not yet offer a systematic way to measure whether interventions are effective at improving physician practices and/or patient outcomes in pain management.^{3,14} Studies have shown that pain management education programs can change self-perceptions of knowledge, skill, and comfort/confidence, as well as objective knowledge, including knowledge about the appropriate use of opioids.^{18,20-22} However, measuring changes in the physician's self-perceived or objective knowledge may not accurately indicate whether the educational intervention has altered his or her behavior.^{23,24}

No studies to date have shown that a pain management or palliative care curriculum can produce sustained improvements in physician practices or patient outcomes.^{23,24} However, expecting patient outcomes to improve immediately after a basic-level learner receives a relatively brief intervention is unrealistic.²⁴⁻²⁶ Such a negative study might also give the false impression that an intervention was ineffective, when it actually was effective as a first step toward behavioral change. An

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alternative way of studying the effectiveness of clinical or educational interventions is to design a sustained educational intervention and then to examine the actual behavior of physicians, such as prescribing of pain medications.

This study, conducted at a 650-bed private teaching hospital in New York City, was part of the evaluation of a palliative care curriculum for medical residents. We performed a prospective chart review of patients who received an opioid(s) during hospitalization to determine the impact of the curriculum on medical residents' opioid prescribing practices. The 3 practice measures studied were the use of meperidine, the concomitant use of bowel medication, and the adjuvant use of NSAIDs. These topics were emphasized in the curriculum. Meperidine's toxic metabolite, normeperidine, is associated with seizures, delirium, and dangerous drug interactions.^{4,27} Constipation is an important and treatable opioid side-effect.²⁸⁻³⁰ NSAIDs are recommended because they usually achieve an "additive effect."^{3,4} Decreases in meperidine orders and increases in the use of bowel medications and NSAIDs were therefore considered evidence of improved prescribing practices.

METHODS

Study Design

Curricular Intervention. This study was part of the evaluation of a case-based pain management/palliative care curriculum for medical residents at St. Vincent's Catholic Medical Centers of New York, Manhattan Campus (SVCMC) that was implemented in January 1998. Previous studies conducted at SVCMC indicated a need for a palliative care/pain management curriculum for its internal medicine residents.³¹ Since opioids are a mainstay of moderate-to-severe acute pain management, and a significant percentage of the SVCMC patient population had cancer (~18%) at the time of the study, pain management and the safe and effective use of opioids were made major curricular goals.

Two modules of the curriculum were devoted exclusively to pain management. These modules used a case-based teaching format and emphasized current clinical practice guidelines for opioid use in pain management,³ including pharmacology, optimal delivery route, assessment of treatment response, side effects and their treatment and prevention (including the toxicities of normeperidine), and the appropriate use of adjuvant NSAIDs and bowel medications in conjunction with opioids. These modules underwent outside review by content and curricular design experts to ensure the curriculum's relevance and potential for effectiveness. One hundred percent of house staff attended at least 1 of the pain management seminars during the intervention period, 93% attended both pain management seminars, and 83% completed the entire 10-unit palliative care and pain management curriculum.

Data Collection. Consecutive patient drug administration records (Nursing Drug Disposition Records [NDDRs]) from the experimental group (medical service, $n = 733$) and comparison groups (neurology/rehabilitative medicine service, $n = 273$) were reviewed from periods 6 months before (1/1/97 to 6/30/97) and after (1/1/99 to 6/30/99) the implementation of the curriculum (1/98). NDDRs from all medical, neurology, and rehabilitation medicine floors were included, with the exception of the cardiac and medical intensive care units, because opioids were more likely to be used for indications other than pain management on these units.³² Consecutive patients identified through the NDDR as having an opioid ordered were considered eligible for the study. NDDRs provided data on the following: 1) patient name; 2) name and dosage of opioid ordered; 3) name of physician who ordered the medication; 4) date of opioid order; and 5) hospital unit where the patient was treated. The patient's name, date of opioid order and hospital unit were then cross-referenced with a hospital billing database to collect the following data: 1) medical record number; 2) primary diagnosis (on admission and discharge); 3) secondary diagnoses, including any addiction diagnoses (American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition); 4) bowel medications ordered; 5) name of opioid ordered (to validate the pharmacy record); 6) patient age; 7) patient race; and 8) patient gender. All other identifying information about patients was excluded to ensure confidentiality. Institutional Review Board approval was obtained. Of these patient records, 88% had usable data from the nursing record and 93% had matching billing records that could be used.

Outcome Measures

The 3 practice outcomes measured were: 1) percentage of opioid orders for meperidine^{3,4}; 2) percentage of patients receiving bowel medications (to prevent constipation)^{2-4,33}; and 3) percentage of opioid orders accompanied by adjuvant NSAIDs.^{3,4} Since the hospital policy mandates that all inpatient orders be written by house staff, the outcome measures were felt to be representative of house staff practice throughout the study. The chart review validation process revealed that 97.3% of the opioid orders from the pre and post periods ($n = 50$) were written by house staff, with no difference between the pre and post periods ($P = .29$), or between the experimental and comparison groups ($P = .55$).

On the basis of the interviews with pain management experts used to establish content validity, all patients with a primary or secondary diagnosis of nonmalignant biliary disease were excluded from the study. The experts felt that this was important because, although the evidence is poor, meperidine is believed to prevent contraction of the Sphincter of Oddi³⁴⁻³⁶ and is still often recommended for patients with biliary disease.³⁴⁻³⁶ Therefore, this practice was not expected to change through one educational

intervention. For these reasons, challenging beliefs about the use of meperidine in biliary disease was not part of the curriculum, although the problems associated with meperidine due to its metabolism were discussed extensively, since this was believed to be a more pressing problem.

Although choice of optimal route was identified as a potential measure, pharmacy and billing records were found to not accurately distinguish the different parenteral routes of opioid administration (intravenous, intramuscular, subcutaneous, patch). Therefore, this measure was dropped from the study.

Validation of Measures

The content validity of the measures as representative of relevant clinical practice for an intern was established through a thorough literature review and interviews with 3 external pain management experts and 3 chief medical residents. The literature review generated a list of possible measures that were consistent with clinical practice guidelines.^{3,33} The concordant responses among the 6 interviewees were chosen as the outcome measures. In addition, the measures were noted as "core" content covered in the curriculum by 2 independent content experts who reviewed the curriculum (prior to its introduction in 1998) and by 3 curricular design experts who were consulted for this study.

To validate data obtained from the NDDR and billing records, a group of 50 charts was randomly selected from the pre and post periods to compare NDDR data and billing records with direct review of patient charts. The concordance rate between the direct chart review and the chart review protocol was 89.9%. Fisher's exact test showed no difference in the accuracy of the methodology between the pre and post periods or the experimental and comparison groups ($P = .44$).

Statistical Analysis

In analyzing differences between the study and comparison groups, and between the pre and post periods, the χ^2 statistic was used for dichotomous variables. However, for analyses in which the cell size was too small to support χ^2 analysis, Fisher's exact test was used instead. Continuous variables were analyzed by t testing.

The comparison group functioned to allow us to look for a secular trend, albeit on a different service, but within the same institution over the same time period. However, this was not a randomized study, and the experimental and comparison groups (medicine versus neurology/rehabilitation medicine) were dissimilar in ways that could have affected the outcome variables of interest. We therefore developed separate multivariate logistic regression models (for each of the outcome measures) for the pre-post comparison for each of these 2 groups (medicine versus neurology/rehabilitation) to control for independent variables that could act as confounders in analyzing the

outcomes. Clinical or sociodemographic variables associated with the outcome variable (at $P < .05$) in univariate analyses were included in the multivariate models in order to adjust for nonrandom distribution of these factors. Since age and race were consistently found to be associated with 2 of the outcome measures, these 2 independent variables were forced into both the experimental and comparison group models for all 3 outcome measures.

The sample sizes allowed us to detect a 10% change from baseline rates in the experimental group (80% power, $\alpha = .05$, 2-tailed by Fisher's exact method) and a 20% change in the comparison group (80% power, $\alpha = .05$, 2-tailed). The SPSS statistical software (Version 10; SPSS, Inc., Chicago, Ill) was used for all analyses.

RESULTS

There was a greater percentage of patients with HIV or malignancy in the study group, whereas the comparison group had a greater percentage of patients with an orthopedic diagnosis. Otherwise, the demographic profiles of the comparison and experimental patient groups did not significantly differ (Table 1).

Univariate Analysis

Table 2 contains the pre and post percentage of patients receiving meperidine, bowel, and NSAID medications. The percentage of patients receiving meperidine decreased significantly ($P = .03$) from 10.4% to 6.0% in the study group, but remained stable (11.0% to 11.8%) in the comparison group ($P = .85$). Bowel medication use increased in both groups, but was only significant in the study group (28.5% to 37.0%, $P < .05$). While the percent change in the use of NSAIDs by the comparison group appeared greater than that in the experimental group, when patients with orthopedic diagnoses were excluded from the sample, the percent change in NSAID use was similar.

Table 1. Patient Demographics

	Comparison Group		Study Group	
	Pre (n = 154)	Post (n = 119)	Pre (n = 365)	Post (n = 368)
Mean age, y	57.0	59.5	54.9	57.4
Male, %	53.9	47.9*	58.4	57.6
White, %	59.1	59.7	57.3	57.1
Diagnosis, %				
Malignancy	5.4	7.0	14.5	15.5
Ortho	44.1 [†]	35.2	6.4	10.1
HIV	6.5	4.2	28.5*	16.8*
Other	44.1 [†]	53.5	50.6	57.6

* Significantly different when comparing the study group with the comparison group within the same pre or post period, $P < .05$ (χ^2 statistic).

[†] Significantly different within the same study or comparison group when comparing the pre with the post period, $P < .05$ (Fisher's exact test).

Table 2. Pre and Post Outcome Measure Results

	Comparison Group		Study Group	
	Pre, n (%) (n = 154)	Post, n (%) (n = 119)	Pre, n (%) (n = 365)	Post, n (%) (n = 368)
Receiving meperidine	17 (11.0)	14 (11.8)	38 (10.4)	22 (6.0)*
Receiving bowel meds	67 (43.5)	57 (47.9)	104 (28.5)	136 (37.0)*
Receiving NSAID	14 (9.1)	22 (18.5)*	44 (12.1)	64 (17.4)*

* Pre-post comparison, P < .05 (Fisher's exact test).

Multivariate Analysis

Table 3A contains the logistic regression models for meperidine use for the experimental and comparison groups. The multivariate model showed that the odds of an experimental group patient receiving meperidine in the poststudy period was 0.55 (95% confidence interval [95% CI], 0.32 to 0.96), compared with the prestudy period. However, in the comparison group model, the pre- and poststudy period variable was not significant.

Table 3B contains a similar pair of logistic regression models for the concomitant use of bowel medications. The multivariate model showed that the odds of an experimental group patient receiving a concomitant bowel medication in the poststudy period was 1.48 (95% CI, 1.07 to 2.03) compared with the prestudy period. However, in the comparison group model, the pre- and poststudy period variable was not significant. In both multivariate models, age and race were the other independent variables associated with bowel medication prescriptions, with older and nonwhite patients being more likely to receive these concomitant medications in both groups.

Table 3C contains the logistic regression models for concomitant NSAID use for the experimental and comparison groups. The multivariate model showed that the odds of an experimental group patient receiving a NSAID in the

poststudy period was 1.53 (95% CI, 1.01 to 2.32) compared with the prestudy period. Interestingly, the odds of a patient in the comparison group receiving concomitant NSAID therapy in the poststudy period also increased to 2.27 (95% CI, 1.10 to 4.67) compared with the prestudy period.

DISCUSSION

The main finding of this study is that a case-based pain management/palliative care curriculum for medical residents was associated with a sustained (>6-month) improvement in 3 prescribing practice measures covered in the curriculum. Among comparison group physicians, only NSAID prescribing changed, but among medical residents, all 3 practice measures improved, suggesting that this was not a secular trend. These changes in physician practice do not directly indicate whether the patients experienced improved pain control. However, these practices are considered salutary—decreasing the likelihood of side effects and increasing the likelihood of effective pain management. These results might also constitute an early marker of changes in physician behavior that could eventually translate into improved patient outcomes.

Opioids are the cornerstone of pain relief for patients with moderate to severe acute pain and, in some cases, for those with intractable chronic pain. Many patients who require opioids do not receive them, and if they do, their pain relief is often inadequate, due in part to poor prescribing practices (inadequate dose of opioid, NSAID not used for additive effect, etc.). The literature has shown that physicians are reluctant to use opioids because of concerns about addiction, associations with drug abuse, and perceptions about “restrictive” laws.^{2,3,6,7,11-13} They are also concerned about the safety and potential side effects of these medications, such as changes in mental status, sedation, respiratory depression, and constipation.^{3,4,32}

Table 3. Logistic Regression Models

	Comparison Group			Study Group		
	Pre-Post	Age	Race	Pre-Post	Age	Race
A. Meperidine prescriptions						
Odds ratio	1.08	0.46	0.86	0.55	0.58	0.88
95% CI	0.51 to 2.30	0.19 to 1.10	0.39 to 1.87	0.32 to 0.96	0.31 to 1.10	0.51 to 1.52
P value	.846	.080	.695	.034	.096	.642
B. Bowel medication prescriptions						
Odds ratio	1.21	3.20	1.01	1.48	2.26	1.61
95% CI	0.74 to 2.00	1.90 to 5.39	0.59 to 1.71	1.07 to 2.03	1.90 to 5.39	0.59 to 1.71
P value	.447	<.001	.975	.017	<.001	.006
C. NSAID prescriptions						
Odds ratio	2.27	0.85	1.74	1.53	1.22	1.33
95% CI	1.10 to 4.67	0.41 to 1.79	0.79 to 3.81	1.01 to 2.32	0.79 to 1.88	0.86 to 2.06
P value	.026	.676	.168	.044	.370	.197

Pre- post denotes pre-intervention compared to post-intervention; Age denotes ≥ age 65 compared to <65; Race denotes non-white compared to white; CI, confidence interval.

While not as definitive as a randomized trial, these results suggest that well-planned educational interventions can improve the opioid prescribing patterns of medical house staff. We did not measure whether total opioid orders increased. However, the fact that interns and residents improved their opioid prescribing practices may indicate a willingness to learn about when to use opioids and how to prescribe them safely and effectively. Most importantly, these results may show the potential for young physicians to change their practices when curricula address clinical concerns and side effects.

The ultimate goal of medical education, as well as clinical interventions, is improved patient care. Education can help to produce the improvements in physician knowledge, attitudes, and self-perception (confidence/comfort, and skill) that are necessary prerequisites. Although better knowledge and self-perception make improvements in clinical practice possible, reinforcement of the principles taught in the classroom needs to occur in the clinical setting for this change to be sustained. Therefore, as previous studies have found, good role models for medical students and residents may be critical to the process.^{19,24}

The effectiveness of our curriculum may have been a result of the importance attached to role modeling in its design. The physicians and nurses who taught the curriculum were all identified by the house staff as excellent clinicians, teachers, and role models in interviews and focus groups conducted as part of a needs assessment.³¹

As good practices are reinforced (e.g., by positive feedback from faculty) and combined with continued learning, theory predicts that improved patient outcomes will gradually follow.^{26,37} The methodology described in this study may provide a realistic way to measure the process of change in physician behavior that is a necessary first step toward improved patient outcomes.

In a previous study of the same cohort of physicians that examined the effectiveness of the curriculum on 3 self-perception domains (comfort, ability, and knowledge), improvements occurred in self-perceived comfort and skill, but not knowledge.³⁸ It would therefore appear that a greater sense of ability or comfort in managing pain, but not necessarily in knowledge, preceded (or occurred in conjunction with) improvement in practice. This would correlate with previous studies in the medical and educational psychology literature and raises questions about whether objective measures of knowledge are a reliable indicator of future performance in pain management.^{37,39-41}

The methodology we developed could be used by institutions and researchers who are trying to measure changes in the prescribing practices of a group of health providers (nurses, doctors, etc.).^{8,39} It could therefore provide an inexpensive form of monitoring continuous quality improvement (CQI) or quality assurance (Q/A) efforts. Since the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is now evaluating whether hospitals have addressed pain management, this

methodology could help hospitals monitor their compliance with this mandate.^{42,43}

The results of chart reviews, such as this one, could also be used to give positive feedback to physicians who improve their practices and provide encouragement or further education to those who do not. Feedback about practice patterns and quality of care measures, when combined with education, has been shown to change physician behaviors.^{24,44-46}

This study had several limitations. First, since it was done at 1 institution, and the sample contained large numbers of patients with orthopedic and AIDS diagnoses, the generalizability of these findings may be limited. Second, this was not a randomized trial, and so a secular trend cannot be completely excluded. However, interviews with nursing and pharmacy administrators indicated that there were no educational interventions, policy changes, or formulary changes with respect to opioids, laxatives, or NSAIDs during the study period. Further, the study was conducted prior to the new JCAHO mandates on pain management.

We also used a comparison group of neurology and rehabilitation patients to assess for a secular trend. While the comparison group was smaller than the experimental group, we had 80% power to detect a 20% change from baseline in our comparison group patients and failed to detect any significant secular trend in the use of either meperidine or bowel medications during the study time period. Using a comparison group poses other problems. For example baseline rates of bowel medication orders were higher in the neurological and rehabilitative medicine service patients. While this might produce a "ceiling" effect, making change more difficult, we suspect that it was most likely that these medications were prescribed because the culture and customs of these services made the prescription of laxatives almost automatic for patients with a high likelihood of impaired mobility and concomitant constipation. Other ways of assessing for secular trends, such as the use of historical controls or the use of a comparison group at another institution, also have limitations.^{47,48}

These findings should be replicated at other institutions. This project also raises a number of questions that future studies will hopefully answer, including: 1) the relationships between changes in objective knowledge, self-perceptions, and attitudes, and changes in practice, 2) the specific components of the curriculum (content, role modeling, instructional strategies, etc.) that were most responsible for the improved practice, and 3) how, and whether, improved practice patterns translate into improved patient outcomes. Longitudinal studies of medical students from the first year through residency training are necessary to examine the interrelationships between the amount, timing, and modalities of education and clinical experience, and improved practices.

This study demonstrates that a pain management and palliative care curriculum for medical residents was associated with better opioid prescribing practices. These

improvements were not seen in a concurrent comparison group. This suggests that the curriculum was responsible for these improvements and that this was not just a secular trend. This study also introduces a novel and relatively inexpensive methodology that can be used to evaluate the effectiveness of educational interventions, institutional policy changes, the effects of CQI and Q/A, and new charting regulations. Further research is needed to refine this methodology and to better understand the relevant factors in why and how pain management practices, and ultimately patient outcomes, can be improved.

Support for this research was received from The Altman Foundation. Wayne A. Ury is a Faculty Scholar of the Open Society Institute and the Project on Death in America.

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