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Research article

Use of e-learning in improving the knowledge, attitudes and confidence of rehabilitation therapists towards palliative care

Melissa Xin Yi Ng[1,*], Josiah Geng Xiang Koh[2], Qian Ci Tang[2], Halim Zul Fahmi[1], Xin Yi Lam[2], Wei Lin Teoh[2], Bernice Lip Lin Soon[2], Mona Oh Yak Mok[1], Xin Mei Ng[2], Chalani Udhyami Ubeynarayana[3] and Laurence Lean Chin Tan[4]

[1] Rehabilitation Services, Yishun Community Hospital, Singapore
[2] Rehabilitation Services, Khoo Teck Puat Hospital, Singapore
[3] Clinical Research Unit, Khoo Teck Puat Hospital, Singapore
[4] Geriatric Medicine and Palliative Care, Khoo Teck Puat Hospital, Singapore

* **Correspondence:** Email: ng.melissa.xy@nhghealth.com.sg.

Abstract: *Background:* Rehabilitation therapists increasingly encounter patients with palliative care needs, yet structured palliative care training for this group remains limited. E-learning has demonstrated effectiveness in healthcare education, but evidence specific to rehabilitation therapists is scarce. This study examined the effectiveness of an animated e-learning intervention in improving therapists' knowledge, attitudes, and confidence toward palliative care. *Methods:* A pre-post cohort study was used. Rehabilitation therapists from two hospitals completed an e-learning intervention consisting of a 12-part animated palliative care video series (Powerfacts). Knowledge (25-item quiz), attitudes (Frommelt Attitude Toward Care Of the Dying Scale), and confidence (single Likert item) were assessed before and after the intervention. Baseline differences and change scores were compared across experience and exposure. Paired and independent t-tests were conducted. *Results:* Of 108 participants who started the intervention, 73 completed both assessments. Baseline scores indicated gaps in knowledge, attitudes, and confidence, with significantly higher knowledge (mean difference −2.37) and confidence (mean difference −0.79) among therapists with prior exposure to palliative care. Following the intervention, significant improvements were observed in knowledge (mean difference −3.92; $p < 0.001$), attitudes (mean difference −6.98; $p = 0.004$), and confidence (mean difference −0.90; $p < 0.001$). Change scores did not differ significantly across experience or exposure groups, indicating consistent benefits across demographic subgroups. *Conclusion:* Animated e-learning significantly improved rehabilitation therapists' knowledge, attitudes, and confidence in palliative care, addressing

foundational gaps identified at baseline. E-learning is well-suited for basic palliative care training and may complement blended approaches for more advanced competencies. Integrating digital modules within multimodal educational frameworks may enhance the preparedness of rehabilitation therapists to support patients with serious illness.

Keywords: education; palliative care; e-learning; knowledge; attitudes; rehabilitation therapists

1. Introduction

Palliative care aims to alleviate physical, psychosocial, and spiritual distress and optimize quality of life for individuals with life-limiting illness and their families [1]. It is delivered across acute, community, and long-term care settings by generalist and specialist providers, often within multidisciplinary teams. Rehabilitation therapists—including physiotherapists, occupational therapists, and speech therapists—play an important role in this landscape. Their profession-specific expertise supports comfort, functional ability, participation, and goal-setting, complementing pharmacological and nursing care [2]. Despite this contribution, many allied health professionals report limited preparedness and confidence when caring for patients with life-limiting illness, underscoring the need for structured and accessible palliative care training [3].

As the prevalence of chronic, progressive, and life-limiting conditions increases, rehabilitation therapists are increasingly expected to encounter patients with palliative care needs in both acute and community hospitals [4]. Yet, palliative care content remains minimally represented in undergraduate rehabilitation curricula, and opportunities for formal training vary widely across institutions. Existing studies consistently show that healthcare professionals feel underprepared for end-of-life care, particularly in communication, psychosocial support, and symptom management [5]. For rehabilitation therapists, these gaps may affect clinical decision-making, interdisciplinary collaboration, and the ability to align rehabilitation goals with patients' values and priorities.

Concurrently, medical education has undergone a rapid shift toward digital and virtual learning environments. E-learning has demonstrated effectiveness comparable to traditional in-person teaching for knowledge and skills acquisition, with additional advantages in accessibility, flexibility, and scalability [6–8]. In palliative care, digital learning tools have shown to enhance understanding and application of principles among medical students, nurses, and physicians [9–12]. Animated e-learning may offer pedagogical advantages by reducing cognitive load, supporting multimodal information processing, and enhancing learner engagement. These features are consistent with established multimedia learning theory, which posits that well-designed combinations of visual and verbal information improve cognitive processing and reduce extraneous load [13,14].

However, the empirical evidence specific to rehabilitation therapists remain scarce. Their roles, clinical responsibilities, and training needs differ from those of nurses and physicians. Moreover, existing palliative care education frameworks rarely address rehabilitation-specific competencies. As such, it is unclear whether e-learning can effectively address foundational gaps in knowledge, attitudes, and confidence among rehabilitation therapists.

This study therefore examined the effectiveness of an animated e-learning intervention in improving knowledge, attitudes, and confidence of rehabilitation therapists toward palliative care. By evaluating baseline differences, pre-post changes and the differences between working experience and

exposure groups, the study provides insight into both existing training gaps and the potential of animated e-learning as a scalable modality for foundational palliative care training.

2. Materials and methods

The study was reviewed and approved by the National Healthcare Group (NHG) Domain Specific Review Board (DSRB). Data collection was conducted from February 2021 to February 2022, and analyses were performed on de-identified data to maintain confidentiality.

2.1. Study design and participants

A pre-post cohort study design was adopted to evaluate the effect of an e-learning intervention on rehabilitation therapists' knowledge, attitudes, and confidence toward palliative care. Eligible participants were physiotherapists, occupational therapists, or speech therapists registered with the Allied Health Professionals Council (AHPC), employed at Khoo Teck Puat Hospital or Yishun Community Hospital, and providing inpatient rehabilitation services.

Participants were asked about their exposure to "palliative cases" based on their own clinical awareness. Although no definition was provided during data collection, therapists' understanding is expected to align with the World Health Organization (WHO) definition of palliative care, which describes patients with life-threatening illness requiring holistic, multidisciplinary support [1].

Figure 1 presents the flow of participants from enrolment through completion of the pre-course questionnaire, e-learning intervention, post-course questionnaire, and inclusion in the complete-case analysis.

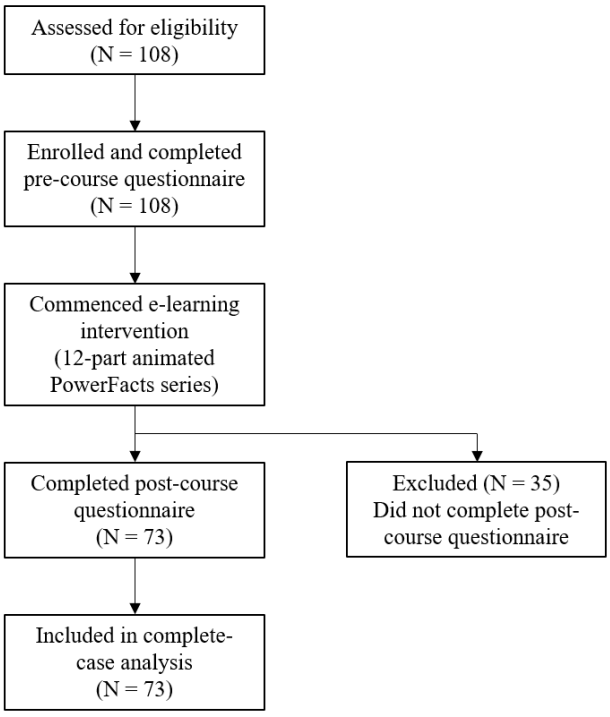


Figure 1. Participant flow through the study.

2.2. Intervention and procedure

The intervention was delivered via the NHG eLEARN Learning Management System (LMS) where therapists accessed the course asynchronously. The e-learning course comprised a 12-part series of bite-sized animated educational videos about palliative care (PowerFacts). Developed by a multidisciplinary team with palliative care experience, each video was 3–5 min long and was accompanied by a short quiz of 2–3 questions for learning evaluation.

Participants completed a pre-course questionnaire and subsequently undertook the e-learning intervention at their own time over 3 weeks. The pre-course questionnaire collected demographic information and included 56 items assessing palliative knowledge, attitudes, and confidence. An identical questionnaire was administered post-intervention. All data were de-identified prior to analysis.

2.3. Measures

For *knowledge*, a multiple-choice question (MCQ) assessment with 25 questions was constructed by a multidisciplinary healthcare team with palliative care training (Supplementary Appendix 1). The questions reflected information taught in PowerFacts with 20 questions assessing knowledge of palliative care, and 5 questions assessing knowledge of rehabilitation in palliative care. Each item had four response options and one correct answer. One point was awarded per correct response, with a maximum of 25 points.

For *attitudes*, the Frommelt Attitude Toward Care of the Dying Scale (FATCOD) was used to evaluate participants' perceptions and comfort in providing palliative care (Supplementary Appendix 2). The scale comprised 15 positive and 15 negative statements. Participants were required to rate the 30 statements on a 5-point Likert scale. Negative items were reverse-coded before summation. Total scores ranged from 30 to 150, with higher scores indicating more positive attitudes [15]. In addition, the FATCOD was adapted for therapists by replacing references to "nurse" with "allied health professional".

For *confidence*, a 5-point Likert scale response to the statement: "I am confident in seeing patients with palliative care needs", was used to evaluate participants' perceived confidence in caring for patients with palliative needs.

2.4. Statistical analysis

Descriptive statistics summarized participant characteristics. Paired t-tests compared pre- and post-intervention scores. Independent t-tests examined baseline differences and change scores across working experience (<3 vs ≥3 years) and exposure to palliative cases (no: 0–1 vs yes: >1 case/month). To quantify the magnitude of differences, effect sizes were calculated using Cohen's d_z for paired comparisons and Cohen's d for independent comparisons, interpreted using conventional thresholds (0.20 small, 0.50 medium, 0.80 large) [16]. Internal consistency was assessed using Cronbach's alpha for both the knowledge MCQ assessment and the FATCOD, calculated using pre-intervention scores.

Participants who did not complete the post-course questionnaire were excluded listwise. Item-level missingness among completers was minimal and occurred in a random, non-systematic manner. No further missing data modeling was performed. A complete-case analysis was therefore undertaken, yielding an analytical sample of 73 participants.

Normality was assessed using Shapiro–Wilk W test and Skewness and Kurtosis tests. Several variables deviated from normality; however, given the sample size (n = 73), parametric tests remain robust under the central limit theorem [17]. Subgroup analyses were exploratory and not adjusted for multiple comparisons. All statistical analyses were performed using StataNow Standard Edition version 18.5 (Stata Corp LLC, College Station, TX, USA).

3. Results

3.1. Reliability of study measures

Seventy-three participants were included in the complete-case analysis. Internal consistency was assessed using pre-intervention data prior to substantive analyses. The knowledge assessment demonstrated acceptable reliability (Cronbach's $\alpha = 0.66$), while the FATCOD scale showed good reliability ($\alpha = 0.80$), consistent with prior validation work [15].

Table 1. Demographics characteristics of participants (N = 73).

Demographics	N	%
Gender		
Female	62	84.9
Male	11	15.1
Age group (years)		
18–24	14	19.2
25–44	57	78.1
45–64	2	2.7
Profession		
Physiotherapist	32	43.8
Occupational therapist	25	34.2
Speech therapist	16	21.9
Educational qualifications		
Diploma	1	1.4
Degree	67	91.8
Master/PHD	5	6.8
Working experience (years)		
<3	39	53.4
≥3	34	46.6
Exposure to palliative care (palliative cases seen in a month)		
No (0–1)	15	20.5
Yes (>1)	58	79.5

Note: Values are presented as number of participants with corresponding percentages. Percentages are rounded to the nearest decimal place; therefore, cumulative totals may not sum to 100% due to rounding.

3.2. Sample characteristics

Of the 108 rehabilitation therapists, 73 participants (67.6%) completed both the pre- and post-course questionnaire and were included in the final analysis. Thirty-five participants did not complete the post-course questionnaire and were excluded. Item-level missingness among completers was minimal and random. Table 1 summarizes the participant characteristics. Participants were predominantly women (84.9%), aged 25–44 years (78.1%), and held degree-level qualifications (91.8%). Physiotherapists comprised the largest professional group (43.8%). Working experience was quite evenly distributed, and most therapists (79.5%) reported exposure to more than one palliative case per month.

Table 2. Baseline differences in knowledge, attitudes, and confidence across experience and exposure groups.

	N	Mean (SD)	Mean difference	95% CI	t-value	p-value	Effect size (Cohen's d)
Working experience							
Knowledge							
<3 years	39	18.49 (3.15)					
≥3 years	34	19.76 (3.00)	−1.27	−2.72, 0.16	−1.77	0.082	−0.415
Attitudes							
<3 years	39	113.18 (7.17)					
≥3 years	34	113.15 (9.12)	0.03	−3.77, 3.84	0.02	0.987	0.004
Confidence							
<3 years	39	2.41 (0.94)					
≥3 years	34	2.88 (0.77)	−0.47	−0.88, −0.07	−2.33	0.023*	−0.550
Exposure to palliative cases							
Knowledge							
No	15	17.20 (3.03)					
Yes	58	19.57 (2.99)	−2.37	−4.10, −0.64	−2.73	0.008**	−0.787
Attitudes							
No	15	112.33 (8.34)					
Yes	58	113.38 (8.07)	−1.05	−5.74, 3.65	−0.44	0.658	−0.127
Confidence							
No	15	2.00 (0.93)					
Yes	58	2.79 (0.81)	−0.79	−1.28, −0.31	−3.28	0.002**	−0.911

Note: Values are presented as mean (SD). SD: standard deviation; CI: confidence interval. Mean differences represent the difference between the <3 years and ≥3 years groups, and between the "No exposure" and "Yes exposure" groups. Negative mean differences indicate higher scores in the ≥3 years or "Yes exposure" groups. Independent t-tests were conducted assuming equal variances. *$p < 0.05$, **$p < 0.01$

3.3. Baseline differences across experience and exposure groups

Baseline comparisons were conducted to examine whether therapists' knowledge, attitudes, and confidence differed according to working experience (<3 vs ≥3 years) and exposure to palliative cases (no: 0–1 vs yes: >1 case/month). Table 2 summarizes these comparisons.

Therapists with ≥3 years of experience demonstrated slightly higher knowledge scores than those with <3 years, although the difference was not statistically significant (mean difference = −1.27; p = 0.082). Attitude scores were comparable between groups. Confidence differed significantly, with more experienced therapists reporting higher confidence (mean difference = −0.47; p = 0.023; d = −0.550), reflecting a moderate effect size.

On the other hand, therapists with exposure to patients with palliative needs scored significantly higher in knowledge (mean difference = −2.37; p = 0.008) and confidence (mean difference = −0.79; p = 0.002) than those without. Both effect sizes were large. Attitude scores did not differ significantly between these groups.

3.4. Pre-post intervention differences

Paired t-tests demonstrated significant improvements across all three outcomes following the e-learning intervention (Table 3). Knowledge scores increased from a mean of 19.08 (SD = 3.13) to 23.00 (SD = 1.94), yielding a large effect size (p < 0.001; d_z = −1.142). Attitude scores improved by 6.98 from 113.16 (SD = 8.08) to 120.14 (SD = 18.50), with a small effect size (p = 0.004; d_z = −0.354). Confidence also improved significantly by 0.90 post-intervention with a moderate effect size (p < 0.001; d_z = −0.782).

Table 3. Pre-post differences in knowledge, attitudes, and confidence.

Outcome		Mean (SD)	Mean difference	95% CI	t-value	p-value	Effect size (Cohen's d_z)
Knowledge	Pre	19.08 (3.13)					
	Post	23.00 (1.94)	−3.92	−4.72, −3.12	−9.76	<0.001***	−1.142
Attitudes	Pre	113.16 (8.08)					
	Post	120.14 (18.50)	−6.98	−11.57, −2.37	−3.02	0.004**	−0.354
Confidence	Pre	2.63 (0.89)					
	Post	3.53 (0.80)	−0.90	−1.17, −0.63	−6.68	<0.001***	−0.782

Note: Values are presented as mean (SD). SD: standard deviation; CI: confidence interval. Mean differences represent pre-test minus post-test scores. Negative values indicate higher post-test scores. Paired t-tests were conducted assuming equal variances. Effect sizes are reported as Cohen's d_z. ** p < 0.01, *** p < 0.001.

3.5. Change score differences across experience and exposure groups

Change scores did not differ significantly across experience groups (Table 4). Improvements in knowledge, attitudes, and confidence were comparable between therapists with <3 years and ≥3 years of experience. Similarly, change scores did not differ significantly across exposure groups, although therapists without exposure demonstrated an insignificantly larger knowledge gain (mean

difference = 1.87; p = 0.060; d = 0.570). Overall, the intervention produced consistent benefits across these subgroups.

Table 4. Change score differences in knowledge, attitudes, and confidence across experience and exposure groups.

	N	Mean (SD)	Mean difference	95% CI	t-value	p-value	Effect size (Cohen's d)
Working experience							
Knowledge							
<3 years	39	4.36 (3.48)					
≥3 years	34	3.41 (3.36)	0.95	−0.65, 2.55	1.18	0.242	0.277
Attitudes							
<3 years	39	7.10 (23.96)					
≥3 years	34	6.82 (13.70)	0.28	−9.01, 9.57	0.06	0.952	0.014
Confidence							
<3 years	39	1.10 (1.14)					
≥3 years	34	0.68 (1.15)	0.42	−0.11, 0.96	1.59	0.117	0.372
Exposure to palliative cases							
Knowledge							
No	15	5.40 (3.11)					
Yes	58	3.53 (3.43)	1.87	−0.08, 3.81	1.91	0.060	0.570
Attitudes							
No	15	8.40 (7.31)					
Yes	58	6.60 (21.85)	1.80	−9.67, 13.26	0.31	0.756	0.110
Confidence							
No	15	1.33 (1.54)					
Yes	58	0.79 (1.02)	0.54	−0.12, 1.20	1.63	0.107	0.413

Note: Values are presented as mean change (SD). SD: standard deviation; CI: confidence interval. Mean differences represent the difference between the <3 years and ≥3 years groups, and between the "No exposure" and "Yes exposure" groups. Independent t-tests were conducted assuming equal variances.

4. Discussion

This study examined the effectiveness of an animated e-learning intervention in improving rehabilitation therapists' knowledge, attitudes, and confidence toward palliative care. Significant improvements were observed across all three domains, demonstrating that animated digital learning can effectively deliver foundational palliative care content to rehabilitation professionals.

4.1. Baseline scores and pre-intervention gaps

To the best of our knowledge, this study is one of the first to examine the impact of palliative training via e-learning on the knowledge, attitudes, and confidence of rehabilitation therapists. It also highlights the potential of adopting e-learning as a tool for palliative training among this professional group.

Effective palliative care delivery requires adequate knowledge, skills, and attitudes [18,19]. However, our pre-intervention data suggest possible gaps in knowledge, attitudes, and confidence among participants. These gaps are consistent with the limited representation of palliative care content in undergraduate rehabilitation curricula and the variability of formal training opportunities. Therapists with greater exposure to palliative cases showed significantly higher baseline knowledge and confidence, suggesting that experiential contact may enhance familiarity and perceived competence. In contrast, attitudes did not differ significantly across exposure groups, echoing findings among nurses that attitudes toward end-of-life care may be shaped by broader personal, cultural, and professional factors rather than exposure alone [19].

Baseline FATCOD scores in this cohort (mean = 113.17) were lower than those reported among medical students locally (120.30) [20] but higher than those of nursing home staff (95.4) [21]. This pattern aligns with the emerging recognition that rehabilitation therapists require structured palliative care training to support their roles within multidisciplinary teams.

4.2. Effectiveness of animated e-learning

The intervention produced statistically significant and substantial gains in knowledge. The animated, bite-sized format may have supported engagement and facilitated retention, consistent with multimedia learning theory, which posits that well-designed visual–verbal materials reduce cognitive load and enhance learning [13,14]. Moreover, the framework aligns with adult learning principles that emphasize autonomy, relevance, and multimodal presentation [22,23]. These findings mirror evidence demonstrating that digital palliative care programs can improve knowledge and self-efficacy across diverse healthcare groups [10,11,24,25].

The improvement in attitudes is noteworthy given the affective and experiential nature of end-of-life care [19]. Although the effect size was small, the direction of change suggests that animated e-learning may plausibly help shape comfort and perspectives toward caring for patients with life-limiting illness. Confidence also improved meaningfully, indicating that foundational digital content may strengthen perceived readiness to engage with palliative care needs.

4.3. Uniform benefits across experience and exposure groups

Subgroup analyses revealed no significant differences in change scores across experience or exposure groups, suggesting that both novice and experienced therapists achieved comparable improvements. This indicates that the intervention remained effective regardless of therapists' prior familiarity with palliative care. Similar findings have been reported in studies where structured educational content produced comparable gains across novice and experienced learners [26,27]. This highlights the potential scalability of animated e-learning as a baseline training tool for therapists, irrespective of their baseline experience or exposure level.

4.4. Implications for palliative education

The knowledge and competencies required in palliative care vary according to professional role, work setting, interdisciplinary involvement, and complexity of care needs [5,28]. Existing literature describes a three-tiered approach to palliative education, in which Tier 1 is the palliative care approach

(basic training), Tier 2 is the general palliative care (intermediate training), and Tier 3 is the specialist palliative care (specialist training) [4,29,30]. Integrating this tiered framework with recommended pedagogical modalities indicates that e-learning is optimally aligned with Tier 1, where foundational knowledge acquisition and the development of core attitudes are the primary focus. As learners progress to Tiers 2 and 3, increasing clinical complexity necessitates blended learning approaches that combine digital modules with simulation, case-based discussion, reflective practice, and supervised clinical exposure. Although e-learning effectively supports foundational cognitive learning [31], higher-order competencies are more robustly developed when digital content is paired with experiential or supervised practice [32,33]. The evidence from nursing home and general practice contexts similarly demonstrates that blended approaches enhance applied competence in end-of-life care [34,35]. Collectively, this literature highlights the necessity for multimodal, experiential learning pathways as learners progress to more advanced tiers of palliative care training.

4.5. Limitations

Limitations of the study should be acknowledged. Attrition was notable, with approximately one-third of participants not completing the post-course assessment. Although item-level missingness among completers was minimal and appeared random, the potential for attrition bias cannot be excluded. Moreover, baseline characteristics of non-completers were not available for comparison, limiting our ability to fully assess attrition bias. The locally developed knowledge assessment, while aligned with course content, was not formally validated and may have contributed to ceiling effects. The single-item confidence measure also limits interpretability of self-efficacy outcomes. Additionally, behavioral and clinical outcomes were not assessed; future research should examine whether improvements translate into practice changes or patient-centered outcomes. Finally, the study was conducted within a single healthcare cluster, which may limit generalizability.

5. Conclusion

Rehabilitation therapists play an essential role in supporting patients with serious illness, yet structured palliative care training for this group remains limited. This study demonstrates that an animated e-learning intervention can significantly improve therapists' knowledge, attitudes, and confidence, addressing foundational gaps identified at baseline. Improvements were consistent across experience and exposure groups, supporting the use of e-learning as an equitable and scalable modality for basic palliative care training.

However, palliative care encompasses complex communication and clinical skills that require experiential learning. E-learning should therefore be integrated within a multimodal educational framework that includes simulation, case-based discussion, and supervised practice, particularly for more specialized competencies. Future studies should employ validated instruments, address attrition, and evaluate whether gains in knowledge and attitudes translate into clinical behavior and patient-centered outcomes.

Author contributions

MXYN: Conceptualization, data analysis and manuscript revising and final proofreading. JGXK: Conceptualization and data analysis. QCT: Conceptualization and data consolidation. HZF: Data analysis. CUU: Statistical support. LLCT: Conceptualization, supervision of study and manuscript revising. All authors contributed to data collection; manuscript drafting and have read and approved the final manuscript.

Use of AI tools declaration

Artificial intelligence (AI) tool was used only for grammar checking and sentence-level editing. No AI tools were used for data analysis, interpretation, or generation of scientific content. All intellectual content was produced and verified by the authors.

Ethics approval and consent to participate

The National Healthcare Group, Singapore, Domain Specific Review Board (DSRB) reviewed and approved this study protocol (Reference number: 2021/01185). Verbal informed consent forms were obtained from participants. Only de-identified data was analysed.

Conflict of interest

The author declares no conflict of interest.

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