Original Article

Are Nurses Prepared to Manage Cancer Pain? A National Survey of Nurses' Knowledge about Pain Control in Taiwan

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Abstract

Nurses play a crucial role in cancer pain control, but little is known about how well-prepared nurses are to manage cancer pain in Taiwan. The purpose of this study was to examine the level of knowledge about pain management among Taiwanese nurses with different background characteristics and to determine the predictor(s) of nurses' pain management knowledge. Nurse subjects were recruited by a cross-sectional nationwide survey with stratified sampling from nine hospitals distributed in the four major geographic regions of Taiwan. The Nurses' Knowledge and Attitudes Survey-Taiwanese version (NKAS-T) and a background information form were used to collect the data. Of 1900 surveys distributed, 1797 valid questionnaires (94.5%) were analyzed. The average correct response rate was 50.5%, with rates ranging from 7–86% for each survey question. Results from stepwise regression showed that nurses with higher mean correct answer scores had BS or higher degrees, had received pain education at professional conferences, had more prior hours of pain education, had longer clinical care experiences, and always worked with cancer patients. Nurses who worked in intensive care units, however, had significantly lower mean correct scores. The results strongly suggest an urgent need to strengthen pain education in Taiwan. The results also provide the direction for developing pain education. J Pain Symptom Manage 2003;26:1016–1025.

Key Words

Pain, knowledge, attitudes, education

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Introduction

Cancer has been the leading cause of death in Taiwan since 1982,[1] with pain recognized

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as one of the most severe problems for these patients. Pain is experienced by 30.9–85% of cancer patients in Taiwan.[2–4] The data strongly suggest that cancer pain has not been well managed in Taiwan and that problems related to ineffective pain control should be examined.

In the United States (U.S.), health care professionals' lack of accurate pain knowledge and inappropriate attitudes toward cancer pain and use of analgesics have been recognized as major barriers to managing pain.[5] In particular, nurses play a critical role in pain management because they deliver direct patient care on a 24-hour basis. Unfortunately, results from studies in the U.S.[6–14] and several other countries[7,15,16] reveal that nurses' lack of knowledge about pain is a common problem in pain management. The problem may influence nurses' sequential inferences and clinical decision-making on pain control. Therefore, it is important to identify how well nurses are prepared to manage cancer pain.

Assessment of nurses' level of pain management knowledge can provide information about the distribution of different aspects of knowledge about pain management and also be used as the basis for developing appropriate pain management education for nurses who work with cancer patients. Although a few studies have explored student nurses' or nurses' beliefs and knowledge about pain in Taiwan,[17–19] these studies focused on particular groups of nurses with relatively small sample sizes. This lack of data and generalizability fails to represent the level of nurses' knowledge about pain management in Taiwan. In addition, cancer patients are widely distributed among different hospital settings. Therefore, nurses in different work settings may have opportunities to care for cancer patients. Insufficient data, however, prevent knowing whether there are knowledge differences among nurses working in different settings. Even if such differences in pain management knowledge exist, do they stem from different demographic characteristics and educational background? Do these factors predict nurses' pain knowledge level?

As part of a larger pain management project in Taiwan, therefore, the present study focused on analyzing nurses' pain knowledge. The specific aims of this study were to 1) identify the level of knowledge about pain management among Taiwanese nurses, 2) examine nurses' pain management knowledge according to their background characteristics (level of nursing education, frequency of caring for cancer patients, work setting, prior pain education, hours of pain education, sources of pain education), and 3) determine predictor(s) of nurses' pain knowledge using the variables found to be significant in Aim 2.

Methods

Sample and Setting

A nationwide survey of Taiwanese nurses' knowledge about pain management was conducted. In order to study a representative sample, nurses were recruited based on two criteria: hospital category level and geographic distribution. In Taiwan, hospitals are categorized by the number of hospital beds; level of advanced treatments, preparation for teaching, training, and research. The majority of cancer patients in Taiwan are treated at medical centers (the top level or most advanced hospitals) and regional-level hospitals. Nurses who work in hospitals at these two levels generally have many more opportunities to care for cancer patients than nurses working at other types of hospitals. We, therefore, targeted hospitals at these two levels. Targeted settings for data collection were medical wards, surgical wards, oncology wards, medical-surgical mixed wards, intensive care units, and emergency rooms.

The sample surveyed included nurses working at hospitals located in northern, central, southern, and eastern Taiwan. To account for differences in hospital distributions among these four major geographic areas, we recruited nurses from four hospitals in Taipei (two medical centers, two regional-level hospitals), two hospitals in central Taiwan (one of each type of hospital), two hospitals in southern Taiwan (one of each type), and one hospital from eastern Taiwan.

Instruments

The instruments used in this study include the Nurses' Knowledge and Attitude Survey (NKAS)[20] and a background information form. The NKAS has been widely used in assessing nurses' knowledge and attitude towards pain, and has been found to be reliable.[16,20] The NKAS consists of 46 pain management-related items. The first section includes 37 items related to pain assessment and management

knowledge; items 38 to 46 relate to nurses' opinions about the adequacy of pain control in their clinical settings. For the purposes of this study, we used only the items in the first section to examine nurses' knowledge about pain. In addition, the NKAS was translated and back-translated between English and Chinese based on principles of instrument translation across different languages.[21] To account for potential cross-country differences in managing cancer pain, five pain experts (two anesthesiologists, one oncologist, two master's-prepared oncology nurses) verified the content validity (including appropriateness of the content and clarity of the wording) of the NKAS Taiwanese version (NKAS-T) for use in Taiwan.

Because some medications are not widely used in most hospitals in Taiwan, however, the assessment of nurses' knowledge about drugs that are mentioned in these items may not reflect their knowledge about pain management. As suggested by four of the five pain experts, therefore, two items of the original NKAS were not included in the current study. These two items were "Research shows that promethazine (Phenergan) is a reliable potentiator of opioids," and "Which of the following drugs are useful for treatment of cancer pain? (ibuprofen, hydromorphone, amitriptyline)." Among the remaining 35 items, Items 36 and 37 were case studies with two sub-items. Therefore, in total, 37 knowledge questions were assessed in the current study. Each correctly scored item was assigned a score of 1. Incorrectly answered items or those not answered were assigned a score of 0. Total scores were summed and ranged from 0 to 37. Correct answer rates were calculated by dividing the total number of correctly answered items by the total number of items (37). Cronbach's alpha for the NKAS-T in previous studies was 0.82[17] and 0.70,[19] and 0.70 in the current study.

We used a background information form to record nurses' age, formal nursing education (professional nursing high school diploma, junior nursing college level, and BS or higher degree in nursing), length of clinical care experience (months), work setting (medical, surgical, oncology, mixed medical-surgical, intensive care or emergency room), prior experience caring for cancer patients (Yes/No), frequency of caring for cancer patients, prior pain management education (Yes/No), total hours of prior pain management education (No classes, <5 hours, 6–10 hours, 11–15 hours, >15 hours), and major source of prior pain management education (See Table 1 for details).

These instruments were delivered as self-administered questionnaires to nurse subjects ($n = 1900$) recruited from the nine hospitals mentioned above. A cover letter introducing the purpose of the study was included. To increase the reliability of answers, the questionnaires were anonymous and confidential. Anonymity was particularly important to ensure that pain knowledge scores would not be used to evaluate nurses in each data-collection setting, and to increase the nurses' willingness to answer the questionnaire.

Procedures

After hospitals and settings were chosen, the evaluation from the Institutional Review Board

Table 1
Nurses' Background ($n = 1797$)

Categories	*n*	%
Work setting		
Medical unit	763	42.5
Surgical unit	599	33.3
Oncology unit	127	7.1
Mixed medical-surgical unit	49	2.7
Intensive care unit	138	7.7
Emergency Room	121	6.7
Prior care of cancer patients		
No	37	2.1
Yes	1760	97.9
Frequency of caring for cancer patients		
No experience	37	2.1
Rare	224	12.5
Little (cared for about 5 cancer patients/month)	558	31.0
Sometimes (one-fourth of patients have cancer)	450	25.0
Frequent (more than half of patients have cancer)	356	19.8
Always	172	9.6
Received pain management training		
No	629	35.1
Yes	1168	64.9
Total hours of prior pain management training		
No prior training	629	35.1
<5 hours	658	36.4
5–10 hours	308	17.2
11–15 hours	96	5.4
>15 hours	106	5.9
Major sources of pain management training		
0 = No prior pain management training	629	35.1
1 = School education	572	31.8
2 = Workshop or conference	442	24.6
3 = Hospital or work setting	154	8.5

(IRB) in each data collection hospital was further processed before data collection. After the approval from the IRB, the principal investigator met with nurse representatives from the different settings at each hospital to explain the questionnaires and procedures of data collection. The self-administered questionnaires were disseminated to each selected setting through its representative. Nurses at these settings were invited to participate in the study. The importance and purposes of this study were stated on the first page of the questionnaire, and further explained by the representative at each setting. All nurses voluntarily and anonymously participated in this study. Nurses were asked to answer the pain knowledge questions without discussion during a meeting called specifically to fill out the surveys. Nurses who were off duty on the day of the surveys were asked to answer the questionnaires on their next day back at work. Nurses who answered the questionnaire received a small gift for their participation.

Data Analysis

Knowledge scores for each item in the NKAS-T were calculated by giving "1" for correct answers and "0" for incorrect answers, adding the total, and calculating the mean scores for total pain knowledge. The percentages of correct answers for total scores received and for each item were also calculated. *T*-test and analysis of variance (ANOVA) were used to compare the differences of nurses' knowledge according to various demographic groups, including formal nursing education, length of clinical care experience, prior cancer care experience, working setting, prior pain education, hours of pain education and major sources of pain education (See Table 1 for details). Age was not chosen as a variable because it is highly correlated to length of clinical care experience ($r = 0.92$, $P = 0.000$), and age may only reflect the length of nurses' clinical working experience. Stepwise regression was further applied to identify the predictors of nurses' pain knowledge by using demographic and background variables found to be significant from the above analysis.

Results

Nurses' Background in Cancer Care and Pain Management

Of 1,900 questionnaires sent out to the 9 hospitals, 1,797 valid questionnaires were received, indicating a 94.6% response rate. Of the remaining 103 questionnaires, 55 were missing and the other 48 contained too many unanswered items. Results are based on analysis of the 1,797 valid questionnaires. Responding nurses' ages ranged from 18 to 50 years, with the mean age of 25.0 (SD = 4.0). The average length of working in nursing was 47.7 months (SD = 45.3), with a range of 1 to 364 months and a mode of 31 months. Most respondents (84%) received their nursing education at the junior college level. Some respondents ($n = 260$, 14.5%) had a BS or higher degree in nursing. Very few (1.5%) had attended three-year nursing diploma programs at professional high schools (individuals with either junior college preparation or a BS degree in nursing are qualified to take the national RN examination). The majority of respondents worked in either medical or surgical inpatient wards (75.8%), and almost all nurses had prior cancer care experience (97.9%) (Table 1). Almost one-third of respondents (29.4%) reported that they frequently or always cared for cancer patients.

Regarding pain management training, a large proportion of responding nurses (35.1%) had no prior pain management training. The remaining nurses (64.9%) had various hours of prior pain management training (Table 1). Among the nurses with prior pain education, the majority received less than 5 hours of pain education.

Nurses' Pain Knowledge

Among the 37 pain knowledge questions assessed, the mean number of correctly answered questions was 18.52 (SD = 4.61), with a range of 6 to 34 items correctly answered. The correct answer rate for the entire scale, on average, was 50.5%. The correct answer rates for each item were further analyzed and are listed in Table 2 as items receiving less than a 50% correct answer rate and those receiving more than 80% of correct answers. Several items received a very low percentage of correct answers. One case study item (Item 36b) received only a 7% correct answer rate, and another case study item (Item 37b) also had a very low correct answer rate (18%). Ten items had a correct answer rate lower than 30%, eight items had a correct answer rate between 30% to 50%, and only six items had more than an 80% correct answer rate (Table 2).

Table 2
Distribution of Nurses' Knowledge about Pain (n = 1797)

Item Number	Item Content	Correct Answer Rate %
Items receiving less than 50% correct answer rate		
36B	Case Study: Andrew… first day following abdominal surgery. …, he smiles at you … He rates his pain as 8 … your assessment is made two hours after he received morphine 2 mg IV. Half-hourly pain ratings following the injection ranged from 6 to 8, and he had no clinically significant respiratory depression, … His physician's order for analgesia is "morphine IV 1–3 mg q1h PRN pain relief." The action you will take at this time is …	7
34	The percentage of patients who over-report the amount of pain.	10
35	How likely will opioid addiction occur as a result of treating pain with opioid analgesics?	12
28	… The likelihood of the patient developing clinically significant respiratory depression (with opioid treatment).	16
8	Respiratory depression rarely occurs in patients who have been receiving opioids over a period of months.	17
37B	Case Study: Andrew… first day following abdominal surgery. He is lying quietly in bed and grimaces as he turns in bed …He rates his pain as 8 … Your assessment is made two hours after he received morphine 2 mg IV. Half-hourly pain ratings following the injection ranged from 6 to 8, and he had no clinically significant respiratory depression, … His physician's order for analgesia is "morphine IV 1–3 mg q1h PRN pain relief." The action you will take at this time is …	18
11	The usual duration of action of meperidine (Demerol) IM is 4–5 hours.	24
36A	Case Study: Andrew… first day following abdominal surgery. He smiles at you … rates his pain as 8 … your assessment of Andrew's pain is …	24
23	The recommended route of administration of opioid analgesics to patients with prolonged cancer-related pain is…	24
7	Non-drug interventions are very effective for mild-moderate pain control but are rarely helpful for more severe pain.	29
24	Recommended route of administration of opioid analgesics to patients with brief, severe pain of sudden onset, e.g. trauma or postoperative pain, is…	30
4	Patients may sleep in spite of severe pain.	33
14	Beyond a certain dosage of strong opioids, increases in dosage will not increase pain relief.	34
9	Aspirin 650 mg PO is approximately equal in analgesic effect to meperidine (Demerol) 50 mg PO.	41
30	The most likely explanation for why a patient with pain would request increased doses of pain medication is…	44
27	Analgesics for post-operative pain should initially be give …	47
37A	Case Study: Andrew… first day following abdominal surgery. He is lying quietly in bed and grimaces as he turns in bed… He rates his pain as 8 …your assessment of Andrew's pain is …	47
6	Aspirin and other nonsteroidal anti-inflammatory agents are not effective analgesics for bone pain caused by metastases.	48
Items receiving more than 80% correct answer rate		
16	The patient with pain should be encouraged to endure as much pain as possible before resorting to a pain relief measure.	82
33	Which of the following describes the best approach for cultural considerations in caring for patients in pain:	82
19	After the initial recommended dose of opioid analgesic, subsequent doses are adjusted in accordance with the individual patient's response.	84
32	The most accurate judge of the intensity of the patient's pain is the patient.	84
5	Comparable stimuli in different people produce the same intensity of pain.	85
1	Observable changes in vital signs must be relied upon to verify a patient's statement that he has severe pain.	86

The knowledge scores were further analyzed by nurses' background characteristics using t-test, ANOVA, and Pearson's correlation. Significant differences in nurses' pain knowledge were found among subgroups in all background variables except prior experience in caring for cancer patients. In other words, there was no difference in pain knowledge between nurses with or without experience in caring for cancer patients. However, nurses who had always cared for cancer patients (n = 172) had significantly higher pain knowledge than the remaining

nurses ($n = 1625$) with lower frequencies of caring for cancer patients; the mean pain knowledge scores (SD) were 22.37 (5.14) and 18.11 (4.36), respectively ($t = -11.96$, $P = 0.000$). Nurses' pain knowledge was positively correlated to length of clinical nursing care experience (in months) ($r = 0.18$, $P = 0.000$). Nurses with a BS or higher level of education (Master's degree) had significantly higher pain knowledge scores (M = 21.68, SD = 4.83, correct answer rate = 58.6%) than nurses with junior college education (M = 18.00, SD = 4.35), and nurses with diploma (M = 16.5, SD = 4.37) ($F = 79.2$, $P = 0.000$). In particular, nurses with master's degree preparation had the highest mean pain knowledge score (M = 27.00, SD = 5.85) and the highest correct answer rate (73.0%).

Knowledge differences were also found among nurses working in different types of settings ($F = 18.4$, $P = 0.000$). The results of ANOVA with post hoc Scheffe's analysis revealed that nurses working in oncology units and emergency rooms had the highest (M = 21.49, SD = 4.21, 58.1% correct answers) and second highest (M = 20.12, SD = 6.63, 54.4% correct answers) mean knowledge scores compared to nurses working in other settings. Nurses working in intensive care units had the lowest scores of all (M = 17.04, SD = 4.24), with a correct answer rate of only 46.1%.

Prior pain management training also had an impact on nurses' pain knowledge. Nurses who had received pain management education (at school, conferences, or on-site at hospitals) had, on average, significantly higher mean knowledge scores than those without prior pain education; mean scores (SD) were 19.30 (4.72) and 17.06 (4.03), respectively ($t = -10.1$, $P = 0.000$).

Pain knowledge scores were further compared across the three major sources of learning and no prior pain education by using ANOVA and Scheffe's post hoc examination. The results showed that nurses without any prior pain education had the lowest scores. Nurses who received pain education from professional pain management conferences or workshops had significantly higher pain knowledge scores (M = 21.05, SD = 5.09, 56.9% correct answers) than nurses who received pain education from school (M = 18.11, SD = 4.14), hospital on-site continuing education courses (M = 18.70, SD = 4.10), or had no prior pain education at all (M = 17.06, SD = 4.03) ($F = 75.0$, $P = 0.000$).

Pain knowledge scores were also compared among nurses who received different hours of pain education by using ANOVA and Scheffe's post hoc test. Significant differences were revealed in the knowledge scores among nurses having different amounts of hours in pain education ($F = 53.0$, $P = 0.000$). Mean pain knowledge scores descended from high to low, corresponding to the level (hours) of pain management training received by nurses. Those receiving more than 15 hours of pain education scored M = 22.77 (SD = 5.14, correct answer rate = 61.5%), 10 to 15 hours education scored M = 20.98 (SD = 5.21), 5 to 10 hours education scored M = 19.32 (SD = 4.94), less than 5 hours education scored M = 18.48, (SD = 4.11) and nurses with no prior pain education scored M = 17.06 (SD = 4.03, correct answer rate = 46.1%).

One of the study's purposes was to identify predictors of nurses' pain management knowledge. Significant variables from the previous *t*-test, ANOVA, or bivariate correlation were used as independent variables in stepwise regression to predict nurses' pain management knowledge. The results showed that predictors of pain management knowledge were having received more hours of pain management, source of pain management from professional conferences, always caring for cancer patients, having more clinical care experience (months in clinical care), having a BS degree or higher, and not working in intensive care unit (ICU). These variables explained 24.2% of variances of nurses' pain knowledge.

Discussion

This study provides important information about the level of nurses' pain knowledge across Taiwan. In general, the results revealed that nurses' knowledge about pain in Taiwan is far from optimal. Among the 37 pain questions examined, the mean score for correctly answered items was 18.8 (50.5% correct answer rate). Although the instrument used in our study may differ somewhat from those used in previous research,[8,9,13,22,23] our results still show that nurses in Taiwan have relatively low correct

answer rates compared to nurses in the U.S.[8,9,11,13,22,23] However, the correct answer rate is similar to that for nurses from other countries, such as Japan,[7] Greece,[16] and Finland.[24] The less than optimal pain management knowledge in Taiwanese nurses, compared to those in the U.S., may be related to the lack of attention given to pain education in Taiwan in the past. Only with the advent of the hospice movement in Taiwan during the past 10 years has pain control begun to receive attention.

Among the 37 items surveyed, 18 did not even receive half the correct answer rate. Further analysis of items showed four major areas of knowledge deficit: 1) lack of analytic and integration abilities in making clinical pain judgments (as reflected in items related to the case studies), 2) questioning patients' report of pain, 3) lack of knowledge and over-concern about possibilities of developing addiction and respiratory depression, and 4) lack of general knowledge about the use of analgesics.

Two case studies (representing four items) were assessed in the current study. The item that received the lowest correct answer rate (Table 2, Item 36B) is from one case study. In that item, a patient reports his pain (with a smile) as "8" on a 0 to 10 numerical scale. Surprisingly, only 7% of nurse respondents correctly answered the morphine dosage for the patient (PRN, give as needed), and only 24% of nurses correctly rated the pain intensity as "8" in accord with the patient's report (Table 2, Item 36A).

In the other case study, a very similar pain scenario was presented except the patient's position and expression were different (patient is lying quietly in bed and grimaces as he turns in bed). Interestingly, compared to the previous case study, more than twice as many nurses (18%) correctly answered the question about the patient's morphine dose, though the correct answer rate was still very low. Furthermore, compared to the previous case study scenario, almost double the number of nurses (47%) correctly rated the pain intensity "8" as the patient's self-report. In contrast, compare these results to an independent item (Table 2, Item 32): "The most accurate judge of the intensity of the patient's pain is the patient;" surprisingly, 84% of nurses correctly answered the latter item. Our results are similar to and may be best explained by Ferrell et al.'s finding[25] that 91% of nurses stated that asking patients was the most frequently used method to know patients' pain intensity; however, only 45% of nurses actually thought asking patients was the best strategy for determining patients' pain intensity. Taken together, these results indicate that nurses' clinical reasoning about pain is complicated and may be heavily influenced by patients' expression, position, conditions surrounding the pain experience, and even personal pain experiences.[26,27] Our results also reflect potential problems with nurses' abilities to apply pain knowledge and analyze complicated pain situations. The results further suggest that nurses need more training in analyzing and integrating data from clinical pain assessment.

Another critical issue was raised regarding the item about patients' over-reporting of pain (Table 2, item 34). Particular attention should be paid to this issue because nurses who believe that patients are over-reporting their pain may be less likely to apply the most appropriate pain management strategies. Regarding the item of over-reporting pain, the correct answer is less than 10%. In our study, only 10.1% of nurse respondents correctly answered Item 34. In other words, most nurses (89.1%) incorrectly believed that more than 10% of patients over-report their pain. Compared to nurses in Western countries,[7] a greater percentage of Taiwanese nurses seem to identify patients as over-reporting pain. Interestingly, however, our results are very similar to findings about Japanese nurses,[7] only 9.7% of whom believe that less than 10% of patients over-report their pain. We wonder if nurses in Asia share similar cultural values or attitudes toward pain that influence how they identify patients' pain intensity. How cultural values or circumstances shape nurses' attitudes, values, or knowledge about pain have not yet been explored, and should be further examined to understand pain management problems in Asian countries. The high percentage of nurses who believed that patients' over-report pain may also explain why the majority rated patients' pain intensity lower than the patients' self-report of 8 in the case studies. If nurses lack sufficient and accurate knowledge about pain, they may be easily influenced by factors surrounding a patient's pain situation or their own personal factors, and make pain management decisions based on inaccurate assumptions.[28]

These factors were not examined in the present study and merit further in-depth research.

Similar to previous studies,[10,12,13,29,30] knowledge deficits were found in the use of analgesics, particularly in equianalgesic dosing, duration of analgesic treatment, and opioid pharmacology. However, compared to nurses in Western countries,[7,14,30] more nurses (88%) in Taiwan are concerned about addiction (Item 35). Furthermore, similar to a previous study on elderly patients' pain,[31] 84% of nurses in our study had exaggerated concern about opioid-related respiratory depression (Item 28). To close these pain knowledge gaps, nurse educators in Taiwan should use our results as well as guidelines and well-developed programs, such as American Pain Society or pain resources nurses training, to train nurses, particularly in the use of analgesics.

The regression analysis revealed that predictors of more correct pain knowledge were having a BS or higher degree, more hours of pain education, more experience (time) in clinical care, having always cared for cancer patients, and pain education from professional conferences. However, having worked in an ICU negatively predicted nurses' correct pain knowledge. Some important issues are raised by the regression results. First, similar to previous studies,[15] our results strongly support the importance and usefulness of nursing and pain education in improving nurses' knowledge about pain management, though the relatively high knowledge scores found among BS- or MS-prepared nurses are still far from the ideal. Secondly, nurses who received pain education from professional conferences had the highest pain knowledge scores of all educational sources examined. A large number ($n = 629$; 35.1%) of nurses had not received any pain education. Of those nurses with prior pain education, the majority received only 5 hours or less training.

Taken together, these findings further raise important educational issues in Taiwan. First, pain education has not yet been emphasized and generalized across formal nursing education. Second, total hours of pain education may not be sufficient to prepare nurses to deal with complicated clinical pain problems. Third, although mean pain knowledge scores differed significantly among pain education groups, including hours of pain education received, sources of pain management training and levels of nursing education, these differences may not have clinical significance in pain management since they were relatively small. This small difference in scores further suggests that the contents of pain management courses are not sufficiently comprehensive for clinical relevance in pain management. Finally, this last issue, if true, suggests that there are not enough pain experts or nurse educators to provide comprehensive pain education in Taiwan. This lack of sufficient and well-trained pain educators may decrease the effectiveness of delivering and disseminating the most critical and accurate knowledge about pain management.

Similar to a previous study,[9] nurses working in oncology wards had relatively higher pain knowledge levels than nurses in other settings. This finding may reflect that pain management is generally recognized as an important clinical issue in oncology wards in Taiwan. Compared to other types of clinical settings, therefore, nurses on oncology wards may discuss relatively more pain-related issues continuing education and clinical case conferences. These discussions may increase oncology nurses' pain management knowledge. Interestingly, nurses working in emergency rooms had similar pain knowledge levels, which may be because pain is a major problem in both units. In contrast, nurses working in the ICU had the lowest scores in pain knowledge. It's difficult to explain why ICU nurses had the lowest pain knowledge scores compared to nurses working in other settings, though similar findings were found in a comparison of pain knowledge between hospice and ICU nurses.[32] Perhaps ICU patients are too sick to express their pain problems, which ICU nurses may perceive as indicating they have little or no pain. Another possibility is that pain control may not be as high a priority in the ICU, where the main goal is saving patients' lives. Taken together, the results suggest that pain management concepts need to be strengthened across different clinical settings. In particular, the pain management knowledge of ICU nurses could be effectively improved by offering them more pain education and clinical case discussion guided by experienced pain experts, oncology nurses or physicians.

Although this study provides important information about nurses' pain knowledge and identifies factors that predict such knowledge, a few limitations still exist. First, the factors predicting

nurses' pain knowledge explained only 24.2% of the variance. Other factors that influence nurses' pain knowledge are not yet known. Some factors that might be examined include cultural values or attitudes toward pain, personal pain experiences, clinical observations, experience taking care of patients with pain, clinical teaching about pain, habitual pain management procedures used in clinical settings, and influence of other health care providers, for example, physicians.

The lack of appropriate pain management knowledge among physicians is known to be a major barrier to pain control in Taiwan.[33] Because of the close professional interaction between physicians and nurses, physicians' knowledge about pain may be a major factor influencing nurses' pain knowledge. Future research should examine in depth the sources and factors contributing to pain knowledge. Furthermore, nurse educators play an important role in motivating students to learn about pain, yet nursing faculty themselves need more knowledge about pain management.[34] Our findings suggest the necessity of examining pain knowledge of nurse faculty and clinical educators in Taiwan.

Our study, the first nationwide survey of nurses' pain knowledge in Taiwan, provides important information about knowledge deficits in pain management among Taiwanese nurses. These findings provide a clear blueprint for what Taiwanese nurses need to learn about pain management. Although our nurse subjects were all volunteers, the high response rate (94.6%) suggests that nurses in Taiwan recognize and support the meaning and importance of pain management as a critical nursing care issue to be improved. Therefore, development and testing of a nationwide nurses' training program in pain management is urgently needed to increase and disseminate pain education and knowledge in Taiwan.

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