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Are Surprise Questions and Probabilistic Questions by Nurses Useful in Home Palliative Care? A Prospective Study

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Abstract

Background: Surprise questions (SQs) are used as screening tools in palliative care. Probabilistic questions (PQs) are more accurate than temporal predictions. However, no study has examined the usefulness of SQs and PQs assessed by nurses. **Objectives:** To examine the accuracy of nurses' SQ and PQ assessments in patients with advanced cancer receiving home palliative care. **Design:** A prospective single-center cohort study. **Setting/Subjects:** Adult patients with advanced cancer who received palliative care at home in South Korea between 2019 and 2020. **Measurements:** Palliative care specialized nurses were asked the SQ, "Would you be surprised if the patient died in a specific timeframe?" and PQ, "What is the probability that this patient will be alive (0 to 100%) within a specific timeframe?" at the 1-, 2-, 4-, and 6-week timeframes at enrollment. We calculated the sensitivities and specificities of the SQs and PQs. **Results:** 81 patients were recruited with 47 days of median survival. The sensitivity, specificity, and overall accuracy (OA) of the 1-week SQ were 50.0, 93.2, and 88.9%, respectively. The accuracies for the 1-week PQ were 12.5, 100.0, and 91.3%, respectively. The 6-week SQ showed sensitivity, specificity, and OA of 84.6, 42.9, and 62.9%, respectively; the accuracies for the 6-week PQ were 59.0, 66.7, and 63.0%, respectively.
Conclusion: The SQ and PQ showed acceptable accuracy in home palliative care patients. Interestingly, PQ showed higher specificity than SQ at all timeframes. The SQ and PQ assessed by nurses may be useful in providing additional prognostic information for home palliative care.

Keywords

advanced cancer, surprise question, probabilistic question, nurses, palliative care, prognostication

Introduction

Prognostication is the foundation for providing palliative care concordant with personalized goals.[1] Patients, families, and healthcare providers need accurate prognostic information to cope with diverse issues in end-of-life care.[1] Survival duration determines the place of care, treatment options, and resource allocation.[1] However, the prognosis is challenging for clinicians. While the clinician prediction of survival (CPS) is the most widely used prognostic tool, it is well known for its overestimation tendency.[2,3] Recently, studies have reported that the CPS exhibits more accuracy in the prognosis of patients with advanced cancer during the final weeks of their lives.[4,5] The accuracy of prognosis is dependent on the timeframe of patient survival, and CPS is known to be inaccurate in predicting intermediate survival.[6,7]

Surprise question (SQ) required a "Yes" or "No" answer to the question, "Would you be surprised if the patient died in a specific timeframe?" The SQ was initially developed as a screening tool with a 1-year timeframe for patients entering palliative care.[8] It is known to be more accurate in diagnosing

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cancer compared to other serious illnesses.[9] Previous studies have demonstrated the SQs' usefulness in diverse timeframes ranging from weeks to patients' final days.[10-13] Meanwhile, Probabilistic question (PQ) asks, "What is the probability that this patient will be alive (0 to 100%) in a specific timeframe?". The PQ demonstrates more accuracy than temporal predictions ("How much time will this patient have?");[3,14] however, there is a paucity of studies examining the use of PQs in palliative care.

Home palliative care is an essential component of comprehensive palliative care and is needed to meet patients' preferences. Nurses specializing in palliative care play an important role in providing home care, and they are regularly supervised by physicians. However, these medical professionals face dynamic patient situations at the point of care, often working alone in patients' homes. Interestingly, nurses have been shown to have comparable or higher prognostic accuracy than physicians and general practitioners;[2,3,15] this may be because nurses spend more time with patients and may be less affected by optimistic bias.[16] However, prognostication is still difficult for nurses, and there is a lack of studies comparing the accuracy of SQ and PQ in their predictions. Further investigation is needed to determine its usefulness in home palliative care settings. Accordingly, we hypothesized that the convenience of SQ and PQ for nurses could provide additional clinical benefits. Therefore, this study examined nurses' assessments of SQs and PQs in patients with advanced cancer receiving home palliative care.

Methods

Study Participants

This was a single-center, prospective cohort study. Participants were patients who received home palliative care at a university hospital between January 2019 and March 2020. The inclusion criteria were as follows: (1) adult (age ≥18 years), (2) diagnosed with advanced cancer, (3) receiving home palliative care, and (4) voluntarily agreeing to participate in the study.

Data Collection

At the time of enrollment, specialized palliative care nurses recorded basic patient information such as sex, age, the reason for referral to home palliative care, primary cancer sites, and history of cancer treatments. Performance status was assessed using the Palliative Performance Scale (PPS)[17] and the Eastern Cooperative Oncology Group performance scale (ECOG).[18] Nurses were asked the SQ—"Would you be surprised if the patient died in a specific timeframe?"—and the PQ—"What is the probability that this patient will be alive (0 to 100%) within a specific timeframe?". Responses were collected for both questions using four different timeframes: one week, two weeks, four weeks, and six weeks. The patients were enrolled consecutively using convenience sampling. The required sample size was estimated according to the rule of thumb, and a minimum of 10 outcome events (deaths) was desirable for a predictor.[19] We had four SQs and four PQs; therefore, at least 80 participants were required.

This study examined the accuracy of nurses' assessments of SQs and PQs. Thus we collected data related to the nurses, such as age, duration of clinical experience, duration of experience in palliative care, and the number of occasions they cared for patients with advanced cancer per year.

Statistical Analysis

Patients were monitored until death or up to six months after the end of home palliative care; the reasons for ending home palliative care were tracked. If patients died at home or in hospitals, the survival time was calculated by subtracting the date of death at home from the enrollment date in days. If patients were alive after the 6-month follow-up, their data were censored; that is, their final survival status was unknown, but the information (lived until the last follow-up) was included in the survival analysis.

We chose one, two, four, and six weeks as the specific timeframes for the SQs and PQs. These were based on relevant clinical decision-making supported by national representative statistics on home palliative care in South Korea. One week is an important time for families to prepare for the active dying phase. The 2-week timeframe was used as a decision parameter for admission to palliative care units and allocating resources for families in advance. The median total utilization period was 46.0 days (Q1-Q3:25-88) for patients admitted to the palliative care unit from home palliative care services. The median utilization period was 19.0 (9-41) days for patients who had stayed in home palliative care until death in South Korea in 2021.[20] Thus, we posit that the four- and 6-week survival estimates are meaningful for determining appropriate care locations.

We defined accurate survival estimation assessed by SQs and PQs as follows: (1) the patient died within a specific timeframe, and the nurse predicted a "not surprised" or a survival probability ≤30%; or (2) the patient survived in a specific timeframe, and nurses chose a "surprised" or a survival probability ≥70%. The accurate estimation of PQs was determined based on the existing literature.[14] A 40-60% survival probability indicated uncertainty; hence, those ranges were coded as inaccurate, regardless of the survival outcome. Underestimation was defined as when the patient survived in a specific timeframe, and the nurse chose a "not surprised" or survival probability (≤60%). Overestimation was defined as when the patients died within a specific timeframe, and the nurse predicted a "surprised" or survival probability (≥40%).

The sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy (OA) were

calculated to predict survival at one, two, four, and six weeks for each SQ and PQ. We regarded a PQ survival probability of ≥40% as negative test results (ie, not predicted to die).

We performed additional analyses using a different PQ cutoff of 50% survival probability (PQ50). These analyses investigated how cutoff values affect PQ accuracy. We calculated the sensitivity, specificity, positive predictive value, negative predictive value, and OA for the 1-, 2-, 4-, and 6-week PQ50 values. Accurate survival estimation was defined as 1) the patient died within the specific time frame and a survival probability <50% or 2) the patient survived in the specific time frame and a survival probability ≥50%. Underestimation was defined as when the patient survived in the specific time frame and a survival probability <50%. Overestimation was defined as when the patient died within the specific time frame and a survival probability ≥50%.

We compared accurate SQ and PQ estimations in a specific timeframe using McNemar's test. The power of the test for the four comparisons between SQs and PQs was over .9. This means that the sample size was appropriate for comparisons between SQs and PQs.

Kaplan-Meier survival curves were plotted for the SQ and PQ groups. We compared survival between the poor prognosis estimation group ("not surprised" SQs and ≤30% PQs survival probability) and the better prognosis estimation group ("surprised" SQs and ≥70% PQs survival probability) using Log-rank tests.

All statistical analyses were performed using SPSS version 26 software (IBM Corp, Armonk, NY, USA). Statistical significance was set at $P < .05$.

Ethical Statement

All study procedures were approved by the institutional review board of the study institution (2018-08-023). Informed written consent was obtained from the patients or their families (in cases where the patient lacked the capacity to consent).

Results

General Characteristics of Patients

The mean age of patients was 69.2 years, and males accounted for 49.4% (40/81). The median survival of patients was 47.0 days (Q1-Q3:15-77). Most patients (88.9%) were referred to home palliative care from the study hospital. Of the total patients, 24/81 (30%) died at home, and 49/81 (60.5%) were admitted to the study hospital at the end of their home palliative care. The most prevalent cancers were lung cancer (25.9%), colorectal cancer (16.0%), and pancreatic cancer (13.6%). Approximately half of the patients (42/81, 51.8%) had ECOG 3 or 4, while 48.1% of patients (39/81) showed PPS ≥60 (Table 1).

Characteristics of Palliative Care Specialized Nurses

Four female nurses conducted survival estimations using SQs and PQs. The mean age of the nurses was 43.7 years, a mean clinical career of 19.7 years, and a mean career in palliative care of 10.3 years. The nurses cared for approximately 80 palliative care patients annually (data not shown).

Distributions of Answers for SQs and PQs

Regarding the 1-, 2-, 4-, and 6-week SQs, the percentage of responses indicating "not surprised" were 11.1%, 23.5%, 54.3%, and 70.4%, respectively. Regarding the 1-, 2-, 4-, and 6-week PQs, the percentages of answers for a survival probability ≤30% were 1.2%, 9.9%, 28.4%, and 45.7%, respectively. Additionally, the percentage of uncertainty probabilities (40-60%) for the 1-, 2-, 4-, and 6-week PQs were 18.5%, 18.5%, 25.9%, and 24.7%, respectively (Figure 1).

Accuracies of SQs and PQs

One- and 2-week SQ showed sensitivities of 50% and 58.8%, respectively. One- and 2-week SQ specificities were high at 93.2% and 85.9%, respectively. Similarly, 1- and 2-week PQ had low sensitivity (12.5% and 23.5%, respectively) and high specificity (100% and 93.7%, respectively). Conversely, 4- and 6-week SQ showed high sensitivity (85.2% and 84.6%, respectively) and low specificity (61.1% and 42.9%, respectively). Sensitivities of 59.3% and 59.0% were shown at 4- and 6-week PQs, respectively. Four-week PQ showed high specificity at 87.0%, whereas the 6-week PQ had 66.7% specificity. OA was the highest in 1-week SQ and 1-week PQ (88.9% and 91.3%, respectively). The OA decreased as the timeframe lengthened in both the SQs and PQs (Table 2).

Accuracies and Accurate PQ Estimations Using a Survival Probability Cutoff of 50%

Applying the survival probability cutoff of 50% for PQ (PQ50) yielded similar results in terms of performance (sensitivity and specificity). Additionally, PQ50s demonstrated similar proportions of accurate estimation as the SQs (Supplementary Table 1).

Accurate/overestimated/underestimated Proportion by SQs and PQs

The proportion of accurate estimations assessed by the 1-, 2-, 4-, and 6-week SQ were 88.9%, 80.2%, 69.1%, and 63.0%, respectively. The proportion of accurate estimations assessed by the 1-, 2-, 4-, and 6-week PQs were 77.8%, 70.4%, 63.0%, and 49.4%, respectively. Overestimations from the 1-, 2-, 4-, and 6-week SQ were 4.9%, 8.6%, 4.9%, and 7.4%, respectively. Overestimation from the 1-, 2-, 4-, and 6-week PQs were 8.6%, 16.0%, 13.6%, and 19.8%, respectively. Underestimations from the 1-, 2-, 4-, and 6-week SQs were 6.2%, 11.1%, 25.9%, and

Table 1. General Patient Characteristics (n = 81).

	Mean ± SD or n (%)
Age (years)	69.2 ± 13.4
Male	40 (49.4)
Entry route to home palliative care	
Discharge from the PCU of study hospital	5 (6.2)
Discharge from general wards of study hospital	35 (43.2)
Discharge from other hospitals	4 (4.9)
Requested from outpatient departments of study hospital	37 (45.7)
End of home palliative care	
Death at home	24 (29.6)
Admission and death in study hospital	49 (60.5)
Admission and death in other hospitals	7 (8.6)
Admission to other hospitals; was alive at the end of follow up	1 (1.2)
Primary cancer sites	
Lung	21 (25.9)
Stomach	5 (6.2)
Esophagus	1 (1.2)
Colon/rectum	13 (16.0)
Liver	1 (1.2)
Gallbladder/bile duct	9 (11.1)
Pancreas	11 (13.6)
Breast	4 (4.9)
Cervix/ovary	7 (8.6)
Lymphoma/leukemia	1 (1.2)
Head and neck	3 (3.7)
Other	5 (6.2)
Treatment history	
Operation	35 (43.2)
Chemotherapy	47 (58.0)
Radiotherapy	20 (24.7)
Hormone therapy	0 (.0)
None	20 (24.7)
ECOG	
1	16 (19.8)
2	23 (28.4)
3	29 (35.8)
4	13 (16.0)
PPS	
≥60	39 (48.1)
30-50	35 (43.2)
10-20	7 (8.6)
Median survival time [days,(Q1 - Q3)]	47.0 (15-77)

SD, standard deviation; PCU, palliative care unit; ECOG, Eastern Cooperative Oncology Group performance status scale; PPS: Palliative Performance Scale.

29.6%, respectively. Underestimations from the 1-, 2-, 4-, and 6-week PQs were 13.6%, 13.6%, 23.5%, and 30.9%, respectively (Table 2, Figure 2).

Statistically, the proportions of accurate estimations for the 1-, 2-, and 6-week SQs were significantly higher than the same PQ timeframes (P = .004, .039, and .019, respectively). However, the SQ and PQ 4-week timeframes showed similarly accurate estimates (P = .383, Figure 2).

Survival Comparisons Between Groups With Favorable and Unfavorable SQ and PQ Prognoses

In both SQs and PQs, the groups with a favorable prognosis ("not surprised," or survival probability ≥70%) for each timeframe had significantly longer survival compared to the unfavorable prognosis groups ("surprised," or survival probability ≤30%; P < .05 for all analyses; Figures 3 and 4).

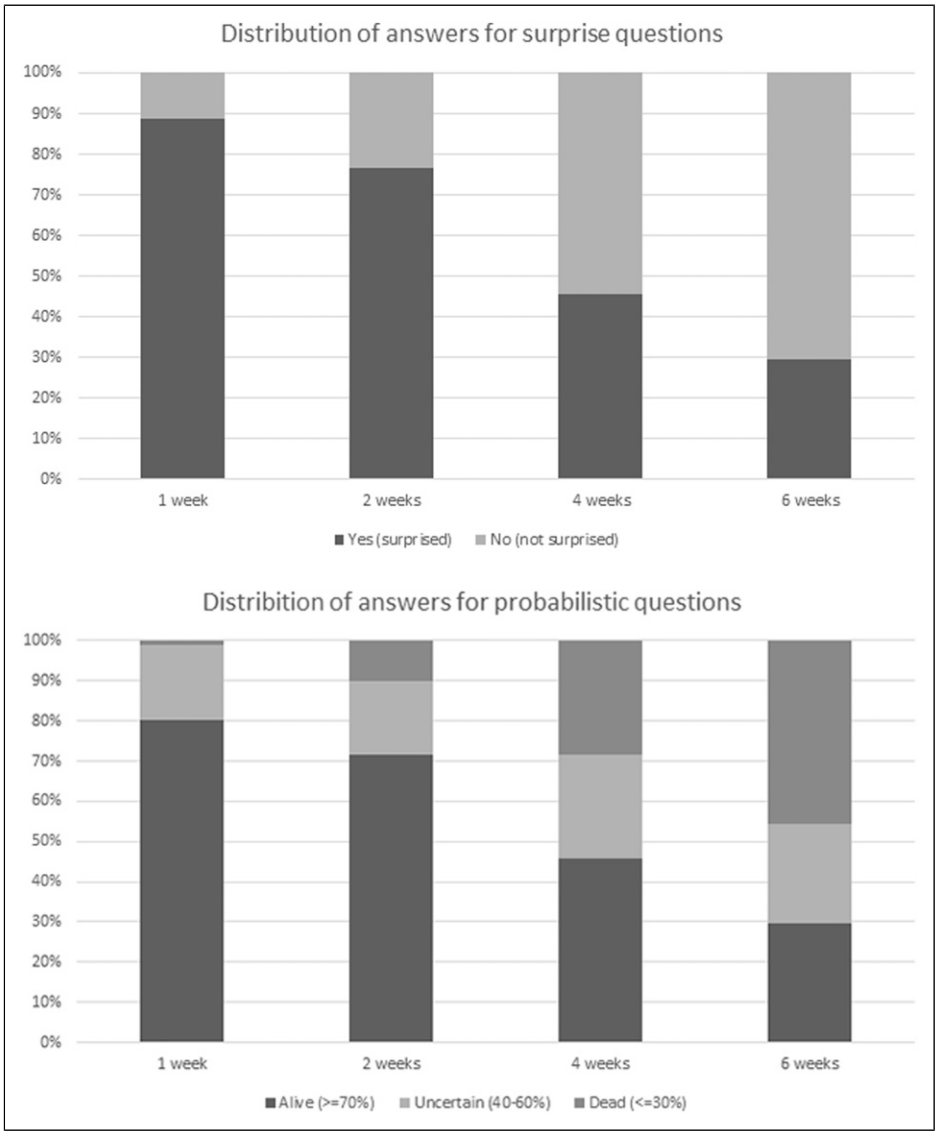

Figure 1. Distribution of answers to surprise and probabilistic questions.

Discussion

Our study found that the SQs and PQs assessed by nurses were accurate and feasible for use in home palliative care settings. Considering their simplicity, both SQs and PQs can be useful prognostic tools for palliative home-based patients with advanced cancer.

The SQs showed better accuracy than the PQs in our study (Figure 2). Both SQs and PQs showed good discriminative abilities for favorable and unfavorable prognoses (Figures 3 and 4). The accuracy of both the SQs and PQs increased as survival decreased. Our findings highlight that PQs have high specificity, especially for short survival. This means that if survival probability is determined to be less than 30% using PQ, there is a high likelihood of predicting death at the 1- and 2-week timeframes (Table 2).

SQ showed approximately 90% of accuracy at the 1-week timeframe. SQs were approximately 80% accurate at the 2-week timeframe but decreased to around 70% at the 4-week timeframe and to 63% at the 6-week timeframe. PQ showed the highest survival rate accuracy at more than 90% in OA for the 1-week timeframe, similar to SQ. As both SQ and PQ belong to CPS, they exhibited CPS properties. In other words, SQ and PQ exhibited good discriminative ability in distinguishing between groups with shorter and longer survival times. The "horizon effect"—where the accuracy of predictions increases as the predicted time approaches—was observed in both questions; CPS was more accurate as the time of death drew nearer. It is important to note that CPS—and similarly SQs and PQs—is not accurate enough to estimate survival time precisely. Therefore, the proportion of accurate estimations was lower for both questions than OAs.

Table 2. Accuracy of Surprise and Probabilistic Questions.

	Prevalence of Death	Sensitivity	Specificity	PPV	NPV	OA	Accurate estimation	Under-estimation	Over-estimation
1-week SQ	9.9 (8/81)	50.0 (4/8)	93.2 (68/73)	44.4 (4/9)	94.4 (68/72)	88.9 (72/81)	88.9 (72/81)	6.2 (5/81)	4.9 (4/81)
1-week PQ		12.5 (1/8)	100 (73/73)	100 (1/1)	91.3 (73/80)	91.3 (74/81)	77.8 (63/81)	13.6 (11/81)	8.6 (7/81)
2-week SQ	21.0 (17/81)	58.8 (10/17)	85.9 (55/64)	52.6 (10/19)	88.7 (55/62)	80.2 (65/81)	80.2 (65/81)	11.1 (9/81)	8.6 (7/81)
2-week PQ		23.5 (4/17)	93.7 (60/64)	50.0 (4/8)	82.2 (60/73)	78.9 (64/81)	70.4 (57/81)	13.6 (11/81)	16.0 (13/81)
4-week SQ	33.3 (27/81)	85.2 (23/27)	61.1 33/54)	52.3 (23/44)	89.2 (33/37)	69.1 (56/81)	69.1 (56/81)	25.9 (21/81)	4.9 (4/81)
4-week PQ		59.3 (16/27)	87.0 (47/54)	69.6 (16/23)	81.0 (47/58)	77.8 (63/81)	63.0 (51/81)	23.5 (19/81)	13.6 (11/81)
6-week SQ	48.1 (39/81)	84.6 (33/39)	42.9 (18/42)	57.9 (33/57)	75.0 (18/24)	62.9 (51/81)	63.0 (51/81)	29.6 (24/81)	7.4 (6/81)
6-week PQ		59.0 (23/39)	66.7 (28/42)	62.2 (23/37)	63.6 (28/44)	63.0 (51/81)	49.4 (40/81)	30.9 (25/81)	19.8 (16/81)

PPV, positive predictive value; NPV, negative predictive value; OA, overall accuracy; SQ, surprise question; PQ, probabilistic question.
Data are shown as percentages.
For calculating PQ accuracies, "uncertain (40-60%)" and "alive (≥70%)" were regarded as negative (not predicted to die) test results.
Accurate estimation is regarded as one of follows: (alive and "surprised") or (died and "not surprised") or (alive and survival probability ≥70%) or (died and survival probability ≤30%).
Underestimation is regarded as (alive and "not surprised") or (alive and survival probability ≤60%).
Overestimation is regarded as (died and "surprised") or (died and survival probability ≥40%).

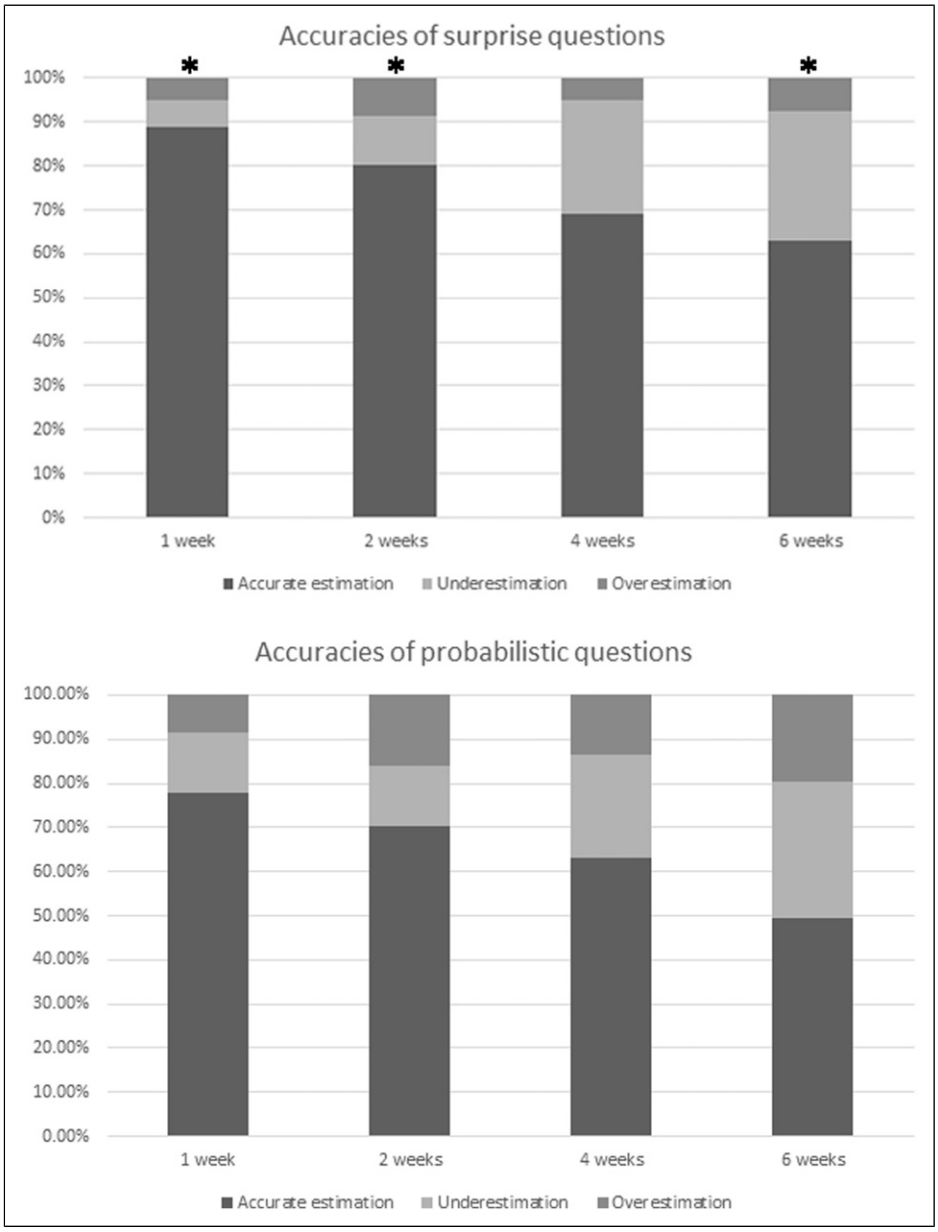

Figure 2. The accurate or inaccurate proportion of survival estimates for surprise and probabilistic questions. Accurate estimation is regarded as one of follows: (alive and "surprised") or (died and "not surprised") or (alive and probability≥70%) or (died and probability≤30%). Underestimation is regarded as (alive and "not surprised") or (alive and probability≤60%). Overestimation is regarded as (died and "surprised") or (died and probability≥40%). * According to McNemar's test, comparing accurate estimations of paired surprise questions (SQs) and probabilistic questions (PQs) was statistically different at 1-, 2-, and 6-week survival (all $P < .05$). However, the accurate estimation of the 4-week survival in the SQ and PQ groups was not statistically different (69.1% vs 63.0%, $P = .383$).

Notably, the SQs demonstrated significantly better estimation accuracy than the PQs. For instance, the proportion of accurate estimation for PQs decreased, with only approximately 50% accuracy achieved at the 6-week survival timeframe. In previous studies, PQs were found to be more accurate than temporal questions (TQ).[14] However, our study did not collect TQ data; thus, a direct comparison between PQ to TQ was not possible. Another study found that SQ was as accurate as TQ.[12] At this point, it is hard to compare the accuracies of PQ to other studies because no preceding studies compared PQs to SQs. The PQ has an 11-point scale (0-100%), whereas the SQ has only a yes/no response. One might assume that the PQ is more accurate than the SQ because it has a more precise assessment scale. However, our findings suggest that the SQs demonstrated higher accuracy in estimation than the PQs. One explanation for this is that uncertain responses to PQs (40-60% survival probability) were considered inaccurate in our study, while the SQs divided this

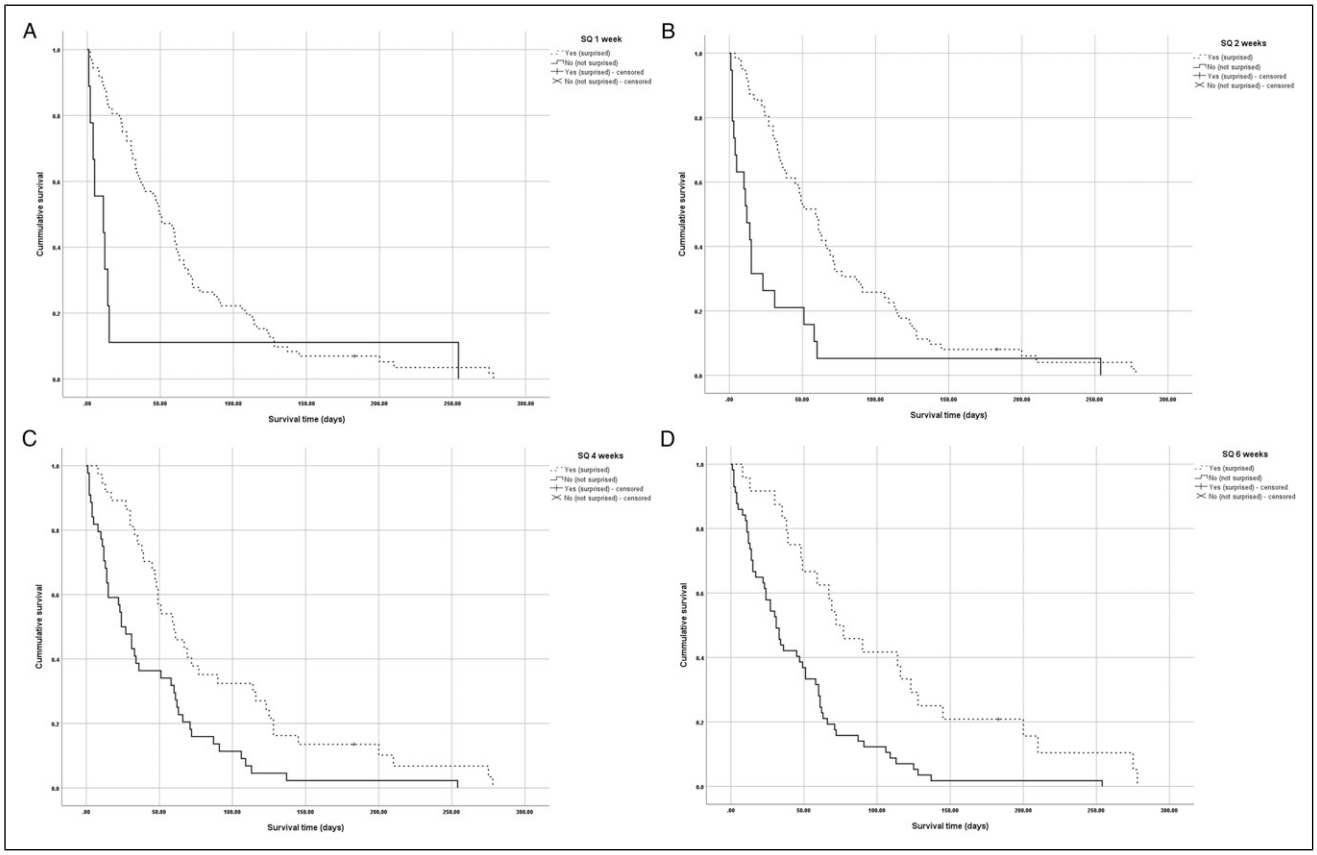

Figure 3. Survival comparisons between groups with favorable and unfavorable prognoses using surprise questions. SQ, surprise question. (A) (1-week SQ): Median survival time (95% confidence interval [CI]) of the "surprised" group was significantly longer than that of the "not surprised" group (49 [34.5-63.6] days vs. 11 [0.0-28.5] days, P=0.023). (B) (2-week SQ): Median survival time (95% CI) of the "surprised" group was significantly longer than that of the "not surprised" group (59 [45.5-72.5] days vs 12 [6.3-17.7] days, $P < .001$). (C) (4-week SQ): Median survival time (95% CI) of the "surprised" group was significantly longer than that of the "not surprised" group (60 [38.6-81.5] days vs 24 [14.3-33.8] days, $P = .001$). (D) (6-week SQ): Median survival time (95% CI) of the "surprised" group was significantly longer than that of the "not surprised" group (72 [44.4-99.6] days vs 31 [21.8-40.3] days, $P < .001$).

uncertainty into clear yes/no answers. This assumption was confirmed using a different cutoff for PQ (50% survival probability; Supplementary Table 1). However, further research is needed as this is the first study to use 50% survival probability as a cutoff for PQ. Another possible explanation is that nurses may answer 40-60% probability with less confidence, and the uncertain response zone of the PQ may increase such uncertainty, while the SQ requires decisively dichotomous answers.

Our findings have several clinical implications. SQs and PQs both showed high specificity—around 90% for 1-week and 2-week timeframes. Thus, both SQs and PQs can be useful tools to predict death in 1- and 2-week timeframes. On the contrary, SQ sensitivities were high at more than 80% for the 4- and 6-week timeframes. Therefore, we suggest using the 4- and 6-week SQ as screening tools to avoid late entry to palliative care services or advance care planning.

Compared with previous studies, our results showed similar accuracy for SQs. In a meta-analysis, SQs' pooled accuracy was approximately 75%.[9] However, our results for SQs were different from sensitivities for unfavorable survival. The estimated sensitivity was 71% in another recent meta-analysis.[21] Our findings revealed that SQs had lower sensitivities but higher specificities compared to preceding studies.[10,21] However, our results were similar to those of Kim et al[12] suggesting that patient characteristics or clinician factors may have influenced the outcomes.

A unique characteristic of the current study was the care setting, as patients with relatively good performance status could receive care at home. This resulted in longer survival times than those in hospital settings. Home care is essential to systematic palliative care, as it can reduce hospital use and increase patient satisfaction.[22] Hamano et al reported that prognostics tools should be re-examined in home palliative care settings.[23,24] Some widely used prognostic models have been primarily developed and validated to predict the survival of patients in a hospital palliative care setting.[25-27]

Prognostication is a complex and challenging task for clinicians, and overestimation tendency is one of the pitfalls of CPS. CPS is reportedly quite accurate in predicting the

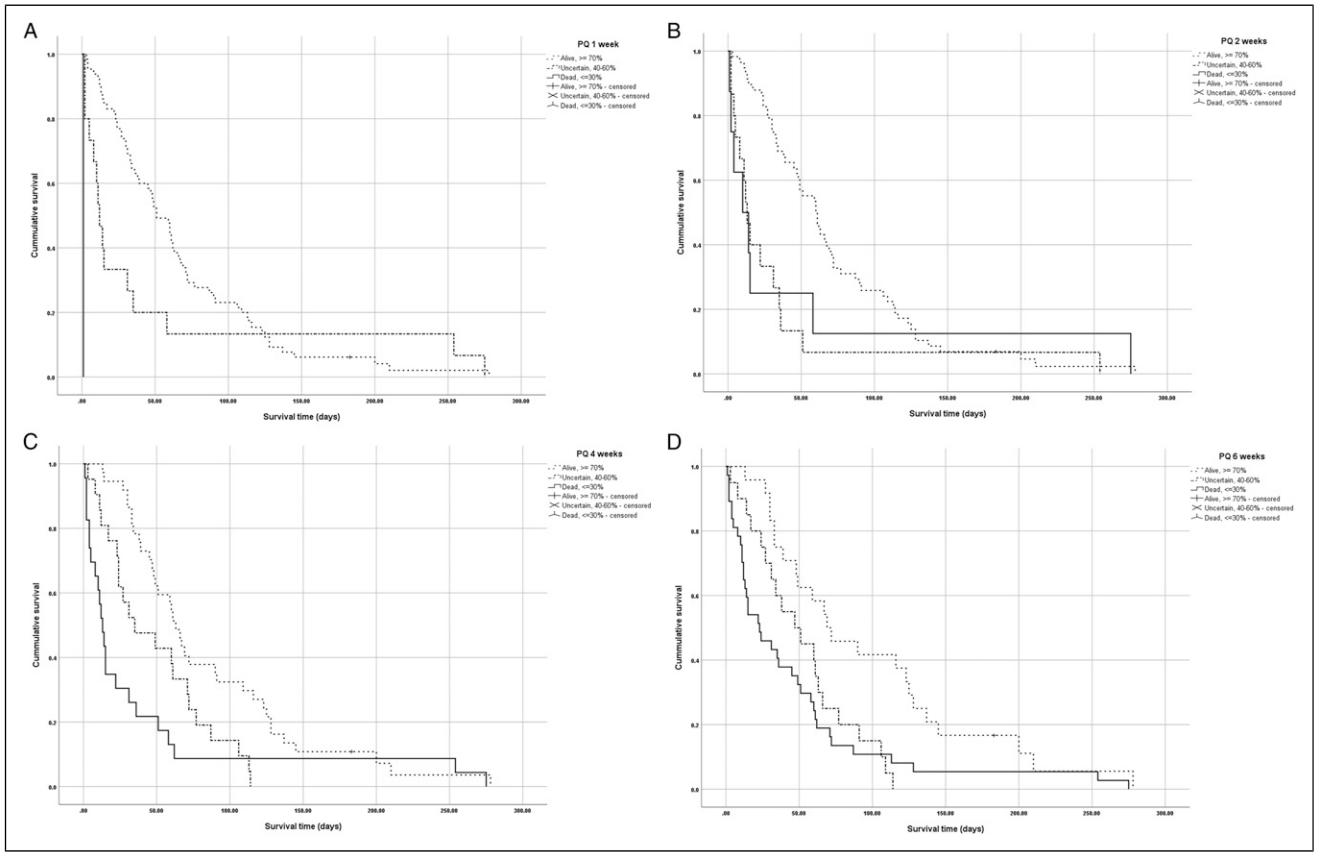

Figure 4. Survival comparisons between the groups with favorable and unfavorable prognoses based on probability questions. PQ, probabilistic question. (A) (1-week PQ): Median survival times (95% Confidence Interval [CI]) of the "probability≥70%" group, "uncertain: probability 40-60%" group, and "probability≤30%" group were statistically different (51 [37.5-64.5] days vs 12 [7.0-17.1] days vs 1.0 days, respectively, P = .023). (B) (2-week PQ): Median survival times (95% CI) of the "probability≥70%" group, "uncertain: probability 40-60%" group, and "probability≤30%" group were statistically different (60 [46.3-73.7] days vs 13 [8.0-18.1] days vs 10 [.0-23.9] days, respectively, P = .008). (C) (4-week PQ): Median survival times (95% CI) of the "probability≥70%" group, "uncertain: probability 40-60%" group, and "probability≤30%" group were statistically different (63 [53.5-72.5] days vs 35 [2.1-67.9] days vs 13 [2.4-8.3] days, respectively, P < .001). (D) (6-week PQ): Median survival times (95% CI) of the "probability≥70%" group, "uncertain: probability 40-60%" group, and "probability ≤30%" group were statistically different (69 [31.8-106.2] days vs 47 [18.5-75.5] days vs 23 [6.1-39.9] days, respectively, P = .001).

final few weeks of survival of patients with advanced cancer; [4,5] however, it can differ depending on patient survival.[7] For intermediate survival, more research is needed to examine prognostic tools.[6] Preceding studies found that nurses are as accurate or more accurate than physicians.[2,15,28] In Korea's home palliative care, specialized nurses visit patients' homes on weekly basis. Physicians supervise medical charts, receive reports as needed, and conduct monthly visits to patient homes with nurses. If a patient's status deteriorates rapidly, nurses must make decisions promptly to prepare patients and their families for significant changes. Thus, we examined the accuracy of SQs and PQs assessed by nurses in home palliative care. Our findings show that nurses' overestimations ranged from 4.9∼19.8%. The overestimation tendency was lower for SQs than for PQs. These were lower compared to physicians, which were reported as ∼45% (43∼49%) by Amano et al.[29] Since Amano et al investigated TQs, the calculation method for overestimations may differ. Nevertheless, there have been consistent findings in previous studies.

According to a previous study using the probabilistic approach, nurses were significantly more accurate at predicting survival on final days than physicians.[14] Nurses typically spend more time with patients, which may enable them to detect patient changes more promptly and accurately for survival prediction.[16] Another factor is physicians' overestimation tendency. Physicians have traditionally been trained to maintain life and health; thus, they may hesitate to underestimate patients' life expectancy. Similarly, patients may present their condition more favorably to physicians due to social desirability bias or hope for treatment. Ermacora et al[15] stressed nurses' critical role in palliative care settings. In other words, nurses may have a more comprehensive understanding of overall patient needs; moreover, families can easily communicate with nurses on the frontline of treatment.[30] Therefore, nurses' prognostication was reported to be at least as

accurate as physicians in previous literature.[2,9,14,15,28] Thus, nurses' survival estimations can provide additional prognostic information to crosscheck physicians' overestimation tendencies.

The strengths of this study are as follows: We compared the accuracies of the SQs and PQs simultaneously at different timeframes (one, two, four, and six weeks). The nurses proactively formulated all predictive assessments for home care. The study participants' survival time was intermediate, which requires further investigation. Furthermore, the place of care was patients' homes, contrasting most previous studies performed in hospital settings.

This study has some limitations. This was a single-center study; thus, it may not represent the findings of other institutions. More elaborate prognostic models were not compared to SQs and PQs. It is uncertain whether clinicians can replicate our results with different specialties and places of palliative care. The accuracy of the SQ and PQ may differ according to diagnosis; thus, further research is warranted in patients receiving palliative care for non-cancer diseases.

Currently, well-validated prognostic models are available for palliative care. Therefore, it is worth comparing SQs and PQs with the simplified Palliative Prognostic Index,[30] Palliative Prognostic Score,[25] and Objective Prognostic Score[31] in the future. Further research is required to incorporate SQs and PQs into website calculators (predictsurvival.com)[32] for more accurate and easier prognostication and communication.[33] Serial SQ and PQ assessments may better reflect the dynamic process of a patient's disease trajectory. Further investigations are needed to understand how patients and families understand prognostic information using SQs and PQs.

In conclusion, nurses' SQs and PQs showed acceptable accuracy in home palliative patients at 1-, 2-, 4-, and 6-week survival timeframes. PQs can be useful in predicting death in the final one or two weeks of a patient's life due to their high specificity. The nurses' SQs and PQs may provide additional prognostic information for home palliative care.

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