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Knowledge and practical skills for cancer pain management among nurses on remote islands in Japan and related factors nationwide

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Abstract

Objective: To clarify the knowledge and practical skills needed for cancer pain management among nurses on remote islands in Japan and related factors nationwide.

Setting: Due to geographical factors, nurses working on remote islands in Japan have few opportunities to attend training programs, which makes it difficult to acquire the knowledge and practical skills needed to provide pain management for patients with cancer.

Methods: We conducted a self-administered questionnaire survey regarding knowledge and practical skills in pain management for patients with cancer.

Design: Cross-sectional study.

Participants: Nurses working in cancer pain care in medical facilities and home care on remote islands throughout Japan.

Results: We analysed 128 responses. Regarding knowledge, the average accuracy level was 49.1%. Items with a low accuracy rate included selecting medicine according to the type of pain and the patient's condition. Regarding practice, the items with low scores included analgesics appropriate for the type of pain and relating physical pain to mental, social and spiritual aspects. The most common significant factor in both knowledge and practice was related to postgraduate training.

Conclusions: These findings suggest that to improve the knowledge and practical skills for cancer pain management among nurses on remote islands in Japan, it is necessary to incorporate clinical reasoning into basic education and establish remote education systems and consultation systems with other facilities.

KEYWORDS

cancer pain management, Japan, nurse, palliative care, remote island

1 | INTRODUCTION

Cancer pain management is often considered to be inadequate, as about 40% of patients with cancer worldwide report experiencing moderate to severe pain, as do about 50%–60% of patients with terminal cancer in Japan.[1–3] Pain relief is important because pain reduces the patient's quality of life and can lead to family distress and regret.[4] To alleviate cancer-related pain, nurses must have sufficient knowledge about pain and medicine. Knowledge about pain management has been confirmed among Japanese nurses in palliative care units, cancer hospitals, university hospitals and general hospitals. Half of these nurses have been shown to have accurate knowledge, with differences between facilities, including high scores for palliative care wards and low scores for general hospitals.[5] However, the actual present circumstances of nurses on the numerous remote islands in Japan have not been confirmed. In total, Japan has 416 inhabited remote islands with a combined population of approximately 620 000 residents.[6] The residents of these islands consider the local lifestyle and support systems crucial and find happiness in continuing to reside within their communities.[7] However, because of factors such as a lack of manpower, facilities and problems in medication management, only about 20% of residents actually pass away on their island.[8,9] Pain relief is an important factor that allows patients on remote islands to stay at home until the end of life[10,11]; therefore, considering and implementing improved education for nurses could enable more residents to spend their final days at home. Although training is beneficial for improving knowledge and pain relief techniques,[12,13] nurses on remote islands face difficulties in participating in continuing education and training because of the inconvenience and high cost of transportation[14–16] and the difficulties involved in taking leave.[14] Utilizing e-learning methods could offer better educational opportunities for nurses on remote islands; however, programs tailored to the characteristics of nurses on remote islands are essential to ensure effective education, and at present, no such programs exist. Given this background, the present study aimed to clarify the knowledge and practical skills needed for cancer pain management among nurses on remote islands in Japan and related factors nationwide. The results could help provide foundational information for the development of an effective remote nursing education program.

What is already known about the topic?

- Nurses working on remote islands in Japan have few opportunities to attend training programs, which makes it difficult to acquire knowledge and practical skills in pain management for cancer patients.

What does this paper add?

- This study investigated the knowledge and practical skills for cancer pain management among nurses on remote islands in Japan and related factors nationwide.
- The accuracy of knowledge regarding cancer pain care and the self-evaluated level of practical implementation were moderate among nurses on remote islands.
- Nurses on remote islands demonstrated limited knowledge concerning medication tailored to different types of pain and patients' conditions.
- The most significant factors for improving knowledge and the most significant factor for improving practice were attending more training programs and feeling that postgraduate training was useful respectively.

2 | MATERIALS AND METHODS

This nationwide cross-sectional quantitative descriptive research study was conducted from December 2021 to December 2022 in Japan. The study protocol was approved by the Ethics Committee of Kagoshima University, Japan (No. 210133).

In this study, “cancer pain” refers only to pain directly caused by the cancer itself, not to postoperative pain, pain associated with chronic disease or pain related to cancer treatment. In addition, “remote islands” are defined as those designated under Japan's Remote Island Promotion Law, Okinawa Promotion Special Measures Law, Amami Islands Promotion and Development Special Measures Law and Ogasawara Islands Promotion and Development Special Measures Law[17]; islands with convenient transportation via bridges and similar infrastructure connecting them to the mainland were excluded.

2.1 | Subjects

The study participants were registered nurses working in cancer pain care in medical facilities and home care on 117 remote islands throughout Japan. Remote islands other than Okinawa, the Amami Islands and the Ogasawara Islands were selected with reference to Remote Island Promotion Measures.[18] At the time of the survey request, nurses who had previously worked in cancer pain care,

even in operating rooms or similar settings, were recruited as participants. Given the high prevalence of small hospitals and clinics on remote islands, where even nursing supervisors are directly engaged in nursing care, nursing supervisors were included as respondents. Nurses who were working in palliative care wards, Certified Nurse Specialists in Cancer Nursing, some Certified Nurses (i.e. those working in cancer pain, palliative care, cancer radiation therapy, cancer chemotherapy, breast cancer, chronic heart failure and chronic respiratory disease) and nurses without experience in cancer pain management were excluded. In addition, facilities open only once or twice a week were excluded, taking into consideration the possibility that the nurses also worked at other facilities. It was not possible to confirm the precise number of nurses working in hospitals and clinics on Japan's remote islands; therefore, an estimate was made based on the situation of nurses in Kagoshima Prefecture. A Prefecture has 28 inhabited islands,[19] and is recognized as having many remote islands. In 2022, 1730 of the 23 522 nurses within A Prefecture were working on remote islands.[20] Since 24% of nurses work in public health centres and nursing care facilities, it was estimated that 1487 nurses were working in hospitals and clinics on remote islands. This corresponds to approximately 6% of nurses in the prefecture. Since the total number of nurses in Japan is 1.19 million,[21] it was assumed that 6% of them, 71 400, were working in hospitals and clinics on remote islands. However, this is only an approximation, as islands vary in size and population.

2.2 | Data collection and methods

After obtaining permission from facilities on the remote islands, we sent anonymous self-administered questionnaires and descriptions regarding the approved number of participants by post to the nursing administrators for distribution to the nurses. The responses were mailed individually.

2.3 | Materials

To assess knowledge of nursing care for cancer pain management (hereafter referred to as knowledge), we used the pain management items from the End of Life Nursing Education Consortium-Japan Core Quiz (ELNEC-J CQ),[22] which was developed by the End of Life Nursing Education Consortium-Japan (ELNEC-J). The End-of-Life Nursing Education Consortium (ELNEC) project is a national and international education initiative that aims to improve palliative care.[23] ELNEC-J is the Japanese version of End of Life Care, one of ELNEC's programs, and consists of 10 modules, such as Pain Management and Communication. The ELNEC-J CQ is an evaluation scale with 10 questions for each module rated on a 3-point Likert-type scale ("Correct", "Wrong" and "Don't know"). We set "Correct" as one point and "Incorrect" and "Don't know" as zero points. Thus, the total score ranged from 0 to 10 points.

To assess practical skills for nursing care for cancer pain management (hereafter referred to as practice), we used the Shortened Version of the Nursing Care Practice Scale for Cancer Pain developed by Takahashi et al.[24] This 12-item scale delineates essential elements for nursing practice concerning cancer pain. The responses are structured around a 5-point Likert-type scale, from 1) "Never" to 5) "Always", for a total score range from 12 to 60 points. The reliability and validity of the above two scales have been confirmed, and no permission was needed for their use. A definition of "cancer pain" was provided in the questionnaires.

2.4 | Factors related to education and training

2.4.1 | Education and postgraduate training

Undergraduate education involved confirming whether students had taken a "Nursing Care for Cancer Pain" course. We asked the extent to which they had learned, such as "learned in detail", and the usefulness of the learning in practical applications. Questions about postgraduate training concerned participation/attendance, number of times attended, specific training programs completed (e.g. ELNEC-J, Palliative care Empasis program on symptom management and Assessment for Continuous medical Education [PEACE][25]) and whether the training was helpful in their practice. The Continuing Education for Physicians for Palliative Care with a Focus on Symptom Assessment and Management program was developed in Japan, and non-physician health care professionals are able to participate.

2.4.2 | Consultation with a palliative care team

Regarding the experience of consulting with a palliative care team (PCT), the nurses were asked to select one of the following options: "Consulting", "Not consulting" or "No system". There are 544 PCTs nationwide in Japan in 2021.[26] Pain management is the most common subject of consultations with PCTs,[23] so this item was added considering the potential impact of knowledge and practice.

2.5 | Background

We confirmed the following information regarding the participants' background characteristics: age, department of employment, position, education, years of nursing experience, years of nursing for cancer pain management, number of nurses in the organization and presence of a resident physician.

2.6 | Analysis

The distribution of the background characteristics was confirmed using descriptive statistics. Knowledge was quantified based on the number of correct answers, and the number of correct answers for each subscale was aggregated. In practice, the average total score and the average score for each subscale were calculated.

For related factors, univariate analysis confirmed a relationship between knowledge and practice for each background. Next, variables showing associations and variables with potential associations identified through univariate analysis were selected. Multivariate analysis was conducted with the scores as the dependent variable and the background as the independent variable. For normally distributed data, a t-test was performed for two-group comparisons, and one-way analysis of variance was used for three-group comparisons. For non-normally distributed data, the Mann–Whitney U test was conducted for two-group comparisons, and the Kruskal–Wallis test was conducted for three-group comparisons. On multivariate analysis, multiple regression analysis was performed after checking the QQ plots of the residuals. IBM SPSS Statistics 27 (IBM Japan, Ltd., Tokyo, Japan) and EZR[27] were used for the statistical analyses.

2.7 | Ethics approval and informed consent

Ethics approval was granted by the Ethics Committee of Kagoshima University, Kagoshima prefecture, Japan (No. 210133). Informed consent was obtained from all participants involved in the study.

3 | RESULTS

We sent request forms to 255 facilities and obtained consent from 32. The populations of the remote islands targeted varied from 90 to 50 000.[18] The number of individuals for distribution ranged from 1 to 50. A total of 309 questionnaires were distributed, and 138 responses were received (response rate: 44.7%). After excluding 10 surveys with many missing responses, 128 responses were subjected to analysis, among which, 89 individuals (70.0%) reported experiencing difficulties in providing pain management.

3.1 | Background (Table 1)

Among the respondents, 46 (35.9%) were in their 40s, and 106 (82.9%) had graduated from a 3-year nursing course (Nursing school, Junior college). In addition, 55 (43.0%) reported having 10–19 years of nursing experience. Regarding experience in nursing for cancer pain, 48 (37.5%) reported having 0–3 years. In terms of work settings, 82 (64.1%) worked on hospital wards, while 107 (83.6%) were staff nurses. Additionally, 40 (31.3%) worked in corporate general hospitals, and 121 facilities (94.5%) had resident physicians. As for postgraduate training, 55 (43.0%) had attended programs, among whom, 39 (69.6%) reported that they were helpful. Moreover, 14 (25.4%) had participated in ELNEC-J or PEACE. In total, 55 nurses (43.0%) reported consulting with a PCT, while 51 (39.8%) indicated that their institution had no such system in place.

3.2 | Overview of knowledge and practice of nursing for cancer pain (Tables 2 and 3)

The average accuracy rate for all items was 49.1%. The accuracy rates for the 10 knowledge items ranged from 22.7% to 69.5%, with an average score of 4.89 (standard deviation 2.559) out of a maximum of 10 points. Three items had accuracy rates above 60%: the relation between opioid use and life prognosis (69.5%), concurrent use of non-steroidal anti-inflammatory drugs or acetaminophen at the start of opioids (68.0%) and the administration route of rescue doses and scheduled opioids (66.4%). In contrast, the accuracy rate for the following six items was less than 50%: possibility of psychological dependence due to long-term dose of opioids for pain (46.9%), effectiveness of radiotherapy for bone metastases (46.1%), selection of opioids (morphine, oxycodone) for patients with renal dysfunction (40.6%), single dose of rescue opioid administration (38.3%), efficacy of anticonvulsants and antidepressants on neuropathic pain (33.6%) and ceiling effect of morphine (22.7%). Actual practice averaged 42.39 points (out of a maximum of 60). A score of 4 points or higher was achieved for five items: recording the effects and careful observation of side effects during the start or escalation of medical narcotic usage (both 4.23), confirming the

TABLE 1 Background characteristics of the participants.

Variables	*N* (%)
Age, years	
20s	14 (11.1)
30s	24 (18.8)
40s	46 (35.9)
≥50s	43 (33.6)
No answer	1 (0.8)
Education background	
5-year integrated school	10 (7.8)
Nursing school, Junior college	106 (82.9)
University	10 (7.8)
Graduate school	2 (1.6)
Years of experience and working background	
Nursing experience, years	
0–3	5 (3.9)
4–9	20 (15.6)
10–19	55 (43.0)
≥20	48 (37.5)
Experience in cancer pain care, years	
0–3	48 (37.5)
4–9	46 (35.9)
10–19	26 (20.3)
≥20	6 (4.7)
No answer	2 (1.6)
Position	
Head nurse	10 (7.8)
Deputy chief nurse	9 (7.0)
Staff	107 (83.6)
Others	2 (1.6)
Department	
Ward	82 (64.1)
Outpatient	27 (21.1)
Home care	16 (12.5)
Others	3 (2.3)
Affiliation	
National and public hospital	39 (30.5)
Private general hospital	40 (31.3)
Private hospital	15 (11.7)
District clinic	25 (19.5)
Home nursing care facility	8 (6.3)
Others	1 (0.8)
Number of nurses at the facility	
1	6 (4.7)
2–5	12 (9.4)
6–10	13 (10.2)
11–20	20 (15.6)
21–49	39 (30.5)
50–99	16 (12.5)
≥100	22 (17.2)
Resident physician	
Yes	121 (94.5)
No	6 (4.7)
No answer	1 (0.8)
Experience in education or training about cancer pain care[a]	
Undergraduate education	
Learned	81 (63.3)
Did not learn	43 (33.6)
No answer	4 (3.1)
Level of learning in undergraduate education[b]	
Learned in detail	24 (29.7)
Learned	32 (39.5)
Hardly learned	4 (4.9)
Do not remember	20 (24.7)
No answer	1 (1.2)
Usefulness of undergraduate education[b]	
Very useful	1 (1.2)
Useful	26 (32.1)
A little useful	45 (55.6)
Useless	7 (8.6)
No answer	2 (2.2)
Postgraduate training	
Participation	55 (43.0)
Non-participation	73 (57.0)
Number of times attending postgraduate training[c]	
1–3	34 (61.9)
4–5	11 (20.0)
6–10	4 (7.3)
>10	5 (9.0)
No answer	1 (1.8)
Type of postgraduate training[c]	
ELNEC-J[d]	9 (16.4)
PEACE[e]	5 (9.0)
ELNEC and PEACE	1 (1.8)
No ELNEC or PEACE	40 (72.8)
Usefulness of postgraduate training[c]	
Very useful	11 (20.1)
Useful	28 (50.9)
A little useful	10 (18.2)
Useless	3 (5.4)
No answer	3 (5.4)

(Continues)

TABLE 1 (Continued)

Variables	*N* (%)
Palliative care team	
Consult with palliative care team	
Yes	55 (43.0)
No	20 (15.6)
No system	51 (39.8)
No answer	2 (1.6)

Note: *N* = 128.

[a] Percentage of educated or trained population rather than total.

[b] *N* = 81 Learning-experienced population.

[c] *N* = 55 Training-experienced population.

[d] ELNEC-J stands for The End-of-Life Nursing Education Consortium-Japan. The End-of-Life Nursing Education Consortium (ELNEC) project is a national and international education initiative that aims to improve palliative care. ELNEC-J is the Japanese version. Participants learn about 10 courses, such as Nursing in End-of-Life Care, and Pain Management.

[e] PEACE stands for Palliative care Emphasis program on symptom management and Assessment for Continuous medical Education. This program was developed in Japan and aims to provide a "Continuing education program for physicians for palliative care with a focus on symptom assessment and management". It is primarily intended for physicians and non-physician health care professionals.

influence of pain on daily life (4.12), recording the pain situation (4.04) and verifying the situation and treatment strategy to the physician when starting or intensifying pain management (4.02). On the other hand, a score below 3.5 points was observed for two assessment items: an assessment that linked physical pain with mental, social and spiritual aspects (3.48), and an assessment of whether appropriate analgesics for the type of pain were being utilized during the start of or changes to pain management (3.07).

3.3 | Factors related to knowledge and practice (Tables 4 and 5)

Variables related to knowledge in the univariate analysis were: attending postgraduate training (K (1) = 1127.50, $p < 0.001$), higher frequency of attending postgraduate training (U (4) = 20.05, $p < 0.001$), attending Non-participation and No ELNEC or PEACE (U (4) = 19.113, $p < 0.001$), feeling that postgraduate training was useful (U (2) = 17.767, $p < 0.001$) and consultation with a PCT (U (2) = 6.078, $p = 0.048$).

Variables associated with practice were: home-care nurse (U (3) = 15.66, $p = 0.001$), affiliate in a home-care nursing station (U (5) = 13.501, $p = 0.019$), no resident physician (K (1) = 6.786, $p = 0.009$), attending postgraduate training (U (1) = 1469.50, $p < 0.001$), higher frequency of postgraduate training attendance (U (4) = 11.482, $p = 0.022$), perceiving postgraduate training as beneficial (U (2) = 11.226, $p = 0.004$) and no consultation with a PCT (U (2) = 10.932, $p = 0.004$).

Because the QQ plots of the residuals for both knowledge and practice total scores followed a normal distribution, multivariate analysis was conducted using multiple linear regression analysis. All variance inflation factors were below 10.0, indicating no issues with multicollinearity. The following variables were extracted through forward selection analysis. Regarding knowledge, positive associations were found with a higher frequency of postgraduate training attendance (attended 10 times or more: $p = 0.010$, standard error [SE] = 1.580), final education level of a 3-year course ($p = 0.016$, SE = 0.819) and 10–19 years of experience in cancer pain care ($p = 0.035$, SE = 0.617). Regarding practice, positive associations were found with feeling that postgraduate training was useful ($p = 0.010$, SE = 2.293). Negative associations were found with consulting with a PCT ($p = 0.021$, SE = 1.924), having no PCT system ($p = 0.005$, SE = 1.983) and having a resident physician ($p = 0.006$, SE = 3.635).

4 | DISCUSSION

The main findings of this study are as follows:

1. Nurses had limited knowledge about appropriate medications and dosages based on the type of pain and the patient's condition.
2. Before administering medicine, only a small number of nurses assessed whether medications were suitable for the type of pain, or assessed not only physical, but also psychological, social and spiritual aspects.
3. The most significant factors for improving knowledge and the most significant factor for improving practice were attending more training programs and feeling that postgraduate training was useful respectively.
4. The level of knowledge of cancer pain was significantly higher among nurses who had graduated from a 3-year course and those who had 10–19 years of experience in cancer pain care.
5. The absence of a PCT and consultations with a PCT were related to both knowledge and practice.

The first main finding of this study was that nurses have limited knowledge about appropriate medications and dosages based on the type of pain and the patient's condition, as well as the appropriate dosage for rescue administration. The implementation level, based on evidence such as nurses' medication selection and appropriate dosing, has previously been reported to be low,[12,28,29] and this phenomenon is not exclusive to nurses on remote islands. One possible reason for this is that instructions

TABLE 2 Nursing care knowledge regarding cancer pain.

Variables	*N* (%)[a]
1. A long-term dose of opioids shortens patient survival (I)	89 (69.5)
2. Once opioid administration is started, concomitant non-steroidal anti-inflammatory drugs or acetaminophen should be discontinued in principle (I)	87 (68.0)
3. Use a different route of administration for rescue doses than for opioids that are routinely administered in principle (I)	85 (66.4)
4. The primary goal of pain management is to ensure an uninterrupted night's sleep (C)	76 (59.4)
5. A long-term dose of opioids for pain can lead to psychological dependence (C)	60 (46.9)
6. Radiation therapy is often effective for pain caused by bone metastases (C)	59 (46.1)
7. In the treatment of pain, if the patient has renal dysfunction, oxycodone would be better selected over morphine (C)	52 (40.6)
8. When administered orally, a single rescue dose is 10%–20% of the total daily opioid dose (C)	49 (38.3)
9. Anticonvulsants and antidepressants are often effective for treating neuropathic pain (C)	43 (33.6)
10. Morphine has no effective limit (C)	29 (22.7)
Average accuracy for all items	49.1%
Average total score (out of 10 points)	4.89 (SD: 2.559)

Note: $N = 128$. Symbols in parentheses: C = Correct, I = Incorrect.

Abbreviation: SD, standard deviation.

[a] *N* refers to the number of correct answers.

on medication selection tailored to the type of pain and the patient's condition may not be provided prior to graduation. The guidelines for the national nursing exam indicate "understanding of the assessment of physical and holistic pain" and do not provide detailed information on managing cancer pain.[30] Furthermore, it has been revealed that few educators have received education in pain management, and many rely on their own clinical experience when delivering lectures.[31]

In other words, undergraduate education in pain management lacks uniformity because it is often based on educators' personal experiences in nursing.[32] Therefore, students find it difficult to acquire knowledge about medication selection tailored to the type of pain and the patient's condition. Undergraduate education represents a crucial opportunity to provide students with systematic instruction. Educators need to acquire accurate knowledge of pain relief and teach content that fosters a foundation for safe and effective medication administration, including knowledge of medications suitable for various types of pain and medical conditions.

The second main finding of this study was that before administering medicine, only a small number of nurses assessed whether medications were suitable for the type of pain, or assessed not only physical, but also psychological, social and spiritual aspects. In other words, the essential clinical reasoning necessary for the safe and effective administration of medication[33,34] is not being exercised by nurses. Clinical reasoning in medication administration involves nurses possessing clinical and pharmacological knowledge and the ability to conduct comprehensive, situation-specific assessments of patients before medication administration.[35] However, due to the lack of clarity regarding nurses' actual clinical reasoning during medication administration,[35] attributing this solely to the characteristics of remote islands is difficult. As evident from the "knowledge" aspect of this study, we believe that insufficient knowledge about medications and pain resulted in the lack of assessments and decisions. Moreover, nurses tend to believe that physician orders are infallible,[36] which could potentially relate to the lack of proactive assessments. In undergraduate training, educators need to teach medication-related knowledge and how to apply it to clinical reasoning.[33] Additionally, it is essential to provide practical training in clinical reasoning after becoming a nurse.

The third main finding of this study is that the most significant factors for improving knowledge and the most significant factor for improving practice were attending more training programs and feeling that postgraduate training was useful respectively. This result aligns with other studies indicating that participation in pain management training contributes to the enhancement of knowledge and practice.[37,38] However, our results indicate that practice is not related to the frequency of attending training programs, but the feeling that the training was useful. Several studies have used test grades and satisfaction as evaluations of training. However, some research has indicated that a high level of satisfaction with training is not related to subsequent practice, and the specific training

TABLE 3 Nursing care practice regarding cancer pain.

Variables	Mean (SD)
1. Records the effectiveness of medical narcotics when the patient starts or increases taking them	4.23 (0.92)
2. Observes the symptoms of nausea or vomiting as side effects when starting or increasing the dose of medical narcotics	4.23 (0.92)
3. Observes daily activities that are hindered by pain	4.12 (0.88)
4. Records the nature of the pain reported by the patient (e.g. throbbing, numbness)	4.04 (0.95)
5. Confirms the patient's pain situation and treatment policy (pharmacological or non-pharmacological) to the doctor when starting pain treatment or increasing pain	4.02 (0.93)
6. Informs the patient about the side effects of medical narcotics (e.g. constipation, nausea, drowsiness) when starting medical narcotics	3.91 (1.05)
7. Confirms the pain intensity reported by the patient using pain scales such as NRS[a], Face Scale and VAS[b]	3.91 (1.03)
8. Explains to the patients how to deal with pain when they stay out, go out or are discharged from the hospital	3.87 (1.11)
9. Engages with the patient in a manner that is reassuring and relaxing to raise the patient's reported pain threshold (e.g. being by his/her side, talking as a distraction)	3.76 (0.91)
10. Explains correct knowledge to the patient if he/she has misunderstandings about medical narcotics (e.g. addiction, gradual loss of efficacy, strong side effects) at the start of usage	3.58 (1.16)
11. Assesses physical pain in relation to mental, social and spiritual aspects	3.48 (1.04)
12. Assesses whether analgesics appropriate for the type of pain (e.g. somatic, visceral, neuropathic) are being dosed when the start of pain treatment or pain situation changes	3.07 (1.08)
Average score of all items	3.85
Total average score (Max 60)	42.39 (8.16)

Note: $N = 128$.

Abbreviation: SD, standard deviation.

[a]NRS stands for Numerical Rating Scale, which is an index for numerically evaluating the "pain felt by patients". Patients report how much pain they currently have on a scale from 0 to 10, where 0 is "no pain" and 10 is the "worst pain imaginable".

[b]VAS stands for visual analogue scale. The patient indicates how much pain they have on a 10-cm-long scale, with the left end being "no pain" and the right end being the "worst pain imaginable".

contents and methods that could lead to subsequent practice remain unclear.

Future research should investigate the background and circumstances of attending systematic programs, such as ELNEC-J, as well as explore methods and content that will lead to knowledge acquisition and practical application, especially for nurses on remote islands. To enhance the effectiveness of training programs, administrative support is crucial, as is providing participants with explanations of the purpose of the training and expected outcomes beforehand, facilitating reflection on acquired knowledge after training and helping in its application to practice.[39] Therefore, an educational plan should not only involve careful selection of content but also encompass support before and after training.

The fourth main finding of this study is that nurses who had graduated from a 3-year course and nurses who had 10–19 years of experience in cancer pain care demonstrated a significantly higher level of knowledge about cancer pain management. However, elucidating the specific reason for this elevated level of knowledge among these nurses poses a challenge. This difficulty stems from the fact that more than 80% of the subjects in the present study graduated from a 3-year course and had more than 10 years of clinical nursing experience. Consequently, they likely had diverse working and learning experiences after graduation, potentially minimizing the impact of their basic education. Regarding the influence of the basic education curriculum on nurses' ability after graduation, nurses and nursing students who graduated from a 4-year university have been shown to contribute more effectively to patient care and facility operations,[40,41] as demonstrated by studies in Korea and the USA. Additionally, these individuals typically exhibit superior critical thinking skills.[42,43] Conversely, a study conducted in Japan suggested that university students could be expected to demonstrate greater independence,[44] although the disparity in abilities between graduates of 3-year courses and 4-year universities remains unclear. Regarding the relationship between years of experience in pain management and knowledge, more experience is associated with greater knowledge.[13,45,46] One study showed that with moderate experience in cancer pain management, nurses demonstrated greater knowledge[47]; however, other factors may be involved. Further investigation is needed to elucidate the discrepancies in abilities between these groups.

TABLE 4 Factors related to knowledge and practice.

Variables	Knowledge (max 10 points)					Practice (max 60 points)				
	Mean	SD	Mean rank	U or H	*p*	Mean	SD	Mean rank	U or H	*p*
Total	4.89	2.528				42.26	7.995			
Age[a]										
20s	5.29	2.585	68.64	1.284 (H)	0.733	44.36	5.904	70.39	1.168 (H)	0.761
30s	4.42	1.886	57.69			43.96	6.792	68.63		
40s	5.15	2.852	66.95			41.96	8.837	62.40		
≥50s	4.77	2.538	62.86			41.10	8.737	61.05		
Education										
5-year integrated school[b]	3.30	2.003	41.90	5.518 (H)	0.161	43.00	9.006	66.80	6.481 (H)	0.090
Nursing school, Junior college[c]	5.12	2.544	67.58			41.96	8.265	61.61		
University	4.50	2.677	56.90			46.60	5.661	83.45		
Graduate school	4.00	1.414	52.25			52.00	1.414	111.25		
Department										
Ward	4.87	2.463	63.93	1.200 (H)	0.753	42.26	7.195	62.85	15.66 (U)	0.001*
Outpatient	4.89	2.532	63.85			39.37	10.058	51.65		
Home care	4.94	3.087	64.19			48.73	6.745	96.59		
Others (operating or dialysis room)	6.33	2.082	87.50			41.33	5.774	54.00		
Affiliation										
National and public hospital	5.46	2.222	73.12	5.720 (H)	0.334	42.87	5.850	63.42	13.501 (H)	0.019*
Private general hospital	4.55	2.650	58.71			41.08	8.804	58.44		
Private hospital	5.27	2.865	69.63			41.07	7.732	57.47		
District clinic	4.32	2.479	54.82			41.78	10.077	67.40		
Home nursing care facility	5.38	2.973	73.50			51.38	4.749	108.00		
Others[d]	4.00	–	53.00			38.00	–	34.00		
Number of nurses at facility										
1	4.67	2.160	61.67	3.715 (H)	0.715	46.40	5.914	88.50	11.260 (H)	0.081
2–5	4.17	1.992	56.33			45.92	12.413	88.21		
6–10	4.38	2.785	55.62			40.62	12.242	66.04		
11–20	4.60	3.169	58.50			39.05	7.405	50.73		
21–50	5.31	2.430	70.14			42.21	5.782	59.29		
50–100	4.81	2.713	62.72			42.56	6.957	61.72		
>100	5.36	2.258	71.73			43.68	5.777	67.89		

(Continues)

TABLE 4 (Continued)

Variables	Knowledge (max 10 points)					Practice (max 60 points)				
	Mean	SD	Mean rank	U or H	*p*	Mean	SD	Mean rank	U or H	*p*
Resident physician[a]										
Yes	4.90	2.570	62.11	453.0 (U)	0.303	41.96	8.150	62.11	6.786 (U)	0.009*
No	5.67	1.506	102.17			50.33	3.933	102.17		
Nursing experience, years										
<3	5.60	1.673	77.70	2.759 (H)	0.430	45.20	6.301	73.90	1.648 (H)	0.648
4–9	4.55	2.212	58.78			44.60	5.519	72.45		
10–19	4.67	2.465	60.66			41.60	9.215	61.39		
≥20	5.27	2.804	69.61			42.54	8.098	63.77		
Experience in cancer pain care[e], years										
<3	4.38	2.110	58.01	1.954 (H)	0.582	43.75	7.689	68.08	2.465 (H)	0.482
4–9	5.25	2.511	65.54			40.87	9.498	57.66		
10–19	5.50	3.063	69.25			42.29	6.498	62.88		
≥20	5.33	3.670	66.83			45.00	9.508	74.25		
Experience in undergraduate education about cancer pain care[f]										
Learned	4.68	2.407	60.10	1936.0 (U)	0.303	42.83	8.579	64.77	1557.500 (U)	0.333
Not learned	5.33	2.679	67.02			42.07	7.106	58.22		
Level of learning in undergraduate education[f]										
Not learned	5.30	2.655	66.03	2.553 (H)	0.466	42.25	7.124	57.29	3.587 (H)	0.310
Learned in detail	5.43	2.428	67.02			45.35	5.630	73.44		
Not much	4.31	2.340	54.90			41.86	10.321	62.61		
Do not remember	4.70	2.408	60.08			41.85	7.590	57.30		
Usefulness of undergraduate education										
Non-participation[g]	5.33	2.679	65.27	0.889 (H)	0.641	42.07	7.106	57.21	1.467 (H)	0.480
Useful	5.00	2.617	61.37			44.07	5.929	67.69		
Useless	4.62	2.285	58.45			42.19	9.590	61.84		
Postgraduate training in cancer pain care										
Participation	5.96	2.293	80.50	1127.500 (U)	<0.001*	44.51	8.142	74.28	1469.500 (U)	<0.001*
Non-participation	4.12	2.432	52.45			41.10	8.018	57.13		
Number of times attending postgraduate Training[a]										
None	4.17	2.421	52.77	20.05 (H)	<0.001*	41.22	8.000	57.63	11.482 (U)	0.022*
1–3	5.69	2.259	76.37			42.66	8.911	65.43		
4–5	5.36	2.730	70.45			44.27	6.589	71.36		
6–10	6.00	1.826	83.13			49.50	5.196	99.00		
>10	8.40	1.817	109.60			50.20	4.91	101.50		

TABLE 4 (Continued)

Variables	Knowledge (max 10 points)					Practice (max 60 points)				
	Mean	SD	Mean rank	U or H	*p*	Mean	SD	Mean rank	U or H	*p*
Type of postgraduate training										
Non-participation	4.17	2.421	53.08	19.113 (H)	<0.001*	41.22	8.000	57.75	9.328 (H)	0.053
ELNEC-J[h]	6.00	2.398	81.94			42.11	8.253	61.56		
PEACE[i]	7.40	2.074	100.10			48.40	5.771	91.50		
ELNEC & PEACE (one person)	9.00	–	118.00			54.00	–	122.00		
No ELNEC or PEACE	5.59	2.398	75.07			44.02	8.413	72.30		
Usefulness of postgraduate training[j]										
Non-participation	4.17	2.421	52.26	17.767 (H)	<0.001*	41.22	8.000	56.84	11.226 (U)	0.004*
Useful	6.26	2.302	82.38			46.00	6.109	78.85		
Useless	4.86	2.507	64.21			38.93	10.521	50.54		
Consult with a PCT[e]										
Yes	5.45	2.501	71.32	6.078 (H)	0.048*	43.27	7.665	66.07	10.932 (U)	0.004*
No	4.00	2.248	48.93			46.95	7.665	83.85		
No system	4.76	2.605	60.78			40.59	8.152	52.75		

Note: $N = 128$. U = Test statistic of the Mann–Whitney U test. H = Test statistic of the Kruskal–Wallis test.

Abbreviation: PCT, palliative care team.

[a]$N = 127$, missing values: 1.

[b]Three years of high school in nursing and 2 years of a nursing major course in schools that adopt a system of education to train nurses with a consistent curriculum for 5 years. One or 2 years before graduating from a university or vocational school, one can obtain the qualification to take the national exam for nurses.

[c]Three-year course.

[d]$n = 1$.

[e]$N = 126$, missing values: 2.

[f]$N = 124$, missing values: 4.

[g]$N = 122$, missing values: 6.

[h]ELNEC-J stands for The End-of-Life Nursing Education Consortium-Japan. The End-of-Life Nursing Education Consortium (ELNEC) project is a national and international education initiative that aims to improve palliative care. ELNEC-J is the Japanese version. Participants learn about 10 courses, such as Nursing in End-of-Life Care, and Pain Management.

[i]PEACE stands for Palliative Care Emphasis program on symptom management and Assessment for Continuous Medical Education. This program was developed in Japan and aims to provide a "Continuing education program for physicians for palliative care with a focus on symptom assessment and management". It is primarily intended for physicians and non-physician health care professionals.

[j]$N = 125$, missing values: 3.

*$p < 0.05$.

TABLE 5 Relevant factors of knowledge and practice.

Variables	Coefficient	Standardized coefficient	*t*	*p*
1. Knowledge				
Participate in postgraduate training 10 more times	4.149	0.305	2.627	0.010*
Junior college, Nursing school (3-year course)	2.013	0.311	2.459	0.016*
10–19 years of experience in cancer pain care	1.319	0.211	2.137	0.035*
2. Practice				
Feel that postgraduate training was useful	6.042	0.374	2.635	0.010*
Consult with a PCT	−4.504	−0.298	−2.341	0.021*
No PCT system	−5.634	−0.363	−2.841	0.005*
Resident physician	−10.261	−0.279	−2.823	0.006*

Note: (1) Adjusted $R^2 = 0.218$ and (2) Adjusted $R^2 = 0.183$, $*p < 0.05$, multiple regression model.

Abbreviation: PCT, palliative care team.

The fifth main finding of this study is that the absence of a PCT and consultations with a PCT were both associated with lower levels of practical implementation. While the presence of a well-functioning PCT is crucial for effective pain management, establishing PCTs in remote areas can be difficult because of a shortage of personnel. The absence of a PCT and specialized experts has been reported to lead to reduced opioid usage,[48] and given the lower population and patient numbers on remote islands,[8] there might be limited opportunities for nurses to engage in opioid-related care practices. In cases where specialized expertise is lacking, establishing a consultation system with other facilities is believed to contribute to the effective use of opioids and improved pain management.

On the other hand, the lower level of practical implementation among nurses who consulted with a PCT could be attributed to the role of PCTs in recording interventions, monitoring side effects, providing guidance for responding to increased pain and collaborating with physicians.[49,50] Nurses in PCTs are responsible for palliative care education and on-the-job training (OJT); however, in remote areas with limited personnel, organizing and having staff participate in training programs might be challenging, making OJT during rounds more important. While OJT during PCT rounds has been reported to be beneficial for improving physicians' pain management skills,[51] the effects on nurses have yet to be clearly established; therefore, further investigations are warranted.

This study has several limitations. First, 80% of the nurses had more than 10 years of experience. Nurses with less experience might prefer urban positions, and in remote areas, there may be a higher concentration of mid-level and experienced nurses. Further research is needed to determine whether this pattern can be considered characteristic of remote islands. Second, the number of respondents was small at 128, which is only 0.1% of all nurses working on remote islands. As the survey was conducted during the COVID-19 pandemic, nurses likely did not have enough time to participate in research. Further consideration of the timing and response method will be necessary in future research. Third, there is also a possibility of differing roles in public and private hospitals on remote islands; however, in the present study, we did not verify the functions of each facility. Classifying and confirming the functions of such hospitals is, therefore, needed. Fourth, the opioids available at each facility might be limited, especially on remote islands. Since the population of remote islands is small, it would be difficult to store a large variety of medications in small-scale facilities. Future research should consider the types of opioids available for use at each facility. Finally, nurses' awareness of opioids may influence their knowledge and practice of pain management. In Japan, some people are fearful of the risk of addiction to opioids and the potential for a shortened lifespan, while others consider the use of such strong medications to be suitable only as a last resort.[52] Further clarification and consideration of nurses' perceptions about opioids are, therefore, needed.

5 | CONCLUSIONS

In this study, both the accuracy of knowledge regarding cancer pain care and the self-evaluated level of practical implementation were moderate among nurses on remote islands. Nurses on remote islands demonstrated limited knowledge concerning medication tailored to different types of pain and patients' conditions. In addition, assessments of medication were relatively infrequent. These findings suggest that to improve the knowledge and practical skills for cancer pain management among nurses on remote islands in Japan, it is necessary to incorporate clinical reasoning into basic education and establish remote education systems and consultation systems with other facilities.

AUTHOR CONTRIBUTIONS

Sachiko Shimizu: Conceptualization; methodology; project administration; funding acquisition; formal analysis; supervision; writing – review and editing; writing – original draft; investigation; data curation; visualization; resources. **Satomi Yoshida:** Conceptualization; investigation; formal analysis; writing – review and editing; data curation; methodology. **Yasuhito Nerome:** Conceptualization; methodology; project administration; writing – review and editing; supervision.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The datasets used for the study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

ETHICAL APPROVAL

Ethics approval was granted by the Ethics Committee of Kagoshima University, Kagoshima, Japan (No. 210133).

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