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Full length article

Development and validation of a Care Of the Dying Evaluation - Thai version (CODE-THAI)

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ABSTRACT

Background: Palliative care in Thailand has been integrated into the national healthcare system. Few instruments are available to assess outcomes relating to the quality of death and dying. However, no specific tool exists to evaluate the quality of care during the dying phase. This study aimed to translate into Thai and cross-culturally adapt the 'Care Of the Dying Evaluation' (CODE-THAI). Additionally, the study aimed to evaluate its reliability and validity.

Methods: A forward-backward translation approach was employed. Content validity and cognitive interviews were then conducted. The construct validity, concurrent validity, and reliability were assessed among bereaved relatives recruited from two hospitals in Thailand.

Results: Of the 966 questionnaires distributed, 229 were returned, and 185 (19.2%) were included in the analysis. The CODE-THAI demonstrated linguistic, semantic, and conceptual equivalence, with excellent content validity (CVI = 1.00). The instrument indicated good internal consistency (Cronbach's $\alpha = 0.89$) and excellent test-retest reliability (ICC = 0.81, $p < 0.001$). The four-factor model demonstrated suboptimal fit, with several fit indices failing to reach recommended standards. The concurrent validity was supported by a moderate correlation with the Good Death Inventory-Short Version ($r = 0.41$, $p < 0.001$).

Conclusions: The CODE-THAI represents the first instrument developed to assess the quality of care during the dying phase in Thailand and has demonstrated acceptable psychometric properties. These findings suggest its potential use by healthcare providers for evaluating dying care quality in both clinical practice and research.

1. Introduction

Quality of care (Donabedian, 1988) is recognized as a fundamental paradigm for evaluating and improving medical care. Simultaneously, the quality of care during the dying phase is an essential component of palliative care, focusing specifically on the last days of life. At present, efforts to improve the quality of care during the dying phase are crucial to ensuring dying individuals and their families receive high-quality care and support (Mayland et al., 2022). These efforts have encompassed the development of assessment instruments that serve as indicators of the care quality delivered to end-of-life individuals and their families. One such measure that has been recognized as valid and

reliable, demonstrating strong psychometric properties, is the 'Care Of the Dying Evaluation' (CODE™) tool (Kupeli et al., 2019).

CODE™ is a self-completion tool used with bereaved people after a death. It is designed to assess both the quality of care and the level of support provided to dying individuals and their families in the last days of life. Generally, it is used at least 6–8 weeks after the death (Mayland et al., 2022, 2014, 2019). In addition, CODE™ is an internationally validated tool used within hospital, home, and hospice settings (Mayland et al., 2022, 2014; Chua et al., 2021; Yildiz et al., 2022; Mayland et al., 2017), including Argentina, Brazil, the U.K., Norway, Poland, Uruguay (Mayland et al., 2019, 2021; Haugen et al., 2021), Germany (Vogt et al., 2020; Heckel et al., 2020), Singapore (Chua et al.,

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2021), and China (Zheng et al., 2025a, 2025b).

In Thailand, palliative care has been integrated into the national healthcare system and has also continued to evolve through developments in legislation, policies, religious considerations, and research related to end-of-life care (Kunakornvong and Ngoasri, 2020; Pitanupong and Janmanee, 2021; Chaiviboontham and Pokpalagon, 2021; Jiraphan and Pitanupong, 2022; Dokmai et al., 2021; Keratiche-wanun et al., 2023). In the Thai context, studies on death and dying are diverse and strongly influenced by culture and religious beliefs. As cultural beliefs play a significant role in shaping perceptions of death and dying. Buddhist philosophy, which predominates in Thai society, often views death and dying as a natural and inevitable part of life (Upasen et al., 2022). The process of accepting death through engaging with suffering, being open-minded to death, and adhering to Buddhist practices is considered an important dynamic pathway toward achieving a good death (Upasen et al., 2022). The concept of good death is also multidimensional and culturally embedded. Thai patients and their relatives emphasized the importance of physical and psychological comfort (Keratiche-wanun et al., 2023; Chindaprasirt et al., 2019), preferred place of death, and maintaining meaningful relationships with both family members and healthcare providers (Chindaprasirt et al., 2019). In addition, preferences for end-of-life care among Thai populations further reflect these cultural values. Key preferences include being free from distressing symptoms, being surrounded by loved ones at the end of life (Pitanupong and Janmanee, 2021; Jiraphan and Pitanupong, 2022), receiving truthful information (Jiraphan and Pitanupong, 2022), maintaining awareness, and preferring to receive care and die at home (Pitanupong and Janmanee, 2021), although this may place considerable responsibility on caregivers (Supaporn et al., 2022). These culturally specific perceptions and expectations regarding death and dying.

As most existing studies in Thailand have primarily relied on qualitative approaches to explore perspectives on death and dying, quantitative evidence remains limited. One key reason may be the clear need for culturally sensitive and contextually appropriate tools to evaluate care, particularly during the final days of life. A number of instruments have been developed to evaluate outcomes related to the quality of death and dying, particularly in the Thai context, such as the Quality of Dying and Death (QODD) (Vattanavanit et al., 2017), the Family Satisfaction with End-of-Life Care-2 (FAMCARE-2) (Ooraikul et al., 2020), the Palliative Care Outcome Scale (POS) (Pukrittayakamee et al., 2018), and the Good Death Inventory (GDI) (Trakoolngamden et al., 2025). Although several instruments have been developed and culturally adapted for use in Thailand, they do not comprehensively capture care quality during the dying phase.

Ideally, dying individuals themselves would report on the care they received; however, assessing the quality of care during the last days of life presents substantial challenges. Consequently, bereaved relatives' perspectives provide meaningful insights into both the quality of care and the care their families received. To date, however, no specific instrument exists to comprehensively evaluate the quality of care during the dying phase, and evidence regarding such care remains limited. Moreover, addressing family needs is crucial for improving end-of-life care and bereavement support (Thaqi et al., 2024). Therefore, the development of a valid and reliable measurement tool for bereaved relatives is essential to ensure accurate and culturally relevant assessment, thereby enhancing understanding of quality of care during the dying phase in Thailand.

2. Methods

This study employed a cross-sectional observational design, aiming to understand a part of palliative care phenomena. The process of study took place in 2 phases, including 1) translation and cultural adaptation of the CODE™ into Thai (Fig. 1), and 2) evaluation of its reliability and validity among the bereaved relatives from two hospitals in Thailand by

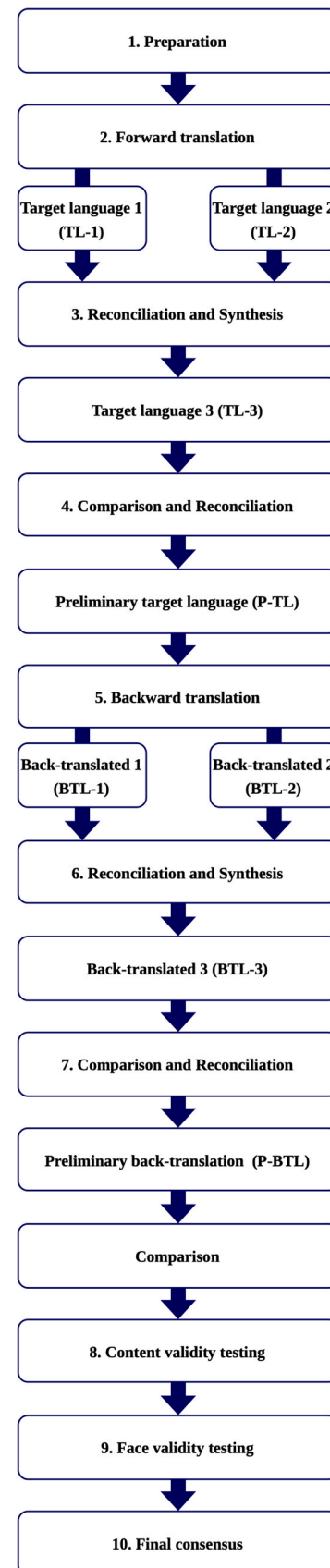


Fig. 1. Overall process of phase 1.

postal survey and online completion.

3. Phase 1

3.1. Translation and cultural adaptation

The translation and cultural adaptation process followed the forward-backward translation protocol, based on the guidelines of the European Organization for Research and Treatment of Cancer (EORTC) (Kuliš et al., 2017) and related literature (Brislin, 1970; Jones et al., 2001; Phongphanngam and Lach, 2019; Cruchinho et al., 2024). Firstly, the forward translation was conducted by two bilingual translators, both PhD students with a good command of English and familiarity with the palliative care context, who independently translated the CODE™ into Thai, creating two initial translations (TL-1 & TL-2). The two initial translation versions were then reviewed in a reconciliation and synthesis meeting involving the two translators and a bilingual adjudicator with expertise in gerontological nursing and in cross-cultural research. During this meeting, discrepancies were reconciled, wording was refined, and items were culturally adapted to the Thai context, resulting in a single synthesized target language version 3 (TL-3). Next, TL-3 was reviewed by three palliative care experts (one physician and two nursing faculty members at the assistant professor level) to assess semantic equivalence and cultural appropriateness. Consequently, a preliminary target language version (P-TL) was developed.

The P-TL underwent two independent back-translations by bilingual translators who were not involved in the forward translation. Given the difficulty of identifying native English speakers proficient in Thai. Therefore, one translator was a PhD student with overseas academic training and familiarity with the subject matter, while the second back-translation was conducted by a linguist affiliated with a university language institute. The two back-translated versions were then reconciled and synthesized into a single version (BTL-3) by the forward translators and a backward translator. Subsequently, a bilingual translator based overseas with expertise in cross-cultural research reviewed the BTL-3 alongside the P-TL to ensure semantic and linguistic consistency between the two versions. All comments and suggestions were reviewed and reconciled. A consensus was reached among the translation team. This process produced a preliminary back-translation version (P-BTL), which was then professionally reviewed by the instrument developer (CRM) to confirm conceptual, content, and semantic equivalence across versions.

3.2. Content validity

The provisional CODE-THAI was evaluated for content validity using content validity index (CVI) to assess semantic equivalence, clinical relevance, and cultural appropriateness relative to the original version. The evaluation was conducted by six experts with extensive experience in palliative and end-of-life care, including both clinicians and academic researchers. The panel comprised one physician, three associate professors in nursing, and two clinical nurses, all with at least five years of professional experience and demonstrated familiarity with the cultural and clinical context of palliative care in Thailand. Based on established criteria, an item-level CVI (I-CVI) of at least 0.78 is considered acceptable, while both the scale-level CVI (S-CVI) and S-CVI/universal agreement (S-CVI/UA) require minimum values of 0.90 (Prakash et al., 2025).

3.3. Face validity

We conducted an online face validity assessment and cognitive interviews using verbal probing techniques (Willis, 1999, 2004) to evaluate clarity, linguistic appropriateness, cultural equivalence, and comprehension. A total of five bereaved relatives, who were monolingual Thai speakers residing in Thailand and representative of the target population, participated in this part. All participants were female,

aged 41–62 years, and had direct experience caring for the dying individual who had died in a hospital setting for at least three months prior to the study. Their relationships to the deceased included spouse, child, niece, and sister-in-law. A minimum sample size of five participants was deemed appropriate for cognitive interviewing, as supported by previous methodological studies (Mayland et al., 2019; Willis, 1999). Participants were asked to complete the questionnaire prior to joining the online interview, and verbal informed consent was obtained before the interview. Following these interviews, necessary revisions were discussed and applied to further refine the instrument.

4. Phase 2

4.1. Reliability and validity evaluation

In this phase, we assessed the validity of the CODE-THAI using confirmatory factor analysis (CFA), assessed concurrent validity, examined internal consistency, and evaluated the stability over time through test-retest reliability. These evaluations were conducted with bereaved relatives over a six-month period.

4.2. Measurements

CODE-THAI is a self-completion instrument that is administered to bereaved family members and friends to assess the quality of care and the level of support provided to individuals and their families in the last two days of life. The original CODE™ instrument was developed and initially validated in England (Mayland et al., 2014), then internationally validated via the international study (i-CODE) (Mayland et al., 2022, 2019). The instrument comprises 32 main questions organized into four factors 1) overall care (OC), 2) communication and support (CAS), 3) trust, respect, and dignity (TRAD), and 4) symptom management (SM), including Likert scale, verbal anchors, and ordinal response options with varying scoring. According to the instrument user guide, 27 items were selected to construct four composite scales aligned with the four-factor structure. Item pairs (C17/C18 and E24/E25) demonstrated high correlations ($r \geq 0.8$) and were therefore combined into single composite variables following initial coding. As a result, 25 items were retained in the final scoring system, yielding a total score ranging from 0 to 66. Higher scores indicate better quality of care.

The Thai version of the Good Death Inventory-Short Version (GDI-SV-THAI) was used for concurrent validation in this study. This tool was developed to evaluate the quality of death from the perspectives of bereaved relatives. Originally the tool was developed by Miyashita et al (Miyashita et al., 2008). This tool in the Thai version was developed by WS and MM, consisting of 18 items comprising ten core questions and eight optional questions. Each item was rated on a seven-point Likert scale ranging from absolutely disagree (1) to absolutely agree (7). The total score was calculated by summing responses across all core and optional items, yielding a possible score range of 18–126, with higher scores indicating a greater level of a good death.

A demographic questionnaire was included in the CODE-THAI, and additional items were developed to collect personal information regarding both the deceased patients and bereaved relatives.

4.3. Data collection

Bereaved relatives were recruited from two tertiary hospitals. However, due to the restrictions on data access, we were permitted to access only a predefined subset of the eligible population. The screening process was carried out in collaboration with palliative care nurses at each hospital's palliative care center. Screening (Fig. 2) was performed for 1945 deceased patients between January 1, 2024, and May 31, 2025. A total of 937 deceased patients were excluded based on the following criteria, including age < 18 years, length of stay < 3 days, and having declined treatment or preferred home death. In addition, 42 deceased

patients were dropped out during the screening process due to no provided addresses, no identifiable relatives, or relatives indicating that they refused to contact them. Consequently, research instruments, a return envelope, and an invitation flyer were compiled into a single research package and mailed to 966 eligible participants who were relatives or friends of deceased patients who had died at least three months but no more than twelve months prior to recruitment. Participants could select their preferred mode of participation, either postal mail or an online survey, to participate in test-retest reliability assessment 14 days after returning their initial response. A reminder research package was sent to participants who did not respond within four weeks. Of these, 657 did not respond, and 80 were undelivered due to incorrect addresses, relocation of recipients, addressee unknown, or refusal to accept the mail.

Initially, we aimed to obtain at least 200 completed questionnaires. According to typical cited guidelines for CFA, a minimum of five participants per item is recommended (Kyriazos, 2018), which supports the proposed sample size for this study.

4.4. Statistical analysis

Multiple statistical analyses were conducted using SPSS version 29 and Amos version 24.

Demographic characteristics were summarized using descriptive statistics. Comparisons between responders and nonresponders were conducted using available data of the deceased patients, including age, gender, and place of death, due to limited access to information on non-responders. Age was compared using an independent *t*-test, while categorical variables were analyzed using the chi-square test, as appropriate. In addition, Bland-Altman plots were used to assess agreement in test-retest reliability. Ideally, the mean differences (bias) should be close to zero, with approximately 95% of observations falling within the limits of agreement (Giavarina, 2015; Kalra, 2017).

Internal consistency for the overall and subscale was assessed using Cronbach's α coefficient, with a value ≥ 0.60 considered marginal, ≥ 0.70 acceptable, ≥ 0.80 good, and ≥ 0.90 excellent (George and Mallery, 2022; Alberti et al., 2024). Missing data were handled using listwise deletion, whereby only cases with complete item-level data were included in the analysis. While test-retest reliability was examined using the intraclass correlation coefficient (ICC), a value below 0.40 was interpreted as poor, ≥ 0.40 as moderate, ≥ 0.60 as good, and ≥ 0.75 as excellent (Cicchetti, 1994; Wu et al., 2022; Long et al., 2023). Domain and total scores were calculated by summing item responses, resulting in no missing data for this analysis.

For the CFA, 25 items were included in the final scoring in accordance with the original structure and underlying theoretical framework of CODE™ instrument. Missing values primarily arose from structurally defined responses (e.g., not applicable, don't know, or composite coding procedures). These were therefore considered structural missingness inherent to the questionnaire design rather than nonrandom missingness. As the proportion of missing data was low across items ($<10\%$), although higher missingness was observed for the composite items Q17/18 (18.9%). No clear systematic pattern of missingness was identified among the observed data (Supplementary Table 1). Therefore, missing data were assumed to be missing at random (MAR). Model-based imputation using the Expectation-Maximization (EM) method (Vogt et al., 2020; Harrington, 2009) was employed to handle missing data in the CFA, as it is appropriate for datasets with missing data typically less than 10–20% (Hair et al., 2019). EM imputation was applied exclusively in the CFA to retain all available cases. Inter-factor correlations were then examined. A correlation coefficient below 0.85 indicated adequate domain distinctiveness (Prakash et al., 2025). The model fit of the CODE-THAI was evaluated using a rule-of-thumb approach based on standard fit indices, including whether $X^2/df < 3$, $GFI \geq 0.95$ (Hair et al., 2019), $RMSEA \leq 0.06$, $SRMR \leq 0.08$ (Hu and Bentler, 1999; Kline, 2023), and $CFI \geq 0.95$ (Hair et al., 2019; Hu and Bentler, 1999; Kline,

2023).

Model modification was undertaken to improve model fit based on establishing variable correlations (Xiong et al., 2025). Modification indices (MIs) and residual correlations were initially evaluated to identify potentially redundant items. Item pairs with the high MIs value ($MIs \geq 10$) were considered candidates for releasing correlated residuals (Evudottir and Heimisson, 2024). Modifications were implemented sequentially, freeing one pair of the theoretically justified items at a time and allowing correlated residuals only between items with clear concept overlap (Zheng et al., 2025a; Xiong et al., 2025). In addition to MIs magnitude, standardized expected parameter change and theoretical justification were considered when determining which residual covariances to release (Xiong et al., 2025). As well as factor loadings were classified as low (< 0.30), moderate (0.30–0.59), and high (≥ 0.60) (Zheng et al., 2025a).

Concurrent validity was assessed by examining the correlations between total and subscale scores of the CODE-THAI and the total score of the GDI-SV-THAI using Pearson's correlation. The correlation coefficients < 0.30 considered low, ≥ 0.30 moderate, and ≥ 0.70 high, respectively (Zheng et al., 2025a). To address missing data, listwise deletion was also employed, resulting in the exclusion of seven cases from the analysis.

4.5. Ethical considerations

The ethical approvals were obtained from the Graduate School of Medicine, Tohoku University, Japan (number: 2024–1–820), Faculty of Medicine, Chiang Mai University, Thailand (number: 094/2025), and Lamphun Hospital, Thailand (number: Ethic LPN 008/2568). The principles of the Declaration of Helsinki were followed. Bereaved relatives were contacted by postal invitation using the last known registered address of the deceased. Participation was voluntary. An information sheet and informed consent form were provided together with a set of questionnaires. Participants were informed of their right to withdraw from the study at any time without providing a reason and to pause, resume, or discontinue the questionnaire if they experienced distress. Contact information for support services was also provided. Implied consent was assumed if the questionnaire was returned.

5. Results

5.1. Phase 1: translation and cultural adaptation of the CODE™ into Thai

The CODE™ instrument was translated and culturally adapted into Thai through multiple iterative steps. Revisions were made until full consensus was reached among the translation team. The provisional CODE-THAI achieved an I-CVI of 1.00, and both S-CVI and S-CVI/UA were also 1.00. Minor revisions to phrases and terminologies were made based on feedback from the cognitive interviews. (Supplementary Table 2)

5.2. Phase 2: reliability and validity evaluation

Of the 966 questionnaires distributed, 229 (23.7%) were returned. Among these, we excluded 44 participants (4.6%) based on the study criteria. Consequently, 185 participants (19.2%) who agreed and completed the initial questionnaires were included in the analysis. For the test-retest reliability assessment, 62 participants (33.5%) returned the second questionnaires, of whom 44 respondents (23.8%) did so via postal mail and 18 (9.7%) completed them online. (Fig. 2)

The majority of the deceased patients were female (55.7%) and aged 70–79 years (36.2%). While the majority of the bereaved relatives were female (69.7%), most were aged 50–59 years (28.7%). Additional participant characteristics compared between first (T1) and second (T2) completions, with a 14-day span, are presented in Table 1.

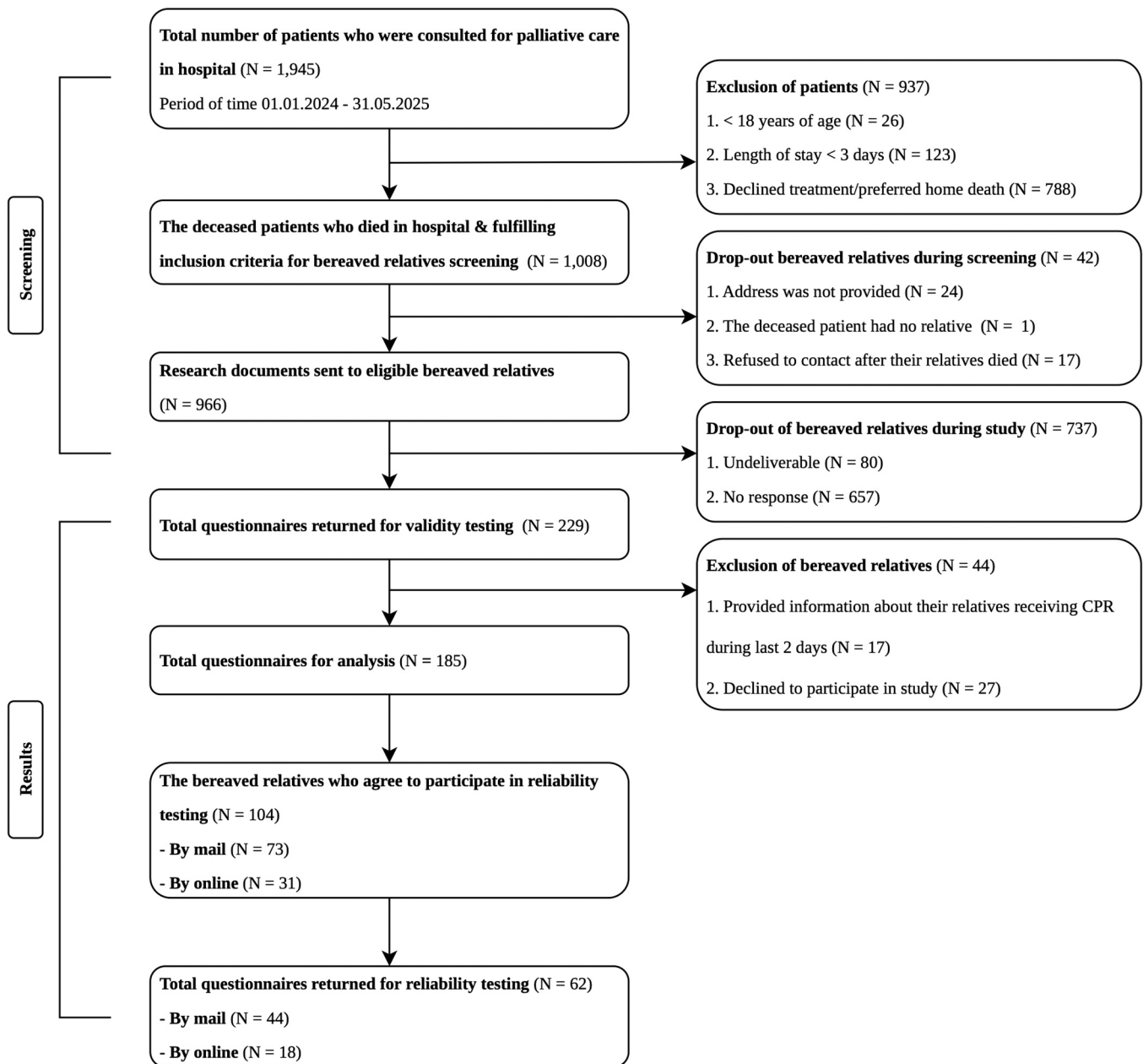


Fig. 2. Diagram for collecting data.

Further comparisons between responders and nonresponders were conducted using available characteristics of the deceased patients, including age, gender, and place of death. Deceased patients in the responder group were older (mean age = 73.42 ± 14.84 years), more likely to be female (23.9%), and more likely to have died in palliative care units (33.3%). Significant differences were observed in age (mean difference = 5.49 years; 95% CI = 3.11–7.85; $p < 0.001$), gender ($X^2 = 11.54$, $p < 0.001$), and place of death ($X^2 = 18.25$, $p < 0.001$). These findings suggested potential non-response bias.

6. Reliability

The CODE-THAI demonstrated good internal consistency (Cronbach's $\alpha = 0.89$), while the reliability of individual domains ranged from marginal to good (Cronbach's $\alpha = 0.62$ – 0.81). The ICC for the total scale was 0.81, indicating excellent reliability. The ICC values for the subscale domains ranged from moderate to excellent (0.40–0.99) (Table 2).

The Bland–Altman plots (Supplementary Figure 1) were used to assess agreement between test and retest scores across the total scale and its subdomains. Overall, the mean differences (bias) were close to zero across all domains and overall scale, indicating minimal systematic bias. Most domains demonstrated acceptable agreement, with a low proportion of observations falling outside the limits of agreement, including overall care (4.9%), trust, respect, and dignity (6.9%), symptom management (5.6%), and the overall scale (1.9%). Although some domains showed a slightly higher proportion, it remained within an acceptable range. In contrast, the communication and support domain exhibited a substantially higher proportion of observations outside the limits of agreement (36.8%).

Table 1

Demographic data of deceased patients and bereaved relatives.

	T1		T2	
	n	%	n	%
Deceased patients' data				
Gender				
Female	103	55.7	37	59.7
Male	82	44.3	25	40.3
Age (years old)				
20–29	2	1.1	1	1.6
30–39	2	1.1	1	1.6
40–49	15	8.1	3	4.8
50–59	11	5.9	3	4.8
60–69	37	20	15	24.2
70–79	67	36.2	21	33.9
≥ 80	51	27.6	18	29.1
Religious				
Buddhist	181	97.8	61	98.4
Christian (all denominations)	4	2.2	1	1.6
Illness led to the death (allow more than one answer)				
Cancer (including leukemia and lymphoma)	85	46	30	48.4
Heart disease	14	7.6	5	8.1
Chronic Obstructive Pulmonary Disease	12	6.5	4	6.5
End Stage Renal Disease	17	9.2	7	11.3
Dementia	13	7.0	5	8.1
Motor neuron disease	12	6.5	2	3.2
Don't know	3	1.5	1	1.6
Others	68	37.3	28	45.2
Ward on which they had died				
Internal ward (Medical, Surgical, & Private room)	119	64.3	38	61.3
Intensive care unit	27	14.6	13	21.0
Palliative care ward	39	21.1	11	17.7
Bereaved relatives' data				
Gender				
Female	129	69.7	37	59.7
Male	52	28.1	25	40.3
LGBTQ+	2	1.1	0	0
Prefer not to say	2	1.1	0	0
Age (years old)				
20–29	8	4.3	3	4.8
30–39	20	10.8	9	14.5
40–49	37	20	14	22.6
50–59	53	28.7	16	25.8
60–69	40	21.6	15	24.2
≥ 70	27	14.6	5	8.1
Religious				
Buddhist	174	94	57	91.9
Christian (all denominations)	9	4.9	4	6.5
No religion	2	1.1	1	1.6
The relationship with the deceased individual				
Spouse/Partner	38	20.5	11	17.7
Son/Daughter	104	56.2	39	62.9
Brother/Sister/Sibling	13	7	5	8.1
Son/Daughter in law	2	1.1	0	0
Father/Mother	14	7.6	6	9.7
Others	14	7.6	1	1.6
Educational level				
Primary school	14	7.6	3	4.8
Junior high school	8	4.3	1	1.6
Senior high school/vocational	22	11.9	6	9.7
Higher vocational/associate degree	15	8.1	5	8.1
Bachelor's degree or higher	126	68.1	47	75.8
Marital status				
Single	63	34.4	24	38.7
Married	85	46.5	29	46.8
Widowed	26	14.2	8	12.9
Divorced/Separated	9	4.9	1	1.6

First (T1) and second (T2) completions in a 14-day span

7. Validity

7.1. Construct validity

A comparison of CFA results between the initial model and the final (modified) CODE-THAI model was conducted. The modified model

Table 2

Internal consistency and Test-retest reliability of the CODE-THAI.

CODE-THAI	Number of items	Cronbach's α coefficient	ICC (95% CI)
Overall care	8	0.81	0.80*** (0.69–0.87)
Communication and support	7	0.69	0.99*** (0.98–0.99)
Trust, respect, and dignity	7	0.71	0.84*** (0.74–0.90)
Symptom management	3	0.62	0.40*** (0.18–0.59)
Overall scale	25	0.89	0.81*** (0.71–0.88)

ICC = Intraclass Correlation Coefficient; 95% CI = 95% Confidence Interval

*** $p < 0.001$

incorporated five theoretically justified correlated residuals (TRAD1 and TRAD2, TRAD3 and TRAD4, OC1 and OC2, OC3 and OC4, and CAS4 and CAS5). The highest inter-factor correlation was observed between overall care (OC) and communication and support (CAS) ($r = 0.83$), whereas the lowest correlation was found between symptom management (SM) and overall care (OC) ($r = 0.45$). Model fit improved following modification, although it remained less than optimal, with only the X^2/df ratio (1.96) and SRMR (0.07) meeting recommended thresholds (Table 3). Standardized factor loading indicated CAS2, TRAD3, and TRAD4 remained below 0.30 (Fig. 3 and Supplementary Table 1).

7.2. Concurrent validity

The CODE-THAI total score showed a moderate correlation with the GDI-SV-THAI total score ($r = 0.41$, $p < 0.001$). Correlations between each CODE-THAI domain and the GDI-SV-THAI total score ranged from low to moderate ($r = 0.27$ – 0.38 , all $p < 0.001$) (Table 4).

8. Discussion

In Thailand, research on death and dying has largely relied on qualitative approaches (Pitanupong and Janmanee, 2021; Jiraphan and

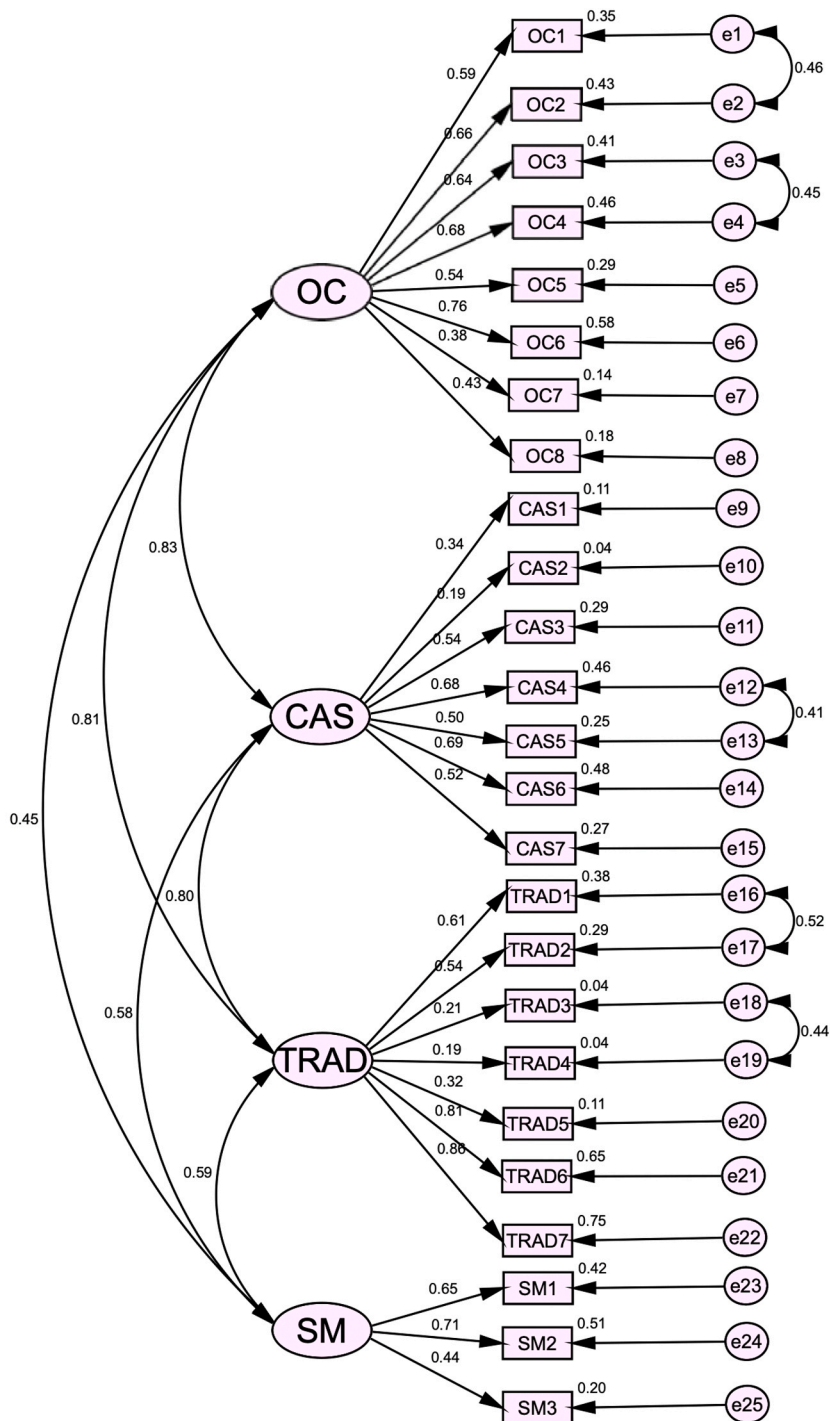
Table 3

Fit indices and inter-factor correlation matrix between the initial and final models of CODE-THAI.

Fit indices	Criteria	Model 1: Initial model	Model 2: Final model
X^2/df	< 3	2.59	1.96
GFI	≥ 0.95	0.77	0.82
CFI	≥ 0.95	0.73	0.84
RMSEA	≤ 0.06	0.09	0.07
SRMR	≤ 0.08	0.08	0.07
Inter-factor correlation matrix			
Factor 1 (OC) and Factor 2 (CAS)	0.74		0.83
Factor 1 (OC) and Factor 3 (TRAD)	0.77		0.81
Factor 1 (OC) and Factor 4 (SM)	0.40		0.45
Factor 2 (CAS) and Factor 3 (TRAD)	0.79		0.80
Factor 2 (CAS) and Factor 4 (SM)	0.54		0.58
Factor 3 (TRAD) and Factor 4 (SM)	0.60		0.59

X^2/df = Chi-Square to Degree of Freedom; GFI = Goodness-of-Fit Index; CFI = Comparative of Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

OC = Overall Care; CAS = Communication and Support; TRAD = Trust, Respect, and Dignity; SM = Symptom Management



CFA of CODE-THAI

Chi-square/df = 1.966

GFI = .828

CFI = .845

RMSEA = .072

SRMR = .073

OC = overall care; CAS = communication and support; TRAD = trust, respect, and dignity; SM = symptom management

Fig. 3. Path diagram for confirmatory factor analysis (Final model).

Pitanupong, 2022; Keratichevanun et al., 2023; Upasen et al., 2022; Chindaprasirt et al., 2019), with limited quantitative evidence available. Although several instruments have been adapted for use in Thailand (Vattanavanit et al., 2017; Ooraikul et al., 2020; Pukrittayakamee et al., 2018; Trakoolngamden et al., 2025), they may not fully capture the multidimensional nature of care during the dying phase, highlighting the need for culturally sensitive and contextually appropriate tools. In response, this study developed the CODE-THAI to evaluate the quality of

care provided to dying individuals and the level of support offered to their families or friends during the last two days of the patient's life. Our robust translation and cultural adaptation process was conducted rigorously to ensure linguistic accuracy and cultural appropriateness for Thai users, consistent with previous international adaptations of the CODE™ instrument (Vogt et al., 2020; Zheng et al., 2025b). Bereaved relatives were able to understand and respond to the instrument as intended. Collectively, these findings suggest that the CODE-THAI

Table 4

Concurrent validity of the CODE-THAI with the GDI-SV-THAI (N = 178).

CODE-THAI	GDI-SV-THAI	p-value
Overall care	0.38	< 0.001***
Communication and support	0.35	< 0.001***
Trust, respect, and dignity	0.31	< 0.001***
Symptom management	0.27	< 0.001***
Overall scale	0.41	< 0.001***

GDI-SV-THAI = Thai version of the Good Death Inventory-Short Version

*** $p < 0.001$

achieved linguistic, semantic, and conceptual equivalence, with appropriate cultural adaptation.

A response rate (19.2%) may indicate potential response bias, as suggested by differences between responders and non-responders. Responders were more likely to be relatives of the older female deceased patients who died in palliative care units ($p < 0.001$). These patterns may reflect response tendencies, including the possibility of socially desirable responding, whereby individuals may present themselves in a more favorable manner (Tellis and Chandrasekaran, 2010). To mitigate this potential bias, several strategies were planned and employed, including ensuring respondent anonymity and administering the survey by post to maintain distance from participants, consistent with previous studies (Tellis and Chandrasekaran, 2010). Nevertheless, substantial non-response bias may persist, as individuals with less favorable experiences may have been less likely to participate (Sakshaug et al., 2010). Consequently, the sample may be skewed toward more favorable and relatively homogeneous care experiences, potentially limiting the generalizability of the findings and influencing the psychometric outcomes (Rosenman et al., 2011).

The overall reliability of the scale demonstrated good internal consistency (Cronbach's $\alpha = 0.89$) (Prakash et al., 2025), which is comparable to the original version (Cronbach's $\alpha = 0.92$) (Mayland et al., 2022), the German version (Cronbach's $\alpha = 0.86$) (Vogt et al., 2020) and the Chinese version (Cronbach's $\alpha = 0.91$) (Zheng et al., 2025a). Similarly, test-retest reliability demonstrated excellent stability, with an overall ICC of 0.81, comparable to that reported for the German version (ICC = 0.85) (Vogt et al., 2020) and slightly higher than that observed in the Chinese version (ICC = 0.73) (Zheng et al., 2025a). All CODE-THAI subscales revealed moderate to excellent reliability (ICC = 0.40–0.99), consistent with previous findings that yielded moderate reliability across subscales (Zheng et al., 2025a). These results may imply that bereaved relatives were able to interpret the items consistently and express their perceptions reliably over time.

However, the ICC results should be interpreted with caution due to several potential sources of bias. The adequacy of the test-retest subsample (N = 62) should also be considered. While some recommendations suggest larger sample sizes for reliability studies (Mehta et al., 2018; Kennedy, 2022; Williams et al., 2025), the present study met commonly recommended criteria for sample size estimation (Koo and Li, 2016; Bujang et al., 2024). Although the subsample size was considered sufficient to provide stable estimates of reliability, nonresponse bias remains a concern, as discussed above. The use of mixed data collection modes (postal and online surveys) may have contributed to this bias. Previous studies suggested that mail and mixed-mode designs were associated with low nonresponse bias when compared to face-to-face approaches (Rybak, 2023). While other mixed modes (telephone and web) may also introduce only small bias (Hu et al., 2025). Nevertheless, these factors may have reduced response variability, resulting in a more homogeneous sample. Such restricted variance may potentially have influenced the estimation ICC values.

A further notable finding was the near-perfect ICC value (0.99) observed in the communication and support domain. However, Bland-Altman analysis (Supplementary Figure 1) revealed a substantially higher proportion of observations outside the limits of agreement

(36.8%), indicating greater variability in agreement. This discrepancy between ICC and Bland-Altman findings highlights the distinction between relative reliability and agreement. While the relative ordering of responses remained stable over time, individual scores in this domain varied in magnitude. Several potential reasons may explain this variation. The relatively short retest interval (14 days) and emotionally relevant experiences may have influenced respondents' recall, potentially leading them to reproduce previous responses rather than reflect true stability. This phenomenon has been considered in prior research. A substantial proportion of respondents (approximately 60%) may reproduce earlier responses due to memory recall rather than actual consistency (Schwarz et al., 2020). Although previous studies comparing shorter (2-day) and longer (2-week) intervals have reported no statistically significant differences in reliability estimates (Marx et al., 2003). Hence, memory effects cannot be entirely ruled out. Furthermore, emotionally meaningful experiences may enhance memory retention (Schümann et al., 2020). Accordingly, although the 14-day interval used in this study can be considered acceptable, the influence of recall and emotional factors should be interpreted with caution and warrants further investigation. Collectively, these findings underscore the importance of interpreting reliability estimates in light of both methodological factors (sample size, retest interval, and data collection mode) and the contextual influences, including sample characteristics, response variability, and emotional context.

Regarding construct validity, the modified model demonstrated suboptimal fit, with several fit indices failing to reach recommended standards (Hair et al., 2019; Hu and Bentler, 1999; Kline, 2023). This indicates limitations in the structural validity of the four-factor model and suggests that the CODE-THAI does not fully align with the theoretical structure of the original instrument. In comparison, the original version demonstrated acceptable model fit (RMSEA = 0.057, CFI = 0.962) (Mayland et al., 2022), and the Chinese version also reported acceptable fit (RMSEA = 0.069, CFI = 0.879) (Zheng et al., 2025a). Despite these limitations, the overall pattern of factor loadings and inter-factor relationships provided partial support for the plausibility of the four-factor structure. Accordingly, these findings should be interpreted with caution. Following sequential model modification, several observed variables (CAS2, TRAD3, and TRAD4) demonstrated relatively weak standardized factor loadings (< 0.30), which may have reduced the overall construct validity. This pattern is comparable to that observed for TRAD3 (informed about impending death) in the Chinese study (0.13) (Zheng et al., 2025a), while, CAS2 (discussion about fluids) demonstrated lower factor loading in the Thai version compared with the Chinese version (Zheng et al., 2025a). Nevertheless, items with low factor loadings were retained due to their conceptual importance, theoretical justification, and clinical relevance. Although removing poorly performing indicators may improve model fit (Xiong et al., 2025). Such statistically driven modifications may lead to an overly data-driven model (Xiong et al., 2025) and may compromise content validity. Therefore, retaining these items preserves essential aspects of care during the dying phase and supports consistency with the conceptual framework of the original instrument, facilitating comparability with international studies (i-CODE). Furthermore, the observed low factor loadings may reflect sociocultural influences and recall processes rather than a lack of conceptual relevance (Zheng et al., 2025a), consistent with the present findings. The observed discrepancies may be attributable to cultural differences between the Thai and international contexts. Such differences may also reflect genuine cross-cultural variations in how the quality of care for dying individuals is perceived across countries (Mayland et al., 2022). Retaining these items enables a more comprehensive representation of the construct while preserving the integrity of the original scale.

In terms of concurrent validity, the CODE-THAI demonstrated a moderate correlation with the GDI-SV-THAI ($r = 0.41$, $p < 0.001$), showing a pattern similar to that observed in the Chinese version ($r = 0.50$, $p < 0.001$) (Zheng et al., 2025a). However, the magnitude of

this association also indicates that concurrent validity is limited, suggesting that the two instruments do not fully capture the same underlying construct. This pattern reflects both conceptual overlap and divergence between the two measures. While both instruments assess end-of-life experiences from the perspective of bereaved relatives. The good death inventory primarily evaluates the overall quality of death, encompassing broader end-of-life care outcomes (Miyashita et al., 2008), whereas the CODE-THAI focuses specifically on the quality of care and support provided during the last days of life. Therefore, the observed moderate correlation supports partial conceptual overlap alongside meaningful divergence in construct focus, indicating that the CODE-THAI captures a related but distinct dimension of end-of-life care. Notably, the symptom management subscale demonstrated the weakest correlation with the good death inventory, consistent with both present and previous studies (Zheng et al., 2025a). This may further reflect construct divergence, as symptom control, particularly in the dying phase, represents a specific clinical aspect of care, whereas the concept of GDI emphasizes broader experiential and evaluative dimensions of quality of death. These findings suggest that the two instruments assess complementary rather than identical aspects of end-of-life care. Accordingly, although the CODE-THAI demonstrates evidence of concurrent validity, the magnitude of the association should be interpreted with caution.

9. Strengths and limitations

The findings provide robust evidence for evaluating the quality of care during the dying phase and for contextualizing the care of dying individuals in Thailand in comparison with findings from i-CODE studies. The scale's psychometric performance followed a consistent pattern, supporting cross-country comparability and suggesting that the quality of care during the dying phase in Thailand is broadly congruent with international practices. While observed differences may be attributed to cultural and contextual variations in care provision. These reflected bereaved relatives' perceptions of care during the patient's final days.

However, this study has several limitations. First, we conducted the survey of bereaved relatives in two tertiary hospitals, which may have their own unique patterns of care. These institutional differences could have influenced participants' perceptions of care quality and, consequently, the overall findings. Second, the small response rate may limit the generalizability of the results to bereaved relatives across Thailand. Consistent with previous findings, response rates for mail-based surveys tend to be lower than those for electronic data collection (Baruch and Holtom, 2008). This may be attributable to the one-way nature of postal communication or potential reluctance among bereaved relatives to participate. This limitation may also have affected the stability of the CFA model. Third, the use of mixed-mode data collection (mail and online surveys) may have introduced non-response bias and reduced sample variability. Respondents may therefore represent individuals with more favorable perceptions, potentially influencing the model and the interpretation. Future research should further evaluate the construct validity of the CODE-THAI in larger and more diverse samples, including multi-site studies, to enhance generalizability and strengthen its psychometric robustness. Items with low factor loading warrant further investigation, particularly regarding potential cultural or clinical influences on item interpretation. Furthermore, the applicability of the CODE-THAI in community settings should be examined to determine its capacity to assess the quality of care during the dying phase beyond hospital contexts, including home-based care.

10. Conclusions

Overall, the CODE-THAI is the first instrument developed to evaluate the quality of care and level of family support during the dying phase in Thailand. The present study provides a rigorously translated and

culturally adapted tool appropriate for the Thai context. The CODE-THAI satisfies the reliability and validity evaluation from the perspective of bereaved relatives. The CODE-THAI may be useful for evaluating the quality of care during the dying phase in acute hospital settings. However, further refinement and validation in larger and more diverse samples are warranted to strengthen its construct validity.

CRedit authorship contribution statement

Warodom Samerchua: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Hideyuki Hirayama:** Writing – review & editing, Visualization, Methodology, Conceptualization. **Catriona R. Mayland:** Writing – review & editing, Visualization, Conceptualization. **Mitsunori Miyashita:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ymecc.2026.100032](https://doi.org/10.1016/j.ymecc.2026.100032).

References

- Alberti, S., Guasconi, M., Bolzoni, M., Donnini, G., Volpi, P., Rovesti, S., Monaco, F., Bonacaro, A., Ferri, P., 2024. Assessing satisfaction in simulation among nursing students: psychometric properties of the Satisfaction with Simulation Experience - Italian Version scale. *BMC Nurs.* 23, 1–8. <https://doi.org/10.1186/s12912-024-01974-1>.
- Baruch, Y., Holtom, B.C., 2008. Survey response rate levels and trends in organizational research. *Hum. Relat.* 61, 1139–1160. <https://doi.org/10.1177/0018726708094863>.
- Brislin, Richard W., 1970. Back-translation for cross-cultural research. *J. Cross Cult. Psychol.* 1, 185–216. <https://doi.org/10.1177/135910457000100301>.
- Bujang, M.A., Omar, E.D., Foo, D.H.P., Hon, Y.K., 2024. Sample size determination for conducting a pilot study to assess reliability of a questionnaire. *Restor. Dent. Endod.* 49, e3. <https://doi.org/10.5395/rde.2024.49.e3>.
- Chaiviboontham, S., Pokpalagon, P., 2021. Palliative care model in Thailand. *Int. J. Palliat. Nurs.* 27, 132–146. <https://doi.org/10.12968/ijpn.2021.27.3.132>.
- Chindaprasit, J., Wongtirawit, N., Limpawattana, P., Srinonprasert, V., Manjajong, M., Chotmongkol, V., Pairojkul, S., Sawanyawisuth, K., 2019. Perception of a “good death” in Thai patients with cancer and their relatives. *Heliyon* 5, e02067. <https://doi.org/10.1016/j.heliyon.2019.e02067>.
- Chua, M.T., Kuan, W.S., Zheng, C.Q., Tiah, L., Kumar, R., Wong, Y.K.Y., Lin, J., Liang, S., Mayland, C.R., Shi, L., Ibrahim, I., Pal, R.Y., 2021. Validation of “care of the dying evaluation” in emergency medicine (CODE-EM): Pilot phase of end-of-life management protocol offered within emergency room (EMPOWER) study. *Ann. Palliat. Med.* 10, 6145–6155. <https://doi.org/10.21037/apm-21-380>.
- Cicchetti, D.V., 1994. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychol. Assess.* 6, 284–290. <https://doi.org/10.1037/1040-3590.6.4.284>.
- Cruchinho, P., López-Franco, M.D., Capelas, M.L., Almeida, S., Bennett, P.M., da Silva, M. M., Teixeira, G., Nunes, E., Lucas, P., Gaspar, F., 2024. Translation, Cross-Cultural Adaptation, and Validation of Measurement Instruments: A Practical Guideline for Novice Researchers. *J. Multidiscip. Health* 17, 2701–2728. <https://doi.org/10.2147/JMDH.S419714>.
- Dokmai, P., Meemon, N., Paek, S.C., Tayjasananant, S., 2021. Structure and process of palliative care provision: a nationwide study of public hospitals in Thailand. *BMC Health Serv. Res.* 21, 1–11. <https://doi.org/10.1186/s12913-021-06623-w>.
- Donabedian, A., 1988. The quality of care: how can it be assessed? *JAMA* 260, 1743–1748. <https://doi.org/10.1001/jama.260.12.1743>.

- Evudottir, E.E., Heimisson, G.T., 2024. Using confirmatory factor analysis and qualitative methods to translate, adapt, and revise personality inventories. *Psychol. Test. Adapt. Dev.* 5, 117–126. <https://doi.org/10.1027/2698-1866/a000077>.
- George, D., Mallery, P., 2022. *Reliability Analysis. IBM SPSS Statistics 27 Step by Step: A Simple Guide and Reference*, 17th ed. Routledge, New York, pp. 251–261. <https://doi.org/10.4324/9781003205333>.
- Giavarina, D., 2015. Understanding bland altman analysis. *Biochem. Med.* 25, 141–151. <https://doi.org/10.11613/BM.2015.015>.
- Hair Jr., J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2019. *Multivariate Data Analysis*, 8th ed. Cengage Learning EMEA, UNITED KINGDOM <https://eli.johogo.com/Class/CCU/SEM/Multivariate%20Data%20Analysis%20Hair.pdf>.
- Harrington, D., 2009. *Requirements for Conducting Confirmatory Factor Analysis: data considerations*, in: *Confirmatory Factor Analysis*. Oxford University Press, Inc., New York, pp. 36–49.
- Haugen, D.F., Hufthammer, K.O., Gerlach, C., Sigurdardottir, K., Hansen, M.I.T., Ting, G., Tripodoro, V.A., Goldraj, G., Yanneo, E.G., Leppert, W., Wolszczak, K., Zambon, L., Passarini, J.N., Saad, I.A.B., Weber, M., Ellershaw, J., Mayland, C.R., Haugen, D.F., Sigurdardottir, K.R., Hansen, M.I.T., Leppert, W., Wolszczak, K., Yanneo, E.G., Tripodoro, V., Goldraj, G., Weber, M., Gerlach, C., Zambon, L., Passarini, J.N., Saad, I.B., Ellershaw, J., Ting, G., Mayland, C.R., 2021. Good quality care for cancer patients dying in hospitals, but information needs unmet: bereaved relatives' survey within seven countries. *Oncologist* 26, e1273–e1284. <https://doi.org/10.1002/onco.13837>.
- Heckel, M., Vogt, A.R., Stiel, S., Radon, J., Kurkowski, S., Goebel, S., Ostgathe, C., Weber, M., 2020. The quality of care of the dying in hospital—next-of-kin perspectives. *Support. Care Cancer* 28, 4527–4537. <https://doi.org/10.1007/s00520-020-05465-2>.
- Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55. <https://doi.org/10.1080/10705519909540118>.
- Hu, M., Freedman, V., Kamens, J., 2025. Effects of mode and transitioning to a mixed-mode (Web/Phone) design on categorical survey estimates: do question characteristics matter? *Eur. Surv. Res. Assoc.* 19, 207–221. <https://doi.org/10.18148/srm/2025.v19i2.8434>.
- Jiraphan, A., Pitanupong, J., 2022. General population-based study on preferences towards end-of-life care in Southern Thailand: a cross-sectional survey. *BMC Palliat. Care* 21, 1–11. <https://doi.org/10.1186/s12904-022-00926-3>.
- Jones, P.S., Lee, J.W., Phillips, L.R., Xinwei, M., Zhang, E., Jaceldo, K.B., 2001. An adaptation of brislin's translation model for cross-cultural research. *Nurs. Res.* 50, 300–304. <https://doi.org/10.1097/00006199-200109000-00008>.
- Kalra, A., 2017. Decoding the Bland–Altman plot: Basic review. *J. Pract. Cardiovasc. Sci.* 3, 36–38. <https://doi.org/10.4103/jpcs.jpcs.11.17>.
- Kennedy, I., 2022. Sample size determination in test-retest and cronbach alpha reliability estimates. *Br. J. Contemp. Educ.* 2, 17–29. <https://doi.org/10.52589/BJCE-FY266HK9>.
- Keratichevanun, P., Dejkriengkraikul, N., Angkurawaranon, C., Pinyopornpanish, K., Chutarattanakul, L., Nantsupawat, N., Wiwatkunupakarn, N., Jiraporncharoen, W., 2023. Stakeholders' perspectives of a good death: a qualitative study from Thailand. *Heliyon* 9, e15775. <https://doi.org/10.1016/j.heliyon.2023.e15775>.
- Kline, R.B., 2023. *Model Testing and Indexing*. In: Little, T.D. (Ed.), *Principles and Practice of Structural Equation Modeling*, 5th ed. The Guilford Press, New York, pp. 156–181 (<https://www.scribd.com/document/696236685/Kline-2023>).
- Koo, T.K., Li, M.Y., 2016. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J. Chiropr. Med.* 15, 155–163. <https://doi.org/10.1016/j.jcm.2016.02.012>.
- D. Kuliš, A. Bottomley, G. Velikova, E. Greimel, M. Koller, EORTC QUALITY OF LIFE GROUP TRANSLATION PROCEDURE, 4th ed. (2017). (<https://qol.eortc.org/manual/translation-procedure/>).
- Kunakornvong, W., Ngoasri, K., 2020. Public awareness and attitude toward palliative care in Thailand. *Siriraj Med. J.* 72, 424–430. <https://doi.org/10.33192/Smj.2020.57>.
- Kupeli, N., Candy, B., Tamura-Rose, G., Schofield, G., Webber, N., Hicks, S.E., Floyd, T., Vivat, B., Sampson, E.L., Stone, P., Aspden, T., 2019. Tools measuring quality of death, dying, and care, completed after death: systematic review of psychometric properties. *Patience* 12, 183–197. <https://doi.org/10.1007/s40271-018-0328-2>.
- Kyriazos, T.A., 2018. Applied psychometrics: sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general. *Psychology* 9, 2207–2230. <https://doi.org/10.4236/psych.2018.98126>.
- Long, Y., Ouyang, X., Yan, C., Wu, Z., Huang, X., Pu, W., Cao, H., Liu, Z., Palaniyappan, L., 2023. Evaluating test–retest reliability and sex-/age-related effects on temporal clustering coefficient of dynamic functional brain networks. *Hum. Brain Mapp.* 44, 2191–2208. <https://doi.org/10.1002/hbm.26202>.
- Marx, R.G., Menezes, A., Horovitz, L., Jones, E.C., Warren, R.F., 2003. A comparison of two time intervals for test-retest reliability of health status instruments. *J. Clin. Epidemiol.* 56, 730–735. [https://doi.org/10.1016/S0895-4356\(03\)00084-2](https://doi.org/10.1016/S0895-4356(03)00084-2).
- Mayland, C.R., Gerlach, C., Sigurdardottir, K., Hansen, M.I.T., Leppert, W., Stachowiak, A., Krajewska, M., Garcia-Yanneo, E., Tripodoro, V.A., Goldraj, G., Weber, M., Zambon, L., Passarini, J.N., Saad, I.B., Ellershaw, J., Haugen, D.F., 2019. Assessing quality of care for the dying from the bereaved relatives' perspective: Using pre-testing survey methods across seven countries to develop an international outcome measure. *Palliat. Med.* 33, 357–368. <https://doi.org/10.1177/0269216318818299>.
- Mayland, C.R., Hughes, R., Lane, S., McGlinchey, T., Donnellan, W., Bennett, K., Hanna, J., Rapa, E., Dalton, L., Mason, S.R., 2021. Are public health measures and individualised care compatible in the face of a pandemic? A national observational study of bereaved relatives' experiences during the COVID-19 pandemic. *Palliat. Med.* 35, 1480–1491. <https://doi.org/10.1177/02692163211019885>.
- Mayland, C.R., Keetharuth, A.D., Mukuria, C., Haugen, D.F., 2022. Validation of 'Care Of the Dying Evaluation' (CODE™) within an international study exploring bereaved relatives' perceptions about quality of care in the last days of life. *J. Pain. Symptom Manag.* 64, e23–e33. <https://doi.org/10.1016/j.jpainsymman.2022.02.340>.
- Mayland, C.R., Lees, C., Germain, A., Jack, B.A., Cox, T.F., Mason, S.R., West, A., Ellershaw, J.E., 2014. Caring for those who die at home: the use and validation of 'Care Of the Dying Evaluation' (CODE) with bereaved relatives. *BMJ Support Palliat. Care* 4, 167–174. <https://doi.org/10.1136/bmjspcare-2013-000596>.
- Mayland, C.R., Mulholland, H., Gambles, M., Ellershaw, J., Stewart, K., 2017. How well do we currently care for our dying patients in acute hospitals: the views of the bereaved relatives? *BMJ Support Palliat. Care* 7, 316–325. <https://doi.org/10.1136/bmjspcare-2014-000810>.
- Mehta, S., Bastero-Caballero, R.F., Sun, Y., Zhu, R., Murphy, D.K., Hardas, B., Koch, G., 2018. Performance of intraclass correlation coefficient (ICC) as a reliability index under various distributions in scale reliability studies. *Stat. Med.* 37, 2734–2752. <https://doi.org/10.1002/sim.7679>.
- Miyashita, M., Morita, T., Sato, K., Hirai, K., Shima, Y., Uchitomi, Y., 2008. Good death inventory: a measure for evaluating good death from the bereaved family member's perspective. *J. Pain. Symptom Manag.* 35, 486–498. <https://doi.org/10.1016/j.jpainsymman.2007.07.009>.
- Ooraikul, L., Wirojratana, V., Phuackchantuck, R., Chompukew, P., Khaisuan, C., 2020. Reliability and Validity Testing of the FAMCARE-2 Scale: Thai Translation. *Asia. Pac. J. Oncol. Nurs.* 7, 280–285. <https://doi.org/10.4103/apjon.apjon.5.20>.
- Phongphanngam, S., Lach, H.W., 2019. Cross-cultural instrument translation and adaptation: challenges and strategies. *Pac. Rim Int. J. Nurs. Res.* 23, 170–179. (<http://he02.tci-thaijo.org/index.php/PRIJNR/article/view/129032>).
- Pitanupong, J., Janmanee, S., 2021. End-of-life care preferences among cancer patients in Southern Thailand: a university hospital-based cross-sectional survey. *BMC Palliat. Care* 20, 1–8. <https://doi.org/10.1186/s12904-021-00775-6>.
- Prakash, G.H., Kumar, D.S., Kiran, P., Arun, V., Yadav, D., Gopi, A., M. R., 2025. Measuring mobile health engagement in cancer care: development and psychometric validation of the CmHEAQ scale. *Meas. Eval. Cancer Care* 3, 100022. <https://doi.org/10.1016/j.jmecc.2025.100022>.
- Pukrittayakamee, P., Sapinun, L., Suwan, P., Harding, R., 2018. Validity reliability, and responsiveness of the Thai palliative care outcome scale staff and patient versions among cancer patients. *J. Pain. Symptom Manag.* 56, 414–420. <https://doi.org/10.1016/j.jpainsymman.2018.05.025>.
- Rosenman, R., Tennekoon, V., Hill, L.G., 2011. Measuring bias in self-reported data. *Int. J. Behav. Healthc. Res.* 2, 320–332. <https://doi.org/10.1504/IJBHR.2011.043414>.
- Rybak, A., 2023. Survey mode and nonresponse bias: A meta-analysis based on the data from the international social survey programme waves 1996–2018 and the European social survey rounds 1–9. *PLoS One* 18, e0283092. <https://doi.org/10.1371/journal.pone.0283092>.
- Sakshaug, J.W., Yan, T., Tourangeau, R., 2010. Nonresponse Error, Measurement Error, and Mode of Data Collection: Tradeoffs in A Multi-mode Survey of Sensitive and Non-sensitive Items. *Public Opin. Q.* 74, 907–933. <https://doi.org/10.1093/poq/nfq057>.
- Schumann, D., Joue, G., Jordan, P., Bayer, J., Sommer, T., 2020. Test-retest reliability of the emotional enhancement of memory. *Memory* 28, 49–59. <https://doi.org/10.1080/09658211.2019.1679837>.
- Schwarz, H., Revilla, M., Weber, W., 2020. Memory effects in repeated survey questions revisiting the empirical investigation of the independent measurements assumption. *Eur. Surv. Res. Assoc.* 14, 325–344. <https://doi.org/10.18148/srm/2020.v14i3.7579>.
- Supaporn, K., Thanawatnanon, P., Isaramalai, S., Khaw, T., 2022. Home-based end-of-life care for Thai elders: family caregivers' perspectives. *Kasetsart J. Soc. Sci.* 43, 1085–1094. <https://doi.org/10.34044/j.kjss.2022.43.4.34>.
- Tellis, G.J., Chandrasekaran, D., 2010. Extent and impact of response biases in cross-national survey research. *Int. J. Res. Mark.* 27, 329–341. <https://doi.org/10.1016/j.ijresmar.2010.08.003>.
- Thaqi, Q., Riguzzi, M., Blum, D., Peng-Keller, S., Lorch, A., Naef, R., 2024. End-of-life and bereavement support to families in cancer care: a cross-sectional survey with bereaved family members. *BMC Health Serv. Res.* 24, 1–11. <https://doi.org/10.1186/s12913-024-10575-2>.
- Trakoolngamden, B., Monkong, S., Chaiviboontham, S., Satitvipawee, P., Runglodvatana, Y., 2025. Effect of a peaceful end-of-life care program on perceived good death in people with advanced cancer and their family caregivers. *J. Hosp. Palliat. Nurs.* 27, 94–101. <https://doi.org/10.1097/NJH.0000000000001100>.
- Upasen, R., Thanasilp, S., Akkayagorn, L., Chimluang, J., Tantitirakul, W., Doudrich, D.L., Saengpanya, W., 2022. Death Acceptance Process in Thai Buddhist Patients With Life-Limiting Cancer: A Grounded Theory. *Glob. Qual. Nurs. Res.* 9, 1–10. <https://doi.org/10.1177/23333936221111809>.
- Vattanavanit, V., Uppanisakorn, S., Bhurayanontachai, R., Khwannimit, B., 2017. Quality of dying in the medical intensive care unit: comparison between Thai buddhists and Thai muslims. *Indian J. Crit. Care Med.* 21, 359–363. <https://doi.org/10.4103/ijccm.IJCCM.88.17>.
- Vogt, A., Stiel, S., Heckel, M., Goebel, S., Mai, S.S., Seifert, A., Gerlach, C., Ostgathe, C., Weber, M., 2020. Assessment of the quality of end-of-life care: translation and validation of the German version of the "care of the Dying Evaluation" (CODE-GER) - A questionnaire for bereaved relatives. *Health Qual. Life Outcomes* 18, 1–15. <https://doi.org/10.1186/s12955-020-01473-2>.
- Williams, B., FitzGibbon, L., Brady, D., Christakou, A., 2025. Sample size matters when estimating test–retest reliability of behaviour. *Behav. Res.* 57, 123. <https://doi.org/10.3758/s13428-025-02599-1>.

- G.B. Willis, Cognitive Interviewing: A “How To” Guide. (1999). (<https://www.hkr.se/contentassets/9ed7b1b3997e4bf4baa8d4eceed5cd87/gordonwillis.pdf/>).
- Willis, G.B., 2004. Cognitive Interviewing Revisited: A Useful Technique, in Theory? In: Presser, Stanley, Rothgeb, Jennifer M., Couper, Mick P., Lessler, Judith T., Martin, Elizabeth, Jean Martin, E.S. (Eds.), *Methods for Testing and Evaluating Survey Questionnaires*. Wiley, pp. 23–43. <https://doi.org/10.1002/0471654728.ch2>.
- Wu, Z., Liu, Z., Jiang, Z., Fu, X., Deng, Q., Palaniyappan, L., Xiang, Z., Huang, D., Long, Y., 2022. Overprotection and overcontrol in childhood: an evaluation on reliability and validity of 33-item expanded Childhood Trauma Questionnaire (CTQ-33), Chinese version. *Asian J. Psychiatr.* 68, 102962. <https://doi.org/10.1016/j.ajp.2021.102962>.
- Xiong, Z., Xia, H., Ni, J., Hu, H., 2025. Basic assumptions, core connotations, and path methods of model modification—using confirmatory factor analysis as an example. *Front. Educ.* 10, 1–9. <https://doi.org/10.3389/feduc.2025.1506415>.
- Yildiz, B., Korfage, I.J., Witkamp, E.F.E., Goossensen, A., van Lent, L.G.G., Pasman, H.R., Onwuteaka-Philipsen, B.D., Zee, M., van der Heide, A., 2022. Dying in times of COVID-19: Experiences in different care settings – An online questionnaire study among bereaved relatives (the CO-LIVE study). *Palliat. Med.* 36, 751–761. <https://doi.org/10.1177/02692163221079698>.
- Zheng, X., Zhao, J., Mayland, C.R., Dong, L., Cong, F., Zhang, X., Wen, Y., Xie, D., Miyashita, M., 2025b. Translation and cultural adaptation of the Chinese version of the International ‘Care Of the Dying Evaluation’ (CODE™) tool for assessing the quality of care for dying patients from the perspective of bereaved family members. *BMC Palliat. Care* 24, 1–10. <https://doi.org/10.1186/s12904-025-01772-9>.
- Zheng, X., Zhou, L., Li, B., Dong, L., Li, Y., Mayland, C.R., Aoyama, M., Miyashita, M., 2025a. Evaluating quality of care for dying patients from the perspective of bereaved relatives: validation of the Chinese version of the international care of the dying evaluation. *Health Qual. Life Outcomes* 23, 123. <https://doi.org/10.1186/s12955-025-02467-8>.