

Original Research

Knowledge and attitudes about palliative care among pharmacy students: A case study of a university in the northeastern region of Thailand

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Abstract

Background: Palliative care is increasingly recognized as a core component of holistic, patient-centered healthcare, particularly in the context of aging populations and chronic illness. In Thailand, the rising demand for palliative services calls for a healthcare workforce that is both competent and compassionate, yet palliative care remains underrepresented in pharmacy education. **Objectives:** This study aimed to assess the knowledge and attitudes of undergraduate pharmacy students at Khon Kaen University toward palliative care (PC), advance care planning (ACP), and advance care directives (ACDs), and to explore their associations with demographic and educational factors. **Methods:** A cross-sectional, descriptive study was conducted using a self-administered bilingual questionnaire (Thai and English) among 250 undergraduate pharmacy students. The instrument included demographics, 25 knowledge questions, and 42 attitude statements regarding PC, ACP, and ACDs. Data were analyzed using descriptive statistics and chi-square tests.

Results: Students demonstrated moderate knowledge of PC (mean 7.13/10, 62.8%) and ACP/ACDs (mean 10.34/15, 57.2%). Attitudes were generally neutral toward PC (62.8%), ACP (56.0%), and ACDs (83.2%). Knowledge scores were significantly associated with age, academic year, and prior training ($p < 0.05$). Attitudes were significantly influenced by personal experience in caring for terminally ill patients ($p < 0.05$). **Conclusion:** Despite moderate knowledge, students' neutral attitudes suggest a lack of confidence or emotional readiness for palliative care roles. Findings underscore the urgent need for curriculum integration of palliative topics tailored by academic level and exposure. Simulation-based, interdisciplinary, and emotionally supportive strategies may enhance both competence and empathy. Future research should evaluate the long-term impact of such interventions on professional practice.

Keywords: Palliative care, Advance care planning, Advance care directives, Pharmacy students, Attitude, Knowledge.

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INTRODUCTION

The global rise in aging populations, including in Thailand, has significantly increased the demand for palliative care (PC), driven by the growing prevalence of cancer and chronic non-communicable diseases (NCDs)¹. An estimated 56.8 million people worldwide require palliative care annually; however, only 40% of countries have services that adequately meet this need². Barriers to effective delivery include limited awareness among healthcare providers and the public, misconceptions about opioid use, and cultural attitudes surrounding death and dying³.

Unlike hospice care, which is typically limited to the terminal stage, PC is introduced at the time of diagnosis and addresses physical, emotional, and spiritual distress while emphasizing patient autonomy and preference⁴⁻⁶. In the Thai

context, a culturally appropriate "good death" is characterized by dignity, peace, and the presence of family and spiritual support⁶. Advance care planning (ACP) facilitates this process by encouraging early conversations about future healthcare decisions. In Thailand, the National Health Act recognizes living wills, providing legal grounds for documenting patients' end-of-life (EOL) care preferences⁷⁻⁹. In 2021, a standardized national ACP framework was introduced to improve consistency and accessibility of EOL care across the country¹⁰.

Pharmacists play a growing role in interdisciplinary palliative care teams, particularly in optimizing medication management, supporting home-based care, and reducing healthcare burdens, especially in rural areas¹¹⁻¹³. However, awareness and understanding of PC, ACP and advance care directives (ACDs) remain limited in the general Thai population and among healthcare professionals, including pharmacists^{1,14,15}. Studies from other countries similarly reveal knowledge gaps and often neutral or negative attitudes among pharmacy students and trainees¹⁶⁻¹⁸.

Given that knowledge and attitudes strongly influence healthcare providers' willingness and ability to deliver effective palliative care¹⁹⁻²¹. This study seeks to assess Thai pharmacy students' knowledge and attitudes toward PC, ACP, and ACDs, and to identify factors associated with these domains.

METHODS

Study design and setting



This descriptive cross-sectional study was conducted at the Faculty of Pharmaceutical Sciences, Khon Kaen University, Thailand, between February and March 2025. A convenience sampling method was employed to recruit undergraduate pharmacy students enrolled during the academic year. The study targeted students across all academic years (first to sixth year), allowing for diverse representation in terms of educational level and exposure to palliative care.

Sample size

The minimum sample size was calculated using a single population proportion formula: $n = N / [1 + Ne^2]$, where N is the total population and e is the margin of error (set at 5%). To account for non-responses and incomplete submissions, 20% was added to the calculated sample size. The final target was set at 354 students to ensure sufficient statistical power.

Participant Eligibility

Inclusion criteria were as follows: pharmacy students aged ≥ 18 years, currently enrolled at Khon Kaen University, able to read and respond in Thai or English, and voluntarily agreeing to participate. Participants were required to have access to an electronic device for completing the online survey. Students with significant visual impairments or cognitive limitations that could hinder questionnaire comprehension were excluded.

Instrument

A structured, self-administered questionnaire was used, comprising three sections:

- Demographic Information: Age, gender, year of study, prior coursework/training in palliative care, and experience caring for chronically ill or terminally ill individuals.
- Knowledge Assessment: 10 items (5 multiple-choice, 5 true/false) adapted from the Palliative Care Attitude and Knowledge (PcAK) questionnaire²², and 15 true/false items from Fried et al.²³ assessing knowledge of ACP and ACDs.
- Attitude Assessment: 6 PcAK items (based on content validity index)²², 9 items from Zhuqing Wen's ACP Attitude Scale²⁴, and 28 items from the General Public Attitudes Toward Advance Care Directives (GPATACD) Scale by Laranjeira et al.²⁵

Recruitment and data collection

Ethical approval was secured from the Khon Kaen University Institutional Review Board (approval code: HE682015). The survey was pilot-tested with 30 students to ensure reliability (Cronbach's $\alpha > 0.70$); these students were excluded from the main analysis. The final version was distributed online via QR codes on posters and LINE messaging groups. Weekly

reminders were issued during the first month. When response rates fell below 50%, in-person follow-ups were conducted. Data collection ceased once the target of 354 responses was reached. All responses were anonymized and securely stored.

Data analysis

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics summarized demographic characteristics, knowledge, and attitude scores. Associations between demographic factors and knowledge or attitudes were examined using Chi-square or Fisher's Exact Tests, with statistical significance set at $p < 0.05$.

Ethics approval

This study was approved by the Center for Ethics in Human Research, Khon Kaen University (approval code: HE682015). Informed consent was obtained electronically. Students were provided with an information sheet describing the study aims, procedures, and confidentiality measures, and consent was implied upon completion of the survey. Participants were assured of the anonymity and confidentiality of their responses, and participation was entirely voluntary.

RESULTS

Baseline characteristics

Of the 354 pharmacy students targeted for this study, 250 provided valid responses, yielding a 71% response rate. Most respondents were female (71.6%), and most were between 21 and 25 years of age (78.8%). Students were distributed across all academic years, with the highest proportion in their fifth year (30.4%). Only 17.2% reported previous coursework or training related to EOL care or living wills. A minority had direct caregiving experience: 19.2% had cared for a patient with a chronic illness, and 23.6% had cared for a family member near the end of life (Table 1).

Knowledge of palliative care, advance care planning, and advance care directives

PC knowledge scores averaged 7.13 out of 10 (SD = 1.49), reflecting a moderate level. Respondents showed a strong understanding of team-based care (93.6%) and palliative care applicability beyond cancer (93.2%). Most recognized symptom relief and quality of life as key goals. However, knowledge was limited regarding management of catastrophic bleeding (9.2%) and treatment of delirium (39.6%) (see Appendix 1 and Table S1).

ACP and ACDs knowledge yielded an average score of 10.34 out of 15 (SD = 2.60). Most students understood core ethical and legal concepts, such as the right to refuse life-prolonging treatments (98.8%) and the function of healthcare proxies (94.4%). Misconceptions persisted: only 36.8% correctly

Table 1. Baseline characteristics of participants (N = 250)		
Variables	Category	n(%)
Gender	Male	67 (26.8)
	Female	179 (71.6)
	Prefer not to say	3 (1.2)
Age (years)	18-20	45 (18.0)
	21-25	197 (78.8)
	Over 25	4 (1.6)
Year of study	1st Year	26 (10.4)
	2nd Year	32 (12.8)
	3rd Year	14 (5.6)
	4th Year	55 (22.0)
	5th Year	76 (30.4)
	6th Year	46 (18.4)
Complete palliative care course/ training	Yes	43 (17.2)
	No	207 (82.8)
Experience caring for patients with chronic disease	Yes	48 (19.2)
	No	202 (80.8)
Experience caring for a family member close to death	Yes	59 (23.6)
	No	191(76.4)

Table 2. Levels of knowledge on PC and ACP/ACDs			
Variables	Knowledge level	Score range	n (%)
PC (N=244)	Low	0-5	38 (15.2)
	Moderate	6-8	157 (62.8)
	High	9-10	49 (19.6)
ACP & ACDs (N= 237)	Low	0-8	45 (18.0)
	Moderate	9-12	143 (57.2)
	High	13-15	49 (19.6)

PC: Palliative care, ACP: Advance care planning , ACDs: Advance care directives

Table 3. Attitude levels toward PC, ACP, and ACDs			
Variables	Level of attitude	Score range	n (%)
PC (N= 245)	Negative	6-17	63 (25.2)
	Neutral	18-24	157 (62.8)
	Positive	25-30	25 (10.0)
ACP (N= 236)	Negative	9-26	4 (1.6)
	Neutral	27-36	140 (56.0)
	Positive	37-45	92 (36.8)
ACDs (N= 228)	Negative	27-80	14 (5.6)
	Neutral	81-108	208 (83.2)
	Positive	109-135	6 (2.4)

PC: Palliative care, ACP: Advance care planning , ACDs: Advance care directives

identified that emotional burden should not justify creating a living will. Less than half were aware that legal assistance is not required to draft a will, and only 44.4% rejected the idea that storing living wills in a safety deposit box is best (see Appendix 1 and Table S1).

Knowledge levels were categorized as low, moderate, or high. Most respondents demonstrated moderate knowledge across both domains. While the initial sample included 250 pharmacy students, only participants who completed all knowledge-related items were included in the analysis.

For the palliative care domain, data from 244 students were analyzed. Among these, 62.8% demonstrated a moderate level of knowledge, 15.2% had low knowledge, and 19.6% scored in the high knowledge range.

For the ACP and ACDs domain, 237 complete responses were analyzed. The majority (57.2%) showed moderate knowledge, while 18.0% and 19.6% had low and high knowledge levels, respectively. Further details are presented in Table 2.

Attitudes toward palliative care, advance care planning, and advance care directives

Attitudes toward PC were generally neutral. Most students (71.6%) agreed that PC should begin at diagnosis. While 54.8% expressed satisfaction with current services, 42.8% remained neutral regarding whether patients or families avoid using such services (see Appendix 2 and Table S2).

Attitudes toward ACP were predominantly neutral (56.0%). The majority agreed that ACP improves patient autonomy (84%), reduces family conflict (76.4%), minimizes non-beneficial interventions (73.6%), and enhances quality of life (80.8%). However, concerns were noted: 25.6% associated ACP with “waiting for death” and 21.2% feared treatment might be withheld (see Appendix 2 and Table S2).

Regarding ACDs, the majority (83.2%) expressed neutral attitudes, but specific responses were favorable. Most disagreed with negative statements such as “ACDs are unnecessary” (78.8%) and affirmed their usefulness for healthcare providers (70.4%). Still, 56.4% felt uninformed about ACDs, and 38.4% were reluctant to prepare a living will due to inadequate knowledge or resources (see Appendix 2 and Table S2).

The overall attitudes of pharmacy students toward PC, ACP, and ACDs were generally neutral, as summarized in Table 3. Although the initial sample size comprised 250 students, some attitude-related questions had incomplete responses. Consequently, the attitude levels were calculated based on the participants who provided complete data.

Among these 245 respondents, 62.8% expressed neutral attitudes toward palliative care, 10.0% had a positive attitude, and 25.2% demonstrated a negative attitude. For advance care

planning, from a total of 236 respondents, 56.0% held neutral attitudes, 36.8% positive attitudes, and only 1.6% negative attitudes. Regarding advance care directives, of the 228 respondents, the majority (83.2%) expressed neutral attitudes, 2.4% positive attitudes, and 5.6% negative attitudes.

Associations between demographics, knowledge, and attitudes

Statistical tests revealed significant relationships between several demographic variables and knowledge scores. Age and year of study were significantly associated with knowledge in both domains ($p < 0.001$). Prior palliative care training was significantly related to ACP/ACDs knowledge ($p = 0.031$). No significant associations were observed between gender, caregiving experience, and knowledge scores (Table 4).

Attitudes toward PC were significantly influenced only by prior experience caring for a dying family member ($p = 0.006$). No demographic factors were significantly associated with ACP and ACDs attitudes (Table 5).

DISCUSSION

Baseline Characteristics

This study investigated pharmacy students’ knowledge and attitudes toward PC, ACP, and ACDs, including key demographic and experiential predictors. The survey achieved a high response rate, with most respondents being female, aged 21 to 25, and in their final academic years, which aligns with national data on Thai pharmacy students. Only a minority had received formal EOL care education, despite nearly half having caregiving experience, mirroring findings among healthcare students in Northwest Ethiopia¹⁶. In contrast, Thai nursing students²⁶, general practitioners²⁷, and healthcare students in Australia²⁸, Malaysia²⁹, Pakistan³⁰, China¹⁹, and Jordan³¹ reported greater EOL education exposure. These disparities underscore the need to integrate both theoretical and practical palliative care components in Thai pharmacy curricula.

Knowledge of palliative care, advance care planning, and advance care directives

Students demonstrated moderate knowledge of PC, echoing findings from other studies where palliative care was valued conceptually but struggled with clinical application^{14,26,27,31–34}. Conceptual understanding was strong, particularly regarding quality-of-life and team-based care, but knowledge of complex symptom management was limited, highlighting insufficient clinical preparation in EOL pharmacotherapy.

Knowledge of ACP and ACDs was also moderate. Although most students recognized patient autonomy and healthcare proxies, misconceptions about legal procedures persisted. Compared with medical students¹⁷ and healthcare professionals³⁵, scores were slightly higher, possibly reflecting Thailand’s



recent ACP policy frameworks¹⁰, but practical understanding remained limited. Notably, healthcare professionals in other studies reported higher knowledge than pharmacy students, underscoring the need for improved education^{36–38}.

Attitude of palliative care, advance care planning, and advance care directives

Overall, student attitudes toward PC were neutral, although the majority supported its early initiation. This neutrality may be attributable to limited clinical exposure. Previous studies have shown that experiential learning, rather than classroom instruction, exerts a greater influence on shaping positive attitudes^{19,31,39}. Interdisciplinary simulations, such as those used by Mollman et al.⁴⁰ have demonstrated lasting improvements in student confidence and clarity of roles.

Attitudes toward ACP were generally neutral. While most students agreed it respects patient wishes and reduces overtreatment, some feared that after signing ACP, they would simply be left waiting for death and medical staff might withdraw care, reflecting discomfort with EOL decision-making. Previous studies show that interventions such as virtual reality and workshops can foster more positive views on ACP^{41,42}. In comparison, studies from China²⁴, Singapore⁴³, Malaysia⁴⁴, and the USA⁴⁵ reported more favorable attitudes, highlighting the need for targeted education to address misconceptions.

Attitudes toward ACDs were predominantly neutral, although students largely agreed that ACDs is helpful for providers and should not be disregarded. This finding aligns with studies conducted in China, Australia, and Korea^{17,46,47}. The main barriers were insufficient information and limited resources. This finding is consistent with a survey conducted in a family clinic in Bangkok⁴⁸. Cultural beliefs may also influence these findings. Thai values rooted in Buddhism, filial piety, and family-centered decision-making can discourage open discussions about death and individual autonomy^{3,49}.

Associations between demographics, knowledge, and attitudes

Determinants of knowledge and attitude. Age, year of study, and prior training were significantly associated with higher knowledge scores, consistent with findings among nurses in Iran⁵⁰. Senior students outperformed their juniors, suggesting knowledge accumulates with academic progression. However, neither gender nor caregiving experience predicted knowledge, which differs from nursing studies where personal bereavement influenced knowledge and empathy²⁶. Comparatively, only prior training was significant among Thai general practitioners²⁷, while gender was the sole determinant among Jordanian medical students⁵¹.

Personal experience caring for a dying relative was the only significant predictor of palliative care attitudes. This is consistent with findings among Chinese nursing students⁵², where direct

exposure enhanced compassion and reduced discomfort with death, underscoring the importance of experiential learning in developing ethical sensitivity and emotional resilience in end-of-life care. In contrast, a study of Jordanian medical students identified gender and exposure to palliative care as significant predictors³¹, while research among Nigerian pharmacists showed that those with palliative care training felt more comfortable with patients than those without training¹⁴.

Strengths

This study is among the first to assess pharmacy students' knowledge and attitudes toward PC, ACP, and ACDs in Thailand. By including students from all academic years, the study captures developmental trends in education and preparedness. The use of validated and adapted instruments enhances methodological rigor, and the high response rate supports the representativeness of the findings. By examining both cognitive (knowledge) and affective (attitude) dimensions alongside demographic and experiential variables, the study provides a comprehensive understanding of pharmacy students' educational needs in EOL care.

Limitations

There are several limitations. First, the use of convenience sampling from a single institution limits the generalizability of the findings. Second, as a cross-sectional study, it provides only a snapshot in time and cannot assess longitudinal knowledge growth or causality. Third, while instruments were adapted from validated sources, local modifications may affect comparability with other international studies. Fourth, self-reported measures may introduce bias, especially on sensitive topics like death and dying and their experience. To minimise this, responses were collected anonymously, and participants were reminded of the voluntary nature of the study and the confidentiality of their answers. Future research may consider incorporating indirect questioning methods, validated social-desirability scales, or qualitative triangulation to better assess the extent and direction of this potential bias. While our analyses focused on overall associations using chi-square and Fisher's Exact Tests, the available sample size may not have provided sufficient power to detect small effects across demographic subgroups. We suggested future multicenter studies with stratified sampling to validate subgroup findings. Furthermore, there was an overrepresentation of senior students (5th and 6th years) compared to junior students. This sampling bias may reflect greater interest or clinical relevance of the topic to senior students, which limits the generalizability of the findings to the entire student population.

CONCLUSION

This study highlights that while pharmacy students in Thailand demonstrate moderate to high levels of knowledge regarding

Table 4. Association between demographic and knowledge levels

Variables	Knowledge PC, N		χ^2	Knowledge ACP and ACDs, N		χ^2
	Low	Moderate to high	(p-value)	Low	Moderate to high	(p-value)
Gender						
Male	15	50	3.510	14	48	0.956
Female	23	152	(0.061)	29	142	(0.328)
Age (years)						
18-20	17	27	21.195	16	25	13.313
21-25 and Over 25	21	176	(< 0.001)	28	165	(< 0.001)
Year of study						
Years 1-2	21	35	26.364	19	34	12.473
Years 3-6	17	170	(< 0.001)	26	157	(< 0.001)
Complete PC course/training						
Yes	3	39	2.743	3	39	4.656
No	35	167	(0.107*)	42	153	(0.031*)
Experience caring for patients with chronic disease						
Yes	6	40	0.276	8	36	0.023
No	32	166	(0.599)	37	156	(0.880)
Experience caring for a family member close to death						
Yes	10	46	0.288	11	46	0.005
No	28	160	(0.591)	34	146	(0.945)

PC: Palliative care, ACP: Advance care planning, ACDs: Advance care directives, p-values marked with an asterisk (*) were calculated using Fisher's Exact Test.

Table 5. Association between demographic and attitude levels

Variables	Attitude PC, N		χ^2	Attitude ACP, N		χ^2	Attitude ACDs, N		χ^2
	Negative	Neutral to positive	(p-value)	Negative	Neutral to positive	(p-value)	Negative	Neutral to positive	(p-value)
Gender									
Male	20	45	1.185	1	63	0.014	4	59	0.001
Female	42	134	(0.276)	3	165	(1.000*)	10	151	(1.000*)
Age (years)									
18-20	16	28	3.188	1	38	0.195	2	41	0.232
21-25 and Over 25	46	151	(0.074)	3	190	(0.524*)	12	169	(1.000*)
Year of study									
Years 1-2	19	37	2.495	1	51	0.019	3	53	0.084
Years 3-6	44	144	(0.114)	3	180	(1.000*)	11	160	(1.000*)
Complete PC course/training									
Yes	6	36	3.466	1	39	0.187	2	38	0.109
No	57	146	(0.063)	3	193	(0.527*)	12	176	(1.000*)
Experience caring for patients with chronic disease									
Yes	11	36	0.162	0	45	0.959	2	40	0.170
No	52	146	(0.687)	4	187	(1.000*)	12	174	(1.000*)
Experience caring for a family member close to death									
Yes	7	51	7.407	0	56	1.266	4	51	0.161
No	56	131	(0.006)	4	176	(0.575*)	10	163	(0.748*)

PC: Palliative care, ACP: Advance care planning, ACDs: Advance care directives, p-values marked with an asterisk (*) were calculated using Fisher's Exact Test.

AC, ACP, and ACDs, their overall attitudes remain largely neutral. Significant knowledge gaps were identified in key clinical areas, including delirium management, opioid toxicity, and the legal understanding of living wills, indicating the need for targeted educational interventions. To address these deficiencies, pharmacy curricula should incorporate structured, practical, and interdisciplinary content on EOL care, emphasizing both clinical competency and ethical communication. The introduction of short-course training modules similar to those implemented for medical students could serve as an effective and scalable strategy to enhance learning outcomes. By equipping pharmacy students with the necessary knowledge, skills, and cultural sensitivity, educational institutions can better prepare future pharmacists to contribute meaningfully to interdisciplinary palliative care teams and improve the quality of EOL care delivery for patients and families.

AUTHOR CONTRIBUTIONS

- Solita contributed to the research design, data collection, data analysis, and drafting of the manuscript.
- Nungruthai assisted in data analysis and contributed to manuscript writing and revision.

- Suthan supervised the research process, contributed to the research design, data collection, data analysis, and drafting of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Appendix 1 Knowledge section

Table S1. Knowledge of palliative care, advance care planning, and advance care directives			
Knowledge assessment		Correct response	Incorrect response
Palliative care	Choice	n (%)	n (%)
K1. Palliative care is different from traditional care because.	I don't know	153 (61.2)	96 (38.4)
	Palliative care is curative.		
	Palliative care is equivalent to hospice care.		
	Palliative care is focused on comfort, rather than cure ^a .		
	Palliative care is equivalent to end-of-life care.		
	Palliative care is withdraws care.		
K2. Which of the following members of the healthcare team are important to the delivery of Palliative care?	I don't know	234 (93.6)	15 (6)
	Physicians		
	Nurses		
	Pharmacists		
	Physical and occupational therapists		
	An interdisciplinary team consisting of doctors, nurses, pharmacists, psychologists, social workers, and volunteers etc ^a .		
K3 ^b . Opioids are used to relieve pain in Palliative care. The hallmarks of opioid toxicity are all the following except.	I don't know	165 (66)	83 (33.2)
	Oxygen saturation < 90%		
	Respiratory rate ≤ 10 /min		
	Pinpoint pupils		
	Sedation		
	Jerky movement		
K4. Which is the most appropriate drug in management of delirium in Palliative care.	I don't know	99 (39.6)	150 (60)
	Fentanyl		
	Haloperidol ^a		
	Midazolam		
	Ondansetron		
	Paroxetine		

K5. Management of Catastrophic bleeding in Palliative care includes:	I don't know	23 (9.2)	225 (90)
	Midazolam		
	Vitamin K		
	Dark towel		
	Tranexamic injection in large doses ^a .		
	Midazolam and dark towel		
K6. All adults and children who are terminally ill are candidates for Palliative care services, not just those with cancer.	True ^a	233 (93.2)	16 (6.4)
	False		
K7. Patients receiving radiation for palliation of symptoms are not candidates for Palliative care.	True	187 (74.8)	61 (24.4)
	False ^a		
K8. Palliative care benefits include enhanced quality of life for the patient and family.	True ^a	242 (96.8)	6 (2.4)
	False		
K9. Palliative care benefits include skilled care for terminally ill patients.	True ^a	213 (85.2)	36 (14.4)
	False		
K10. Palliative care benefits include expert pain and symptom management.	True ^a	223 (89.2)	25 (10.0)
	False		
Advance care planning and advance care directives	Choice	n (%)	n (%)
K11. Patients have the right to refuse medical treatment, even if that treatment might keep them alive longer.	True ^a	247 (98.8)	3 (1.2)
	False		
K12. If the doctor believes patients should undergo a treatment, then patients need to undergo it, even if they do not want to.	True	225 (90.0)	25 (10.0)
	False ^a		
K13. A living will is a document saying patients would not want to be kept alive on machines if they were in a terminal state or permanently unconscious.	True ^a	205 (82.0)	45 (18.0)
	False		

K14. A living will is a document saying that patients would not want to be kept alive on machines if they were a burden on their loved ones.	True	92 (36.8)	158 (63.2)
	False ^a		
K15. A living will is a document saying patients would not want to be kept alive on machines if they had a poor quality of life.	True	94 (37.6)	156 (62.4)
	False ^a		
K16. If patients have filled out a will to say how they want their property divided, they do not have to complete a living will.	True	188 (75.2)	59 (23.6)
	False ^a		
K17. A health care proxy or representative is someone who would make medical decisions on a patient's behalf if they were not able to make their own decisions.	True ^a	236 (94.4)	12 (4.8)
	False		
K18. A health care proxy or representative is someone who would make medical decisions on a patient's behalf even if they were able to make their own decisions.	True	185 (74.0)	62 (24.8)
	False ^a		
K19. A person named as a patient's power of attorney is someone who could make any medical decision on their behalf if they were not able to make their own decisions.	True ^a	208 (83.2)	39 (15.6)
	False		
K20. A living will is legal only if it is drawn up by a lawyer.	True	142 (56.8)	106 (42.4)
	False ^a		
K21. A health care proxy or representative is legal only if it is drawn up by a lawyer.	True	104 (41.6)	145 (58.0)
	False ^a		
K22. Once a patient signed a living will, they could not change their mind about how they would want to be treated.	True	182 (72.8)	68 (27.2)
	False ^a		

K23. Once patients named a health care proxy or representative, they could not change their mind and name someone else.	True	180 (72.0)	70 (28.0)
	False ^a		
K24. The best place to keep a living will is in a safety deposit box.	True	111 (44.4)	137 (54.8)
	False ^a		
K25. The doctor would not need a copy of the patient's living will.	True	164 (65.6)	84 (33.6)
	False ^a		

^a : Correct answer, ^b : All answers are correct

Appendix 2 Attitude section

Table S2. Attitude towards palliative care, advance care planning, and advance care directives					
Attitude assessment	n (%)				
Palliative care	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A1. I have been dissatisfied with the available Palliative care services.*	62 (24.8)	75 (30.0)	87 (34.8)	17 (6.8)	6 (2.4)
A2. I feel there is a lack of timely communication between Palliative care providers and myself.*	24 (9.6)	63 (25.2)	110 (44.0)	43 (17.2)	7 (2.8)
A3. I am not familiar with Palliative care services in this community.*	23 (9.2)	31 (12.4)	65 (26.0)	94 (37.6)	34 (13.6)
A4. I am uncertain of the length and types of coverage under the Palliative care benefit.*	15 (6.0)	23 (9.2)	68 (27.2)	89 (35.6)	53 (21.2)
A5. Palliative care is the right for the patient since day one diagnosis of life threatening illness as long as he/she has complex symptoms such as pain and dyspnea.	7 (2.8)	13 (5.2)	49 (19.6)	74 (29.6)	105 (42.0)
A6. Patients or families are unwilling or unready to elect Palliative care services.*	35 (14.0)	73 (29.2)	107 (42.8)	21 (8.4)	12 (4.8)
Advance care planning	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A7. ACP can respect patients' wishes at the end of their lives.	3 (1.2)	1 (0.4)	34 (13.6)	90 (36.0)	120 (48.0)

A8. ACP can reduce conflicts between family members in medical decision-making.	3 (1.2)	3 (1.2)	50 (20.0)	91 (36.4)	100 (40.0)
A9. ACP can reduce the incidence of invalid medical treatment.	6 (2.4)	6 (2.4)	51 (20.4)	102 (40.8)	82 (32.8)
A10. ACP can reduce unnecessary waste of medical resources.	4 (1.6)	5 (2.0)	49 (19.6)	107 (42.8)	83 (33.2)
A11. ACP allowed patients to end their lives without having to suffer excessive pain.	5 (2.0)	4 (1.6)	49 (19.6)	93 (37.2)	97 (38.8)
A12. The implementation of ACP can increase the quality of life of patients at the end of life and die a natural death.	4 (1.6)	1 (0.4)	42 (16.8)	88 (35.2)	114 (45.6)
A13. After signing the ACP, patients feel insecure about their future medical care.*	42 (16.8)	68 (27.2)	87 (34.8)	34 (13.6)	15 (6.0)
A14. After signing the ACP, patients feared that medical staff would no longer provide any medical services.*	52 (20.8)	76 (30.4)	67 (26.8)	42 (16.8)	11 (4.4)
A15. The patient feared that after signing the ACP, they would wait for death.*	47 (18.8)	56 (22.4)	80 (32.0)	45 (18.0)	19 (7.6)
Advance care directives	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A16. The existence of the vital testament is not important.*	120 (48.0)	77 (30.8)	36 (14.4)	11 (4.4)	5 (2.0)
A17. The opinion of the patients should not be respected in the End of Life (EOL) process.*	137 (54.8)	59 (23.6)	37 (14.8)	8 (3.2)	8 (3.2)
A18. ACDs does not reflect the patient's values and preferences when making therapeutic decisions at the End of Life (EOL).*	86 (34.4)	75 (30.0)	66 (26.4)	11 (4.4)	9 (3.6)
A19. ACDs are a useful tool for healthcare professionals when making decisions about End of Life (EOL) patients.*	9 (3.6)	11 (4.4)	53 (21.2)	82 (32.8)	94 (37.6)
A20. The health care prosecutor appointed by the patient does not facilitate the professionals' decision-making.*	38 (15.2)	61 (24.4)	101 (40.4)	34 (13.6)	15 (6.0)

A21. Compliance with ACDs pertains to the physicians.	27 (10.8)	34 (13.6)	117 (46.8)	49 (19.6)	21 (8.4)
A22. ACDs are a legal form of euthanasia.	34 (13.6)	46 (18.4)	107 (42.8)	45 (18.0)	17 (6.8)
A23. It is not important that patients make their vital testament or ACDs.*	101 (40.4)	82 (32.8)	46 (18.4)	15 (6.0)	2 (0.8)
A24. It is not important that all citizens make their vital testament or ACDs.*	97 (38.8)	78 (31.2)	56 (22.4)	14 (5.6)	4 (1.6)
A25. ACDs are important only for religious reasons.*	119 (47.6)	78 (31.2)	40 (16.0)	9 (3.6)	3 (1.2)
A26. Legalization of the vital testament did not contribute to human dignity.*	91 (36.4)	68 (27.2)	64 (25.6)	13 (5.2)	12 (4.8)
A27. Death must be postponed, regardless of the person's condition.	91 (36.4)	58 (23.2)	64 (25.6)	17 (6.8)	18 (7.2)
A28. End of Life (EOL) care should be provided based on the opinion of the health professional.	43 (17.2)	57 (22.8)	97 (38.8)	41 (16.4)	10 (4.0)
A29. End of Life (EOL) care should not be provided based on the patient's opinion.*	104 (41.6)	80 (32.0)	39 (15.6)	18 (7.2)	7 (2.8)
A30. Patients do not want to be able to have an opinion on the care they can receive in an end-of-life situation.*	92 (36.8)	69 (27.6)	67 (26.8)	15 (6.0)	4 (1.6)
A31. End of Life (EOL) care should be provided based on the opinion of the family.	32 (12.8)	44 (17.6)	112 (44.8)	45 (18.0)	15 (6.0)
A32. The patient's family will make the End of Life (EOL) decisions for them, when necessary.	17 (6.8)	26 (10.4)	81 (32.4)	87 (34.8)	36 (14.4)
A33. Patients will overwhelm their family with End of Life (EOL) decisions.*	70 (28.0)	57 (22.8)	81 (32.4)	30 (12.0)	8 (3.2)
A34. The doctor will make the End of Life (EOL) decisions for patients when the time comes.	42 (16.8)	50 (20.0)	94 (37.6)	52 (20.8)	8 (3.2)
A35. The vital testament is only important for elderly and sick people.*	104 (41.6)	68 (27.2)	59 (23.6)	9 (3.6)	7 (2.8)
A36. I am currently healthy, but there may be a need to consider decisions regarding the final phase of my life.	13 (5.2)	16 (6.4)	71 (28.4)	77 (30.8)	70 (28.0)

A37. At my current age, there is no need to consider End of Life (EOL) decisions.	39 (15.6)	68 (27.2)	84 (33.6)	33 (13.2)	24 (9.6)
A38. I have no information on ACDs /vital testaments.	13 (5.2)	12 (4.8)	82 (32.8)	93 (37.2)	48 (19.2)
A39. It is possible to make End of Life (EOL) decisions, even if I cannot imagine myself in such a situation.	7 (2.8)	17 (6.8)	73 (29.2)	88 (35.2)	63 (25.2)
A40. I do not make a Vital Testament because there is still little information available.	21 (8.4)	41 (16.4)	89 (35.6)	75 (30.0)	21 (8.4)
A41. I don't want to think that I will eventually die or become disabled, to the point of not being able to make decisions.	30 (12.0)	47 (18.8)	87 (34.8)	50 (20.0)	32 (12.8)
A42. I feel comfortable discussing living will with HCP.	11 (4.4)	15 (6.0)	66 (26.4)	87 (34.8)	68 (27.2)

*Items marked with an asterisk are reverse-coded.

Appendix 3 English Questionnaire

Research Title:

Knowledge and Attitude about Palliative Care in Pharmacy Students: A Case Study of a University in Northeastern Region of Thailand.

The questionnaire will serve as the primary tool for data collection in this research. Most items are multiple-choice, allowing respondents to select one or multiple answers, or to provide input by selecting or filling in options. Only a few items require handwritten responses.

Instructions on how to answer each question or statement will be provided at the beginning of each section. The questionnaire consists of three main parts as follows:

Part 1: Demographic profile

Part 2: Knowledge about Palliative Care, Advance Care Planning, and Advance Care Directive

Part 2.1: Knowledge about Palliative Care

Part 2.2: Knowledge about Advance Care Planning and Advance Care Directive

Part 3: Attitude towards Palliative Care, Advance Care Planning, and Advance Care Directive

Part 3.1: Attitude towards Palliative Care

Part 3.2: Attitude towards Advance Care Planning



Part I : Demographic Profiles

Instruction: Please answer by selecting one of the following choices or fill in the blank where applicable and relevant to your information with the multiple-choice questions (single answer).

1. Age:

- ☐ 18-20
- ☐ 21-25
- ☐ Over 25
- ☐ Other

2. Gender:

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

3. Year of Study:

- ☐ 1st Year
- ☐ 2nd Year
- ☐ 3rd Year
- ☐ 4th Year
- ☐ 5th Year
- ☐ 6th Year
- ☐ Other (please specify): _____

4. Have you taken any coursework or training related to end-of-life care or living wills? (such as oncology workshop or palliative care course)

- ☐ Yes
- ☐ No

5. If you have answered “Yes” to the question above, please specify which coursework or training related to end-of-life care or living wills you have taken.

6. Have you had experience caring for patients with chronic disease?

☐ Yes

☐ No

7. Have you had experience caring for a family member close to death?

☐ Yes

☐ No

Part II: Knowledge about Palliative Care, Advance Care Planning, and Advance Care Directive

Instruction: Please answer by selecting the choice below where the statements are relevant to your understanding regarding Palliative Care, Advance Care Planning, and Advance Care Directive.

1.1 Palliative Care

8. Palliative care is different from traditional care because:

[0] I don't know

[1] Palliative care is curative.

[2] Palliative care is equivalent to hospice care.

[3] Palliative care is focused on comfort, rather than cure.

[4] Palliative care is equivalent to end-of-life care.

[5] Palliative care is withdraws care.

9. Which of the following members of the healthcare team are important to the delivery of palliative care?

[0] I don't know

[1] Physicians

[2] Nurses

[3] Pharmacists

[4] Physical and occupational therapists

[5] An interdisciplinary team consisting of doctors, nurses, pharmacists, psychologists, social workers, and volunteers etc.

10. Opioids are used to relieve pain in palliative care. The hallmarks of opioid toxicity are all the following except:

- [0] I don't know
- [1] Oxygen saturation < 90%
- [2] Respiratory rate ≤ 10 /min
- [3] Pinpoint pupils
- [4] Sedation
- [5] Jerky movement

11. Which is the most appropriate drug in management of delirium in palliative care:

- [0] I don't know
- [1] Fentanyl
- [2] Haloperidol
- [3] Midazolam
- [4] Ondansetron
- [5] Paroxetine

12. Management of Catastrophic bleeding in palliative care includes:

- [0] I don't know
- [1] Midazolam
- [2] Vitamin K
- [3] Dark towel
- [4] Tranexamic injection in large doses.
- [5] Midazolam and dark towel

No	Question	True	False
13	All adults and children who are terminally ill are candidates for palliative care services, not just those with cancer.		
14	Patients receiving radiation for palliation of symptoms are not candidates for palliative care		
15	Palliative care benefits include enhanced quality of life for the patient and family.		
16	Palliative care benefits include skilled care for terminally ill patients.		
17	Palliative care benefits include expert pain and symptom management.		

2.2 Advance Care Planning and Advance Care Directive

No.	Question	True	False
18	Patients have the right to refuse medical treatment, even if that treatment might keep them alive longer.		
19	If the doctor believes patients should undergo a treatment, then patients need to undergo it, even if they do not want to.		
20	A living will is a document saying patients would not want to be kept alive on machines if they were in a terminal state or permanently unconscious.		
21	A living will is a document saying that patients would not want to be kept alive on machines if they were a burden on their loved ones.		
22	A living will is a document saying patients would not want to be kept alive on machines if they had a poor quality of life.		
23	If patients have filled out a will to say how they want their property divided, they do not have to complete a living will.		
24	A health care proxy or representative is someone who would make medical decisions on a patient's behalf if they were not able to make their own decisions.		
25	A health care proxy or representative is someone who would make medical decisions on a patient's behalf even if they were able to make their own decisions.		
26	A person named as a patient's power of attorney is someone who could make any medical decision on their behalf if they were not able to make their own decisions.		
27	A living will is legal only if it is drawn up by a lawyer.		

28	A health care proxy or representative is legal only if it is drawn up by a lawyer.		
29	Once a patient signed a living will, they could not change their mind about how they would want to be treated.		
30	Once patients named a health care proxy or representative, they could not change their mind and name someone else.		
31	The best place to keep a living will is in a safety deposit box.		
32	The doctor would not need a copy of the patient's living will.		

Part III: Attitude toward Palliative Care, Advance Care Planning, and Advance Care Directive

Instruction: Please answer by selecting the choice below where the questions are relevant to your opinions and beliefs toward Palliative Care, Advance Care Planning, and Advance Care Directive.

(1) = Strongly Disagree, **(2)** = Disagree, **(3)** = Neutral, **(4)** = Agree, **(5)** = Strongly agree

3.1 Attitude towards palliative care

No.	Question	(1)	(2)	(3)	(4)	(5)
33	I have been dissatisfied with the available palliative care services.*					
34	I feel there is a lack of timely communication between palliative care providers and myself.*					
35	I am not familiar with palliative care services in this community.*					
36	I am uncertain of the length and types of coverage under the palliative care benefit.*					
37	Palliative care is the right for the patient since day one diagnosis of life threatening illness as long as he/she has complex symptoms such as pain, dyspnea.					
38	Patients or families are unwilling or unready to elect palliative care services.*					

3.2 Attitude towards Advance Care Planning

Note: ACP is Advance care planning

No.	Question	(1)	(2)	(3)	(4)	(5)
39	ACP can respect patients' wishes at the end of their lives.					
40	ACP can reduce conflicts between family members in medical decision-making.					
41	ACP can reduce the incidence of invalid medical treatment.					
42	ACP can reduce unnecessary waste of medical resources.					
43	ACP allowed patients to end their lives without having to suffer excessive pain.					
44	The implementation of ACP can increase the quality of life of patients at the end of life and die a natural death.					
45	After signing the ACP, patients feel insecure about their future medical care.*					
46	After signing the ACP, patients feared that medical staff would no longer provide any medical services.*					
47	The patient feared that after signing the ACP, they would wait for death.*					

3.3 Attitude towards Advance Care Directives

Note: EOL is End of life, ACDs is Advance care directives

No.	Question	(1)	(2)	(3)	(4)	(5)
48	The existence of the vital testament is not important.*					
49	The opinion of the patients should not be respected in the EOL process.*					
50	ACDs does not reflect the patient's values and preferences when making therapeutic decisions at the EOL.*					
51	ACDs are a useful tool for healthcare professionals when making decisions about EOL patients.*					
52	The health care prosecutor appointed by the patient does not facilitate the professionals' decision-making.*					
53	Compliance with ACDs pertain to the physicians.					
54	ACDs are a legal form of euthanasia.					
55	It is not important that patients make their vital testament or ACDs.*					
56	It is not important that all citizens make their vital testament or ACDs.*					

57	ACDs are important only for religious reasons.*					
58	Legalization of the vital testament did not contribute to human dignity.*					
59	Death must be postponed, regardless of the person's condition.					
60	EOL care should be provided based on the opinion of the health professional.					
61	EOL care should not be provided based on the patient's opinion.*					
62	Patients do not want to be able to have an opinion on the care they can receive in an end-of-life situation.*					
63	EOLcare should be provided based on the opinion of the family.					
64	The patient's family will make the EOL decisions for them, when necessary.					
65	Patients will overwhelm their family with EOL decisions.*					
66	The doctor will make the EOL decisions for patients when the time comes.					
67	The vital testament is only important for elderly and sick people.*					
68	I am currently healthy, but there may be a need to consider decisions regarding the final phase of my life.					
69	At my current age, there is no need to consider EOL decisions.					
70	I have no information on ACDs /vital statement.					
71	It is possible to make EOL decisions, even if I cannot imagine myself in such a situation.					
72	I do not make a Vital Testament because there is still little information available.					
73	I don't want to think that I will eventually die or become disabled, to the point of not being able to make decisions.					
74	I feel comfortable to discuss living will with HCP.					

***Negative Item**