Original Article

Nursing students' self-assessed level of nursing skills at the time of graduation in a Japanese University: A retrospective observational study

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ABSTRACT

Objective: This study aimed to clarify nursing students' self-assessed levels of nursing skills at a nursing university at graduation and discuss how education and clinical experiences for students and post-licensure nurses should be improved, especially focusing on oncology nursing.
Methods: The study population comprised fourth-year students from 2017 to 2019 at the Faculty of Health Science and Nursing, Juntendo University, who had completed all stipulated clinical placements. The Japanese government determined 141 nursing skills and their target levels. Students subjectively evaluated their achieved levels for the 141 nursing skills after the final clinical placement.
Results: Of the 141 nursing skills, 81 (57%) were rated as "skills with easy-to-achieve targets" and five were rated as "skills with difficult-to-achieve targets." All nursing skills in the two subcategories of environmental adjustment skills and comfort management skills were rated as "skills with easy-to-achieve targets." Nursing skills with low target achievement rates were for patients with oral intake difficulties, unstable respiratory status, and those requiring glycemic control. These skills are also important in oncology nursing.
Conclusions: It cannot be concluded that the nursing university students fully achieved the target levels of nursing skills, as determined by the Japanese government. These findings may facilitate discussions on teaching nursing skills and their target levels at the time of graduation from nursing universities or post-employment.

Introduction

Fourteen-point one million new cancer cases and 8.2 million cancer deaths were estimated to occur in 2012 worldwide.[1] The International Agency for Research on Cancer estimated that, globally, 17 million individuals were newly diagnosed with cancer in 2018.[2] Furthermore, 34 million individuals are expected to be newly diagnosed with cancer by 2070. This number is double that of 2018, which means that many patients receiving nursing care have cancer. Advances in cancer care have accelerated the need for highly specialized oncology nurses worldwide. General nursing education and experience alone cannot ensure safe oncology nursing practice.[3] Nursing faculties and clinical educators need to rethink how to manage the education and clinical experiences of students and post-licensure nurses throughout their careers.[4]

The proper provision of healthcare services requires high-quality healthcare professionals.[5] Nurses are expected to be qualified healthcare professionals.[6] Providing safe and effective care is an essential goal for nurses,[7] and nursing skills are an important element of patient safety.[8] However, several studies have reported that new graduating nurses are not prepared to provide safe care[9–12].

Nursing students tend to have limited opportunities and range of nursing skills to experience during their clinical placement,[13] and opportunities to learn nursing skills are declining.[14,15] Therefore, at the point of graduation, nursing students have only acquired a limited number of nursing skills and, consequently, work without confidence when employed.[16] Patient safety and quality of nursing education are inseparable.[17] The gap between the level of nursing skills that nursing students acquire at graduation and those expected at clinical sites is detrimental to patient safety.[16] For ethical responsibility nursing education should ensure that students possess the skills and knowledge necessary to provide safe care upon graduation.[18] The Ministry of Health, Labour, and Welfare of Japan specified 141 nursing skills and their target

levels to be achieved by nursing students before obtaining a nursing license.[16,19,20] However, to the best of our knowledge, there are no reports on whether Japanese nursing students have reached the target level at graduation. Globally, a limited number of studies have examined students' nursing skill achievement at graduation and the relationship between this achievement and oncology nursing practice. Galassi et al. have highlighted the need for oncology nursing education that begins at pre-nursing-licensure.[3] Examining nursing students' achievement in nursing skills at graduation will help improve education and clinical experiences for students and post-licensure nurses and provide better care for patients with cancer.[21]

First, this study aimed to clarify nursing students' self-assessed level of nursing skills at a nursing university at the point of graduation based on the target level determined by the Japanese government. Second, this study aimed to identify the nursing skills that are difficult or easy for students to achieve their target levels. Third, to discuss how nursing education for students and post-licensure nurses should be improved to provide better oncology nursing practice based on the findings of this study.

Methods

Framework

The Royal College of Nursing has published a conceptual framework about career and education for oncology nursing.[22] The framework consists of four key pillars of professional practice: (1) clinical, (2) leadership/collaborative practice, (3) improving quality and developing practice, and (4) developing self and others. Each pillar has eight levels, with the lowest level being new registrants. Our study focused on the lowest level of new registrants in a nursing university.

We hypothesized that the student's achieved levels in nursing skills at graduation would be influenced by students' personality, ability, university curriculum, clinical placement environment, and types or target levels of nursing skills. In this study, we first examined students' achieved levels in nursing skills at graduation. Second, based on the hypotheses, we examined the relationship between target achievement and other factors. Third, the education of oncology nursing for students and post-licensure nurses was discussed based on the results of this study.

Study design and ethical considerations

A retrospective observational study was performed in which data were prospectively collected as part of the educational process at the Faculty of Health Science and Nursing, Juntendo University, Japan. This study was approved by the institutional review board of Juntendo University (Approval Number: 4–17). The authors' authority on oncology nursing is described in Supplementary material 1.

Study population

The study population comprised fourth-year students from 2017 to 2019 at the Faculty of Health Science and Nursing, Juntendo University, who had completed all stipulated clinical placements.

Instrument

The Ministry of Health, Labour, and Welfare in Japan specified 141 nursing skills and their target levels to be achieved for students before obtaining a nursing license in 2008.[23] Although the reliability and validity of the evaluation of the levels have not been established, it has been widely used in nursing education throughout Japan. These skills were classified into two categories and 13 subcategories. The two categories were (1) daily life support skills and (2) medical support skills. The daily life support skills category consisted of five subcategories and 55 nursing skills: (1) environmental adjustment skills (3 skills), (2) dietary support

skills (10 skills), (3) elimination support skills (13 skills), (4) activity and rest support skills (14 skills), and (5) hygiene and bedclothes exchange support skills (15 skills). The medical support skills category consisted of eight subcategories and 86 nursing skills: (6) respiration and circulation support skills (14 skills), (7) wound management skills (7 skills), (8) medication administration skills (25 skills), (9) emergency medical treatment skills (8 skills), (10) symptom and biofunctional management skills (14 skills), (11) infection prevention skills (7 skills), (12) safety management skills (8 skills), and (13) comfort management skills (3 skills). The target levels for nursing skills determined by the Ministry of Health, Labour, and Welfare of Japan consisted of four levels: Level I: can perform independently, Level II: can perform only under supervision, Level III: can perform only under exercise situations in school, and Level IV: only have knowledge. The lower the target level of a nursing skill, the more difficult it is to achieve.
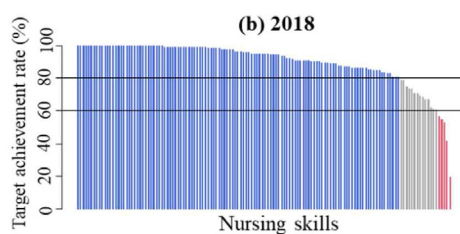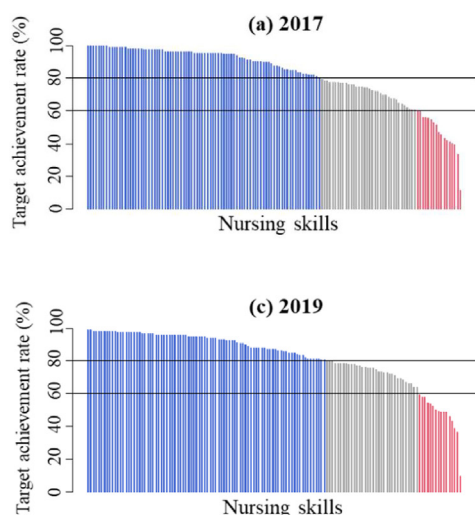
Data collection

Students were given a notebook at the time of university admission, and they recorded their levels of experience within the 141 nursing skills on the notebook with confirmation by the teachers in charge at the end of each clinical placement while at university. The experience levels for the 141 nursing skills consisted of four levels: Level I, performed independently; Level II, performed with a supervisor; Level III, only observed; and Level IV, not experienced. Students who had completed all stipulated clinical placements subjectively evaluated their achieved levels for the 141 nursing skills based on their records after the final clinical placement. The achieved levels for the 141 nursing skills were consistent with the target levels. Informed consent was acquired by an opt-out on the authors' university website.

Clinical placements situation

There are two main instructional roles: teachers at the university and nurse instructors in hospitals during clinical placements. The university teachers provided tutorials on clinical placements to nursing students, monitored them, and evaluated their clinical placement activities. The nurse instructors in the hospitals provided nursing student training and monitored the students' clinical placement activities. Each student was in charge of and provided nursing care to one patient during each clinical placement.

Data analysis

This study defined the target achievement rate for each nursing skill within each year as the proportion of students achieving the target level, based on the achieved levels data. Regarding the calculation of the target achievement rates, if students did not answer the achieved levels, the student was considered as not having achieved the target level. The 141 nursing skills were ranked into four categories according to their target achievement rates: skills with easy-to-achieve targets, skills with neither easy- nor difficult-to-achieve targets, skills with difficult-to-achieve targets, and skills with variable target achievement rates. This classification was called the achievement difficulty rank. A nursing skill rated as "skills with easy-to-achieve targets" was defined as one for which the target achievement rate was more than or equal to 80% in each year. A nursing skill rated as "skills with neither easy- nor difficult-to-achieve targets" was defined as one for which the target achievement rate was (1) less than 80% in all examined years and more than or equal to 60% in any year, or (2) more than or equal to 60% in all examined years and less than 80% in any year. A nursing skill rated as "skills with difficult-to-achieve targets" was defined as one for which the target achievement rate was less than 60% in all examined years. A nursing skill rated as "skills with variable target achievement rates" was defined as one for which the target achievement rate was more than or equal to 80% in any year and less than 60% in any year. The authors determined the cut-off values of

Fig. 1. Waterfall plot: Target achievement rates of nursing skills from 2017 to 2019. In (a), (b), and (c), the horizontal axis represents nursing skills, and the vertical axis represents the target achievement rate, which is defined as the proportion of students achieving the target level of nursing skills. The order of nursing skills differs in (a), (b), and (c) because nursing skills are listed from left to right in the order of the target achievement rate. The target achievement rates for three of the 141 nursing skills in 2018 and 2019 were unavailable due to incomplete data. The blue bar indicates nursing skills with target achievement rates of more than or equal to 80%, the gray bar indicates that of less than 80% and more than or equal to 60%, and the red bar indicates that of less than 60%. The intervals in the table are open to the right and closed to the left, except for the highest interval.

Target achievement rate (%)	2017 N=141	2018 N=141	2019 N=141
80 - 100	88 (62)	119 (84)	88 (62)
60 - 80	36 (26)	14 (10)	34 (24)
0 - 60	17 (12)	5 (4)	16 (11)
NA	0 (0)	3 (2)	3 (2)

60% and 80% through discussion because appropriate values have not been established. The achievement difficulty ranks were summarized as counts and percentages. The association between the target levels or categories of nursing skills and achievement difficulty ranks was analyzed. All statistical analyses were performed using the R statistical package, version 4.2.2 (R Core Team, October 2022; www.r-project.org). A glossary of terms, which appears in this article, is listed in Supplementary Table S1. We did not conduct any statistical inferences due to the violation of assumption of the independent sample since the analysis conducted in this study was for nursing skills rather than students.

Results

Participants' characteristics

No students declined the use of their data for this study. For 2017, 2018, and 2019, 117, 124, and 118 fourth-year students were enrolled, respectively, in this study. Of the 359 students, 33 were males and 326 were females. The ages of the students in this study ranged from 21 to 23 years. The target achievement rates for three of the 141 nursing skills in 2018 and 2019 were unavailable due to incomplete data. For each year and each nursing skill, the proportion of students who did not indicate the achieved level ranged from 0% to 7.6%.

Target achievement rate of nursing skills

Fig. 1 presents the target achievement rates for nursing skills between 2017 and 2019. The distribution of target achievement rates in 2017 and 2019 was similar but differed from that in 2018. The number of nursing skills with target achievement rates of more than or equal to 80% was higher in 2018 than in 2017 and 2019. The number of nursing skills with target achievement rates of less than 60% was less in 2018 than in 2017 and 2019.

Achievement difficulty rank for nursing skills

Table 1 presents the achievement difficulty ranks. Of the 141 nursing skills, 81 (57%) were rated as "skills with easy-to-achieve targets." Five of the nursing skills were rated as "skills with difficult-to-achieve targets." That is, from 2017 to 2019, target achievement rates were less than 60% for these five nursing skills. Nursing skills rated as "skills with difficult-to-achieve targets" were (1) injection of a liquid meal through a nasogastric catheter for a patient, (2) administration of oxygen inhalation therapy, (3) humidifying the throat, (4) simply measuring blood glucose,

and (5) preventing needlestick accidents. Nursing skills rated as "skills with variable target achievement rates" were (1) to perform postural drainage for a medical manikin or students, (2) to perform closed chest cardiac massage correctly for a medical manikin, and (3) to understand the principles of defibrillation and to use automated external defibrillators correctly on a medical manikin.

Category and achievement difficulty rank

All nursing skills in the two subcategories of environmental adjustment and comfort management skills were rated as "skills with easy-to-achieve targets." (Table 2). Subcategories to which more than or equal to 70% of the nursing skills belonging rated as "skills with easy-to-achieve targets" were (1) wound management skills, (2) medication administration skills, and (3) infection prevention skills.

Target level and achievement difficulty rank

Nursing skills with target level II tended to be rated as "skills with difficult-to-achieve targets." Target level III nursing skills tended to be rated as "skills with variable achievement rates." (Table 3).

Nursing skills with or without care and achievement difficulty rank

Four of the 81 nursing skills with care (4/81, 5%) and one of the 60 nursing skills with no care (1/60, 2%) were rated as "skills with difficult-to-achieve targets" (Table 4).

Nursing skills with a medical manikin and achievement difficulty rank

Three of the 15 nursing skills for medical manikins (3/15, 20%) and none of 126 nursing skills not for medical manikins (0/126, 0%) were rated as "skills with variable target achievement rates." (Table 5).

Table 1
Achievement difficulty rank for nursing skills.

Achievement difficulty rank	Number of nursing skills ($n = 141$), n (%)
Skills with easy-to-achieve targets	81 (57)
Skills with neither easy- nor difficult -to-achieve targets	52 (37)
Skills with difficult-to-achieve targets	5 (4)
Skills with variable target achievement rate	3 (2)

Table 2

Relationship between category or subcategory and achievement difficulty rank for nursing skills.

Types of skills		Number of nursing skills (n = 141)	Achievement difficulty rank, n (%)			
Category	Subcategory		Skills with easy-to-achieve targets	Skills with neither easy- nor difficult-to-achieve targets	Skills with difficult-to-achieve targets	Skills with variable target achievement rate
Daily life support skills	Environmental adjustment skills	3	3 (100)	0 (0)	0 (0)	0 (0)
	Dietary support skills	10	4 (40)	5 (50)	1 (10)	0 (0)
	Elimination support skills	13	5 (38)	8 (62)	0 (0)	0 (0)
	Activity and rest support skills	14	9 (64)	5 (36)	0 (0)	0 (0)
	Hygiene and bedclothes exchange support skills	15	9 (60)	6 (40)	0 (0)	0 (0)
Medical support skills	Respiration and circulation support skills	14	6 (43)	5 (36)	2 (14)	1 (7)
	Wound management skills	7	5 (71)	2 (29)	0 (0)	0 (0)
	Medication administration skills	25	19 (76)	6 (24)	0 (0)	0 (0)
	Emergency medical treatment skills	8	2 (25)	4 (50)	0 (0)	2 (25)
	Symptom and biofunctional management skills	14	7 (50)	6 (43)	1 (7)	0 (0)
	Infection prevention skills	7	5 (71)	1 (14)	1 (14)	0 (0)
	Safety management skills	8	4 (50)	4 (50)	0 (0)	0 (0)
	Comfort management skills	3	3 (100)	0 (0)	0 (0)	0 (0)

Discussion

To the best of our knowledge, this is the first study to examine whether nursing students at graduation achieve the target levels of nursing skills determined by the Ministry of Health, Labour, and Welfare of Japan. Although the lack of comparative data makes it difficult to evaluate the results, it cannot be concluded that the students fully achieved the target levels. The target levels and categories of nursing skills were associated with the target achievement of students.

Unkri et al. reported that students self-assessed their nursing skill levels as good at graduation.[14] Similarly, 111 of 142 (78%) of the nursing skills had more than or equal to 70% of the target achievement rate with self-assessment at graduation.[20] Conversely, Maruo et al. reported that only 11 of 83 (13.2%) nursing skills had more than or equal to 80% of the target achievement rate with self-assessment at graduation.[24] The present study

found that 81 of 142 nursing skills (57%) had more than or equal to 80% of the target achievement rate with self-assessment at graduation from 2017 to 2019. A direct comparison between this study's results and previous ones was not possible because the evaluated nursing skills and evaluation methods were not uniform. Nursing education has changed regarding its organization and system.[25] For example, new courses, such as Gerontological Nursing, Home Care Nursing, and Mental Health Nursing, have been established, and the number of courses has increased. The total time spent on basic nursing education has decreased. These revisions may have reduced the students' nursing skills since teachers had to educate them rapidly and with a lack of time. The appropriateness of nursing skills and the target levels that graduating nursing students should achieve should be discussed based on the current nursing education system.

Nursing students are trained in basic nursing skills in first- and second-year university exercises.[24] In addition, nursing students practiced basic

Table 3

Relationship between target level and achievement difficulty rank for nursing skills.

Target level	Number of nursing skills (n = 141)	Achievement difficulty rank, n (%)			
		Skills with easy-to-achieve targets	Skills with neither easy-nor difficult-to-achieve targets	Skills with difficult-to-achieve targets	Skills with variable target achievement rate
I	34	16 (47)	18 (53)	0 (0)	0 (0)
II	54	28 (52)	21 (39)	5 (9)	0 (0)
III	21	5 (24)	13 (62)	0 (0)	3 (14)
IV	32	32 (100)	0 (0)	0 (0)	0 (0)

Table 4

Relationship between nursing skills with or without care and achievement difficulty rank for nursing skills.

With or without care	Number of nursing skills (n = 141)	Achievement difficulty rank, n (%)			
		Skills with difficult-to-achieve targets		Others	
With care	81	4	(5)	77	(95)
Without care	60	1	(2)	59	(98)

Nursing skills can be classified into with or without care.

A nursing skill rated as "skills with difficult-to-achieve targets" was defined as one for which the target achievement rate was less than 60% from 2017 to 2019.

Table 5

Relationship between nursing skills with a medical manikin and achievement difficulty rank for nursing skills.

With or without manikin	Number of nursing skills (n = 141)	Achievement difficulty rank, n (%)			
		Skills with variable target achievement rate		Others	
With manikin	15	3	(20)	12	(80)
Without manikin	126	0	(0)	126	(100)

Nursing skills were classified as with or without medical manikins. For example, one nursing skill is "can do closed chest cardiac massage correctly with medical manikin."

A nursing skill rated as "skills with variable target achievement rate" was defined as one for which the target achievement rate was more than or equal to 80% in any year and less than 60% in any year.

nursing skills throughout their three years of clinical placement, beginning in their second year, regardless of patient characteristics. Minemura et al. suggested that nursing skill experience and the number of experiences in clinical placement affected the students' attainment of nursing skills.[20] In this study, the target achievement rate was consistently high for basic nursing skills such as environmental adjustment and comfort management skills. The total amount of time that students spend experiencing basic nursing skills should be maintained to keep the target level of nursing skills.

Maruo et al. reported that the nursing skills with target achievement rates less than or equal to 10% were predominantly those for high urgency and severity patients or those with physical invasiveness.[24] Similarly, in this study, the nursing skills with low target achievement rates were those for patients with oral intake difficulties, unstable respiratory status, and those in need of glycemic control. Students cannot experience these nursing skills if the patients they care for during clinical placements do not have such symptoms. The limited time for clinical placements restricts the number of patients that students can take care of. Students may have more opportunities to experience these nursing skills by attending to or monitoring the care of patients for whom they are not in charge.

In 2018, approximately 25,000 students were enrolled in nursing colleges in Japan.[26] In 2018, the average number of nursing teachers per nursing college was 32.1, and the average number of students per nursing teacher was 10.8.[26] Noviyanti et al. found that the nursing students to clinical instructors ratio in hospitals in Indonesia was low.[17] Fuentes-Pumarola et al. reported that students considered it important to correctly execute techniques and appreciated it when the nurse mentor/instructor encouraged them to carry out techniques and procedures during the clinical placements.[27] Students may realize that they can achieve their target level of nursing skills when they perform them correctly under the supervision of teachers and nurse instructors. In this study, students found it more difficult to achieve the target levels of nursing skills at target level II than at other levels. This suggests that teachers and nurse instructors may not have sufficient time to teach and instruct nursing students during clinical placements. Given the current number of nursing teachers in Japanese universities, it may be difficult for them to devote more time to students in clinical placements. Therefore, increasing the number of teachers in universities and nurse instructors in hospitals may increase the amount of time spent with students, without increasing the burden on individuals.

The use of medical manikins provides nursing students with realistic experiences and opportunities to explore the nursing role more freely than in clinical placements.[28] Another advantage of using medical manikins is that students can practice nursing skills and explore interventions without fear of hurting anyone.[28] In this study, the proportion of students who achieved the target level for nursing skills using medical manikins fluctuated significantly from year to year compared to nursing skills without the use of manikins. A possible reason for this is the shortage of exercises at the university for the corresponding nursing skills in some years. The Japanese government requires each university to organize its educational content although it sets achievement targets for nursing students at the time of graduation.[29] Therefore, students may not have practiced certain nursing skills due to the content and time allocation for lectures and exercises on nursing skills varying between colleges and years. Another possible reason is the differences in the accessibility of medical manikins between years. Thus, the time spent practicing nursing skills should be examined, and if there is an excess or shortage, the time should be adjusted.

Most patients with advanced cancer experience symptoms such as pain, fatigue, and breathlessness throughout their disease, often with greater intensity toward the end of life.[30] Providing patients with prompt and comforting care can prevent a decline in their quality of life. The importance of basic nursing skills is greater in palliative care than in other settings. Galassi et al. have highlighted that caring for patients with cancer requires knowledge and skills beyond those provided in pre-licensure nursing education.[3] In this study, environmental adjustment and comfort management skills were rated as "skills with easy-to-achieve targets." Nursing skills that students believe they have achieved in their self-assessments need further improvements in oncology and palliative care. Sharing students' achievement of nursing skills at graduation with their future employers (hospitals) will help improve their educational and nursing experiences.

There is a lack of oncology content in the pre-licensure nursing curricula worldwide.[3] The nursing skills identified as "difficult to achieve the target" in this study are important in oncology nursing. For example, the insertion of a nasogastric catheter is a necessary nursing skill to maintain nutrition for patients with head and neck cancer. The administration of oxygen inhalation therapy and throat humidification are often required for patients with lung cancer. The increasing number of patients with cancer who are diabetic[31] and the use of steroids in cancer therapy have made simple blood glucose monitoring a necessary skill. Needlestick injury prevention skills are needed in cancer care because oncology nurses are most likely to be taking blood and administering cancer medications. There is a gap between the level of nursing skills that nursing students acquire at graduation and those expected in clinical

oncology nursing settings. There is a need to improve the content of oncology nursing in university nursing curricula and in the education and training of new nurses in hospitals.

This study had several limitations. First, this was a small study that included only Japanese students educated at a single nursing university. Second, there is a possibility to overestimate for achieved level of nursing skills because of the lack of the option of no knowledge about the nursing skill. Finally, there may have been discrepancies between students' self-assessments and teachers' assessments of the achieved level of nursing skills.

Sufficient acquisition of nursing skills at graduation will help students provide safe and high-quality nursing care to patients in future practice. Repetitive experience is necessary to improve nursing skills.[9,20] Continuous improvements in the accessibility of practice rooms, medical manikins, and other tools for nursing students are important. Additionally, the clinical placement environment must be improved. For example, increasing the number of teachers in universities and nurse instructors in hospitals, and allowing nursing students to observe the care of patients other than their own are considered. The required level of achievement of nursing skills for nursing students at graduation will change with societal transition.[32] Therefore, the validity of nursing skills and target levels that should be achieved by nursing students at graduation should continuously be reexamined. These findings may facilitate discussions regarding the methods and target levels of nursing skill achievement in nursing universities.

Conclusions

It cannot be concluded that the nursing university students fully achieved the target levels of nursing skills, as determined by the Japanese government. Nursing skills at target level II or those with care tended to be difficult for students to achieve their targets. Conversely, basic nursing skills, such as environmental adjustment skills and comfort management skills tended to be easy to achieve their target level. Regarding nursing skills of which students have difficulty to achieve the targets, teachers in nursing universities need to improve their teaching skills, styles, and content. Improvement in nursing students' skills will lead to the provision of safe and effective care for patients with cancer, which is expected to further increase in the future. These findings may facilitate discussions on how to teach nursing skills and their target levels upon graduating from a nursing university and provide important information for supervisors who educate new nurses entering oncology hospitals.

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CRediT authorship contribution statement

Zhang San: Conceptualization, Methodology, Software. **Priya Singh**: Data curation, Writing – Original draft preparation. **Wang Wu**: Visualization, Investigation. **Jan Jansen**: Supervision. **Ajay Kumar**: Software, Validation. **Sun Qi**: Writing – Reviewing and Editing. **Mikako Notsu**: Conceptualization, Methodology, Formal analysis, Writing – Original draft preparation, Writing – Reviewing and Editing. **Tateaki Naito**: Conceptualization, Methodology, Writing – Reviewing, Supervision. **Akifumi Notsu**: Conceptualization, Methodology, Formal analysis, Writing – Reviewing. **Asako Saito**: Investigation, Writing – Reviewing. **Reiko Hiraoka**: Investigation, Writing – Reviewing. **Eriko Suzuki**: Investigation, Writing – Reviewing. **Sachiko Takano**: Investigation, Writing – Reviewing. **Mayuko Yoda**: Investigation, Writing – Reviewing.

Yuko Takakuwa: Investigation, Writing – Reviewing. **Etsuko Yokoyama**: Investigation, Writing – Reviewing. **Taichi Sakai**: Investigation, Methodology, Writing – Reviewing, Supervision. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of competing interest

All authors have no conflicts of interest to declare. The corresponding author, Dr. Tateaki Naito, serves as the Associate Editor of the *Asia-Pacific Journal of Oncology Nursing*. The article underwent the standard review procedures of the journal, with the peer review process managed independently from Dr. Naito and their research groups.

Data availabilitystatement

Datasets used and/or analyzed during the current study are available from the corresponding author, Tateaki Naito, upon reasonable request.

Declaration of Generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apjon.2024.100400.

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