Is spiritual well-being related to survival time of inpatients with advanced cancer? An East Asian cohort study

Yusuke Hiratsuka (hiratsuka.med.t@gmail.com)
Tohoku Daigaku https://orcid.org/0000-0003-2334-3893

Sang-Yeon Suh
Dongguk University

Seon Hye Won
Dongguk University

Sung Eun Choi
Dongguk University

Sun Hyun Kim
Catholic Kwandong University International Saint Mary's Hospital

Shao Yi Cheng
National Taiwan University

Ping Jen Chen
Kaohsiung Medical University

Seok Joon Yoon
Chungnam National University Hospital

Su Jin Koh
Ulsan University Hospital

Shin Ae Park
Seoul Metropolitan Government

Ji Yeon Seo
Seoul Metropolitan Government

David Hui
The University of Texas MD Anderson Cancer Center

Takashi Yamaguchi
Konan Byoin

Tatusya Morita
Seirei Mikatahara Byoin

Satoru Tsuneto
Kyoto University: Kyoto Daigaku

Masanori Mori
Seirei Mikatahara Byoin

Akira Inoue
Tohoku University: Tohoku Daigaku

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Abstract

Purpose: It has been suggested that psychosocial factors are related to survival time in patients with cancer. However, there is no cross-cultural study examining the relationship between spiritual well-being (SWB) and survival time among countries. This study investigated the relationship between SWB and survival time among three East Asian countries.

Methods: This international multicenter cohort study is a secondary analysis involving newly admitted inpatients with advanced cancer in palliative care units in Japan, South Korea and Taiwan. SWB was measured at admission. We performed multivariate analysis using the Cox proportional hazards model to identify independent prognostic factors.

Results: A total of 2638 patients treated at 37 palliative care units from January 2017 to September 2018 were analyzed. The median survival time was 18.0 days (95% confidence interval [CI] 16.5 to 19.5) in Japan, 23.0 days (95% CI 19.9 to 26.1) in Korea and 15.0 days (95% CI 13.0 to 17.0) in Taiwan. Four variables were significant in Japan, Korea and Taiwan. SWB was a significant factor correlated with survival in Taiwan (hazard ratio [HR] 1.27; 95% CI 1.01 to 1.59; p = 0.04), while it was insignificant in Japan (HR 1.10; 95% CI 1.00 to 1.22; p = 0.06), and Korea (HR 1.02; 95% CI 0.77 to 1.35; p = 0.89).

Conclusion: SWB of patients with advanced cancer was related to survival time in Taiwan but not in Japan or Korea. The findings suggest that spiritual care may contribute to prolonged survival in patients with far advanced cancer.

Introduction

The role of psychosocial factors in survival is not clear, while several physical symptoms are clearly related to survival. A previous study [1] reported that depression predicted mortality in cancer patients; however, the study suggested that depression may play a causal role due to the relatively small but statistically significant risk. Notably, some studies suggested a possible relationship between quality of life (QOL) and survival in palliative care population; however, the prognostic value of the tools for QOL evaluation may vary with the subscales used depending on the physical symptoms [2, 3]. However, early palliative care designed to improve QOL and mood prolonged survival time in patients with metastatic lung cancer [4]. Until now, the results are inconsistent, suggesting that psychosocial interventions may prolong survival time [5].

Spiritual well-being (SWB) is one of the important components of QOL, which is related to perception of patients' physical health [6]. Generally, it is defined as a multidimensional concept including peace of mind, faith and meaning of life [7]. Low SWB is associated with hopelessness [8], depression [9], poor QOL [10], anxiety [11] and even expressed wish for hastened death [12]. High SWB is related to less depression, stronger religious belief [11, 13], better self-reported physical health of patients [14, 15] and less anxiety [11, 16, 17]. Thus, SWB may have a close relationship with QOL and psychosocial factors. Additionally, SWB is closely related to psychological rather than physical well-being [7]. Therefore, we hypothesized that SWB is related to survival in patients with advanced cancer. However, few studies have reported the possibility of SWB with survival time in such patients. One study [18] reported that SWB was related to survival time in patients with HIV infection. In a cancer care setting, another study [19] revealed that SWB was related to 3-year overall survival of post hematopoietic stem cell transplant recipients. In these studies, religiosity and spirituality (R/S) are known to be associated with both mental and physical health and affect survival via the following mechanisms [20]. First, R/S affect health outcomes including mortality by enhancing psycho-neuroimmune function [21]. Second, R/S beliefs affect patients' decision-making especially among patients with advanced cancer [22]. For instance, unmet spiritual needs were linked to more aggressive medical treatment at the end of life and worse health outcome. Third, R/S affects the support and care that patients receive from a faith community. However, a Korean study [23] found no significant relationship between SWB and survival time in patients with advanced cancer. Therefore, a further study for patients with advanced cancer is required to clarify the relationship.

As far as we know, there was no cross-cultural study investigating the relationship between SWB and survival time of patients in different countries. East Asian countries have many things in common, such as family-based decision-making and respect for the elderly. Nevertheless, religious and traditional beliefs as well as cultural background differ among the three East Asian countries. The various factors are related to SWB, and thus the effect on survival time may differ among countries. Therefore, this study investigated the relationship between SWB and survival time among patients in three East Asian countries.

Methods

Participants

This study was conducted as a secondary analysis of an international multicenter prospective cohort study involving inpatients with advanced cancer in Japan, South Korea and Taiwan.

It was a sub-study of the East-Asian collaborative cross-cultural Study to Elucidate the Dying Process (EASED), which investigated the dying process and end-of-life care of inpatients with advanced cancer admitted to palliative care units (PCUs) nationwide in the three countries.
Newly admitted inpatients at the participating PCUs during the study period were enrolled consecutively. All observations were performed under routine clinical practice. The inclusion criteria for patients in this study were: (1) adult (> = 18 years in Japan and Korea and > = 20 years in Taiwan), (2) diagnosed with locally extensive or metastatic cancer, and (3) admitted to participating PCUs. The exclusion criteria were: (1) scheduled discharge within 1 week and (2) refusal of patients or their families to be enrolled.

Data collection

The physicians and/or nurses attending PCUs recorded all variables prospectively on a structured data-collecting sheet designed for the study on the first day of admission and follow-up data. We collected and analyzed the following study parameters: patient background, psychosocial aspects, preferred place of death, clinical symptoms, signs and survival time. Survival time was observed from admission to PCUs until death or discharge. We followed up discharged patients for 6 months from admission to PCUs in Japan and Taiwan, and from cases discharged from PCUs in Korea. Therefore, we defined survival time as mortality in and outside of hospitals and calculated by subtracting the cases on the admission date from those on death date. Other live cases at follow-up were considered as censored cases. Physicians and/or nurses asked patients about SWB and evaluated each symptom using the Integrated Palliative Outcome Scale (IPOS): 0, always; 1, most of the time; 2, sometimes; 3, occasionally; 4, not at all; 5, cannot assess because of unconsciousness. The Japanese version of IPOS has been reported as a valid and reliable tool for assessing physical, psychological, social, and spiritual symptoms and to measure outcomes of adult patients with cancer in Japan [24]. The IPOS is undergoing validation in Korea. The validation process of the IPOS in Taiwan has been completed and the results were reported at an international symposium.

We determined the measurement outcomes associated with SWB and survival time and related demographic data based on a literature review.
First, we collected variables, which were associated with survival time [25]: oral intake, dyspnea, and Karnofsky Performance Scale (KPS). Second, we collected the variables, which are potential confounders related to both SWB and survival time [11–13, 26]: age, highest level of education, living with family, religion, preferred place of death and marital status.

Statistical analysis

Descriptive analyses were performed to summarize baseline characteristics. Survival was calculated using the Kaplan-Meier method. Univariate survival analyses were used to compare survival times according to each variable using the log-rank test. We selected the variables with a P-value less than 0.1 based on univariate analyses and SWB, and entered into multivariate analysis. A stepwise regression analysis was performed using the Cox proportional hazards model to identify independent prognostic factors. All analyses were performed using IBM Statistical Package for Social Science (SPSS) Statistics for Windows, version 24.0 (IBM Corp., Armonk, NY, USA).

Ethics

In accordance with the ethical guidelines for human research stipulated by the Ministry of Health, Labor, and Welfare in Japan, patients' informed consent was waived because of the completely observational nature of the study and patients were provided the opportunity to opt out.

In South Korea and Taiwan, informed consent was obtained from patients or their families in case the patients lacked the capacity to decide.
This study was approved by the local Institutional Review Boards of all participating institutions.
The independent ethics committee of Tohoku University School of Medicine (approval no.

2016-1-689) also approved this study.

Results

Patients' characteristics

We analyzed data of 2638 patients across 37 PCUs (22 in Japan, 11 in South Korea and 4 in Taiwan) in this study from January 2017 to September 2018. A total of 2638 patients comprised 1375 men (52.1%) (Japan: 965 (50.9%), Korea: 184 (54.9%), Taiwan: 226 (55.5%)). The mean ± standard deviation of age was 72.4 ± 12.3 years in Japan, 68.3 ± 12.2 years in Korea and 66.6 ± 13.8 years in Taiwan. The median survival time was 18.0 days (95% confidence interval [CI]16.5 to 19.5) in Japan, 23.0 days (95% CI 19.9 to 26.1) in Korea and 15.0 days (95% CI 13.0 to 17.0) in Taiwan. The characteristics of patients are listed in Table 1.

Table 2 lists the results of univariate analysis to identify factors associated with survival time. In Japan, 6 variables were significantly associated with survival time: religion ($p < 0.01$), oral intake ($p < 0.01$), dyspnea ($p < 0.01$), SWB at admission ($p < 0.01$), marital status ($p < 0.01$) and KPS ($p < 0.001$). In Korea, 5 variables were significantly associated with survival time: living with family ($p = 0.03$), oral intake ($p < 0.01$), dyspnea ($p < 0.01$), marital status ($p = 0.03$) and KPS ($p < 0.01$). Due to high collinearity with marital status, living with family was excluded from the final multivariate analysis in Korea. In Taiwan, 4 variables were significantly correlated with survival time: oral intake ($p < 0.01$), dyspnea ($p < 0.001$), marital status ($p = 0.03$) and KPS ($p < 0.001$). Thus, SWB was significant in Japanese patients only in univariate analysis.

Table 3 lists the result of multivariate analysis to identify factors associated with survival time. In the Japanese group, 4 variables were significantly correlated with survival time: lower KPS (10-30 vs. ≥ 40) (hazard ratio [HR] 1.85; 95% confidence interval [CI] 1.65 to 2.07; $p < 0.01$), marital status (Yes vs. Unmarried/Divorced/Widowed) (HR 1.12; 95% CI 1.01 to 1.24; $p = 0.03$), fewer intakes (≤ Mouthfuls vs. Normal/Reduced but more than mouthfuls) (HR 1.76; 95% CI 1.56 to 1.98; $p < 0.01$) and dyspnea (At rest vs. No/Exertional only) (HR 1.68; 95% CI 1.48 to 1.90; $p < 0.01$). In the Korean group, 4 variables were significantly correlated with survival time: lower KPS (10-30 vs. ≥ 40) (HR 2.04; 95% CI 1.52 to 2.75; $p < 0.01$), marital status (Yes vs. Unmarried/Divorced/Widowed) (HR 1.37; 95% CI 1.06 to 1.77; $p = 0.02$), fewer intakes (≤ Mouthfuls vs. Normal/Reduced but more than mouthfuls) (HR 1.38; 95% CI 1.03 to 1.86; $p = 0.03$) and dyspnea (At rest vs. No/Exertional only) (HR 1.56; 95% CI 1.05 to 2.33; $p = 0.03$). In the Taiwanese group, 4 variables were significantly related to survival time: lower KPS (10-30 vs. ≥ 40) (HR 1.41; 95% CI 1.10 to 1.81; $p < 0.01$), Worse SWB at admission (Occasionally/Not at all/Sometimes vs. Always/Most of the time) (HR 1.27; 95% CI 1.01 to 1.59; $p = 0.04$), fewer intake (≤ Mouthfuls vs. Normal/Reduced but more than mouthfuls) (HR 1.74; 95% CI 1.36 to 2.22; $p < 0.01$) and dyspnea (At rest vs. No/Exertional only) (HR 1.73; 95% CI 1.35 to 2.22; $p < 0.01$).

Discussion

The aim of this study was to explore the relationship between SWB and survival time among three East Asian countries. We found that SWB was a significant factor correlated with survival in Taiwan, while it was insignificant in Japan and Korea. This study is the first of its kind to reveal the significant role of SWB in the survival time of patients with advanced cancer.

SWB was a significant factor associated with survival time in Taiwan in multivariate analysis. It was unexpected because we found an insignificant relationship between SWB and survival time in univariate analysis. There are two plausible explanations for this phenomenon from a statistical view point. Survival plots of Taiwanese patients suggested possible differences between groups with Lower and Better SWB. However, some outliers who had lived far longer narrowed the difference at the end of plots (Fig. 1). Second, the influence of SWB was contradictory in univariate analysis and thus it appeared significant after adjustment in multivariate analysis. The unique result may reflect intensive spiritual care in Taiwanese PCUs.

A previous study from Taiwan reported that spiritual care was an essential component of palliative care, especially at the very end of life in Taiwan and Clinical Buddhist Chaplains (CBC's).
It is a mainstay of Taiwanese hospice care, and often spiritual care is provided to patients and families during life-limiting illness [27–28]. The shortest survival of 2 weeks in the Taiwanese group may be advantageous to show the relationship between SWB and survival time. SWB was insignificant in Japanese and Korean patients in the final model, and two groups had longer survival (around three weeks) compared with the Taiwanese group. Patients at the end of life are known to suffer from spiritual distress [6]. It is common to see increasing levels of interest and concern among the families of patients under palliative care as death is nearer.

Therefore, we assume that the influence of SWB on survival time may increase according to the shortened survival. Another biological plausibility is that SWB can affect survival time based on its link with physical symptoms [2, 3]. Spirituality could be protective against physical symptoms [29], while the intensity of physical symptoms is known to be associated with survival time of patients having advanced cancer [30, 31]. Thus, better SWB may prolong survival time. Since the IPOS item for SWB assessed “peacefulness” of the patient, medical professionals may regard SWB as a part of overall QOL or “being free from suffering”. In fact, we observed a weak relationship between SWB and survival time in Japan based on the results of multivariate analysis ($p = 0.06$). Therefore, SWB had a borderline significance on survival time in Japan. In univariate analysis, the median survival time of the Korean group with Worse SWB at admission was 22.0 days and it was longer than in Japanese and Taiwanese groups with Better SWB at admission (respectively, 22.0 days, 17.0 days). Therefore, we presume that SWB affects survival time significantly when death is near. Probably, Korean patients were not the population affected by SWB because of their longest survival time. Another possibility is that SWB is rated according to IPOS implicit overall well-being to some degree. The effect of SWB on survival time may overlap with that of physical distress. Especially in Japan, although SWB was significant in univariate analysis, its role in survival was diminished by other physical symptoms in multivariate analysis. A previous Korean study [23] showed that SWB was not related to survival time. The median survival time of the study participants was about 20 days, which was comparable to our study. Hence, our results involving the Korean group are consistent with the previous study.

Previous studies reported that the intensity of physical symptoms such as dyspnea and anorexia were related to survival time of inpatients with advanced cancer [30, 31]. Notably, dyspnea has been reported to indicate psychosocial and spiritual distress [32, 33]. The lower KPS, fewer oral intakes and dyspnea at rest among Japanese patients were related to shorter survival time as in Korea and Taiwan. These variables have been consistently known to be poor prognostic factors for survival time [25]. Moreover, the intensity of anorexia and dyspnea play a predictive role in the survival time of inpatients with advanced cancer [30, 31]. Our results are consistent with previous studies. Korean patients showed similar results for lower KPS, decreased oral intake and dyspnea at rest, similar to Japanese cases described above. Taiwanese patients had significantly lower KPS, and decreased oral intake and dyspnea at rest with survival, similar to those of Japanese and Korean groups.

Surprisingly, married patients had shorter survival in Japan. Most of the married patients lived with their spouses and children, and their families could be caregivers at home. Therefore, married patients had many opportunities for caregiver support and stayed longer at home. In other words, the survival of married patients was shorter when they were admitted to PCUs. The survival of married Koreans was shorter similar to married Japanese patients. Similar assumptions as the Japanese group may be applied to the Korean group. Thus, unmarried, divorced or widowed patients might survive longer, thereby reflecting the Korean medical environment, where such patients tend to be admitted to PCUs earlier, thanks to the supportive nationwide health insurance coverage. The conditions were more favorable for cancer patients in hospice institutes, where half of all the patients received professional caregiver services at very affordable rates in Korea.

This study has several limitations. First, we used IPOS to evaluate SWB. In this study, IPOS was evaluated by physicians and/or nurses, which may lead to differences between patients’ subjective assessments and physicians’ and/or nurses’ objective assessments. Prior studies reported that the inter-class correlation of SWB for IPOS-Patient and IPOS-Staff was 0.581 in Japan [34] and 0.348 in Taiwan and the correlation ranged from fair to moderate. Therefore, we regard IPOS-Staff as an acceptable tool. Second, the evaluation by IPOS may not capture every domain of spirituality. For instance, IPOS cannot be used to measure “meaning of life”, “connectedness”, or “faith” simultaneously. Those concepts may play a role in prolonging survival time, and thus a further study via in-depth assessment of SWB will be meaningful. In addition, the IPOS SWB may be regarded by medical professionals as an assessment of psychological well-being including SWB, which can be affected by physical condition. Third, our patients do not represent a general population of patients with far advanced cancer, and thus our findings may differ from patients living at home or in a general ward. Therefore, it is required to evaluate the SWB of patients receiving care at home or general ward in near future.

In conclusion, SWB of far advanced cancer patients is related to survival time in Taiwan but not in Japan and Korea. We suggest that spiritual care may contribute to prolonged survival of patients with advanced cancer. A further study is needed to investigate the relationship between SWB of patients with far advanced cancer and survival time.

Declarations

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Declarations:

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Conflicts of interest

The authors declare that there is no conflict of interest.

Data availability

The data that support the findings of this study are available from the corresponding author, Sang-Yeon Suh, upon reasonable request. All authors agree to provide data to the journal for review if needed.

Code availability

Not applicable.

Author contributions

Yusuke Hiratsuka: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review and editing

Sang-Yeon Suh: Conceptualization, Investigation, Methodology, Project implementation, Supervision, Writing – review and editing

Seon Hye Won: Preliminary analysis, Writing – review and editing

Sung Eun Choi: Formal analysis, Writing – review and editing

Sun-Hyun Kim: Investigation, Writing – review and editing

Shao-Yi Cheng: Investigation, Writing – review and editing

Ping-Jen Chen: Investigation, Writing – review and editing

Seok-Joon Yoon: Investigation, Writing – review and editing

Su-Jin Koh: Investigation, Writing – review and editing

Shin Ae Park: Investigation, Writing – review and editing

Ji-Yeon Seo: Investigation, Writing – review and editing

David Hui: Supervision, Writing – review and editing

Takashi Yamaguchi: Investigation, Writing – review and editing

Tatsuya Morita: Investigation, Writing – review and editing

Satoru Tsuneto: Supervision, Writing – review and editing

Masanori Mori: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review and editing

Akira Inoue: Investigation, Supervision, Writing – review and editing

Ethics approval

This study obtained was approved by the local Institutional Review Boards of all participating institutions. The independent ethics committee of Tohoku University School of Medicine (approval no. 2016-1-689) approved this study.

Consent to participate

In accordance with the ethical guidelines for human research of the Ministry of Health, Labor, and Welfare in Japan, patients' informed consent was waived in Japan because of the completely observational nature of the study. Patients were provided the opportunity to opt out.In South Korea and Taiwan, informed consent was obtained from the patients or their families (in case the patient lacked the capacity to decide).

Consent for publication

Not applicable.

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Tables

Table1. Participants’ baseline characteristics (n = 2,638)

	Japan (n = 1,896)	Korea (n = 335)	Taiwan (n = 407)
Age [years]			
< 65	433(22.8)	131(39.1)	181(44.5)
65-74	562(29.6)	81 (24.2)	103(25.3)
> =75	901 (47.5)	123 (36.7)	122(30.0)
Missing	0 (0)	0(0)	1 (0.2)
Sex			
Male	965(50.9)	184(54.9)	226(55.5)
Female	931 (49.1)	151(45.1)	181(44.5)
Primary cancer site			
Lung (small), Lung (non-small)	319 (16.8)	49(14.6)	77(18.9)
Stomach, Esophagus, Colon, Rectum, Small intestine	519 (27.4)	97(29.0)	83 (20.4)
Peritonium, Lymph node, Blood, Myeloma, Thyroid, Bone/soft tissue, Thymus, Mesothelioma, Skin, Unknown, Other, Brain	236 (12.4)	35(10.4)	38 (9.3)
Liver/intrahepatic cholangiocarcinoma, Gallbladder/bile duct, Pancreas			
Breast, Cervix, Uterine,Ovary			
Kidney, Renal pelvis/Ureter, Bladder, Prostate			
Head/neck (excluding thyroid)	363 (19.1)	36 (28.7)	99 (24.3)
	250 (13.2)	34 (10.1)	35 (8.6)
	141 (7.4)	16 (4.8)	27 (6.6)
	68 (3.6)	8 (2.4)	48 (11.8)
Highest level of education			
< = Junior high	58(3.1)	156(46.6)	224(55.0)
High school	141 (7.4)	113(33.7)	91 (22.4)
≥ Some college	170 (9.0)	54(16.1)	85 (20.9)
Missing	1,527 (80.5)	12 (3.6)	7(1.7)
Living with family			
No	498(26.3)	41(12.2)	32(7.9)
Yes	1,376 (72.6)	293(87.5)	375(92.1)
Missing	22 (1.2)	1 (0.3)	0 (0)
Marital status			
Unmarried/widowed/divorced	721 (38.0)	106 (31.6)	157 (38.6)
Married	1,151 (60.7)	227 (67.8)	250 (61.4)
Missing	24 (1.3)	2 (0.6)	0 (0)
Religion			
No religion	822(43.4)	121(36.1)	60(14.7)
Buddhism	206(10.9)	75(22.4)	112(27.5)
Christianity/Protestant/Catholics	38(2.0)	133(39.7)	24(5.9)

Others	808 (42.6)	6 (1.8)	211 (51.8)
Intake			
Normal/reduced but > mouthfuls	1,328(70.0)	236(70.4)	274(67.3)
< = mouthfuls	566 (29.9)	94(28.1)	133(32.7)
Missing	2 (0.1)	5(1.5)	0 (0)
Dyspnea			
No/Yes (exertional only)	1,552(81.9)	292(87.2)	292(71.7)
Yes (at rest)	344(18.1)	31(9.3)	115 (28.3)
Missing	0 (0)	12 (3.6)	0 (0)
Drowsiness			
Not at all/Slightly	1,370(72.3)	234(69.9)	183(45.0)
Moderate/Severely/Overwhelmingly	413(21.8)	78(23.3)	175(43.0)
Missing	113 (6.0)	23 (6.9)	49 (12.0)
Patient's preference for place of death			
PCU/General ward	1,071(56.5)	198(59.1)	252(61.9)
Own home	244(12.9)	49(14.6)	88(21.6)
Others	581 (30.6)	88 (26.3)	67 (16.5)
SWB at admission			
Occasionally/Not at all/Sometimes	608(32.1)	247(73.7)	181(44.5)
Always/Most of the time	1,162(61.3)	73(21.8)	174(42.8)
Missing	126 (6.6)	15 (4.5)	52 (12.8)
KPS [days, median (range)]	40 (10-90)	40 (10-90)	30 (10-90)
Median survival time [days (95% CI)]	18 (16.5-19.5)	23 (19.9-26.1)	15 (13.0-17.0)

Frequencies are expressed as numbers of patients (%).

Abbreviations: PCU, Palliative Care Unit; SWB, Spiritual Well-being; KPS, Karnofsky Performance Scale; CI, Confidence Interval

Table 2. Results of univariate analysis to identify factors associated with survival time (n = 2,638)

	Japan (n = 1,896)		Korea (n = 335)		Taiwan (n = 407)	
	Median(95%CI)	p-value	Median(95%CI)	p-value	Median(95%CI)	p-value
Age [years]		0.79		0.67		0.77
< 65	18.0(15.0-21.0)		25.0(21.7-28.3)		15.0(12.6-17.4)	
65-74	20.0(17.1-22.9)		18.0(13.0-23.0)		15.0(10.9-19.1)	
> = 75	17.0(15.1-18.9)		23.0(15.6-30.4)		14.0(9.3-18.7)	
Living with family		0.15		0.03		0.11
No	19.0(16.1-21.9)		42.0(21.6-62.4)		20.0(9.5-30.5)	
Yes	17.0(15.3-18.7)		22.0(19.1-24.9)		15.0(12.6-17.4)	
Religion		<0.01		0.39		0.17
No religion	19.0 (17.0-21.0)		22.0 (15.0-29.0)		14.0 (9.1-18.9)	
Buddhism	21.0 (15.3-26.8)		28.0 (20.9-35.1)		15.0 (10.2-19.8)	
Christianity/Protestant/Catholicism	35.0 (24.3-45.7)		22.0 (18.1-25.9)		10.0 (4.0-16.0)	
Others	16.0 (14.3-17.7)		8.0 (0.0-34.4)		15.0 (12.3-17.7)	
Intake		<0.01		<0.01		<0.01
Normal/reduced but > mouthfuls	25.0 (23.2-26.8)		26.0 (21.6-30.4)		18.0 (15.6-20.4)	
< = mouthfuls	8.0 (6.9-9.2)		13.0 (9.3-16.7)		9.0 (6.6-11.4)	
Dyspnea		<0.01		<0.01		<0.01
No/Yes (exertional only)	22.0 (20.2-23.8)		24.0 (21.3-26.7)		18.0 (15.3-20.7)	
Yes (at rest)	8.0 (6.3-9.7)		10.0 (3.6-16.4)		9.0 (6.8-11.3)	
SWB at admission		<0.01		0.317		0.12
Occasionally/Not at all/Sometimes	16.0 (14.0-18.0)		22.0 (18.9-25.1)		14.0 (11.3-16.7)	
Always/Most of the time	22.0 (20.0-24.0)		30.0 (20.1-39.9)		17.0 (13.0-21.0)	
Marital status		<0.01		0.03		0.03
Unmarried/widowed/divorced	19.0 (16.5-21.5)		29.0 (24.1-34.0)		19.0 (14.4-23.7)	
Married	17.0 (15.4-18.6)		20.0 (16.2-23.8)		14.0 (12.0-16.0)	
KPS		<0.01		<0.01		<0.01
< = 30	8.0 (7.0-9.0)		12.0 (9.4-14.6)		11.0 (8.7-13.3)	
> 30	27.0(25.0-29.1)		28.0 (21.0-35.0)		26.0 (18.4-33.6)	

Abbreviations: CI, Confidence interval; PCU, Palliative Care Unit; SWB, Spiritual Well-being; KPS, Karnofsky Performance Scale

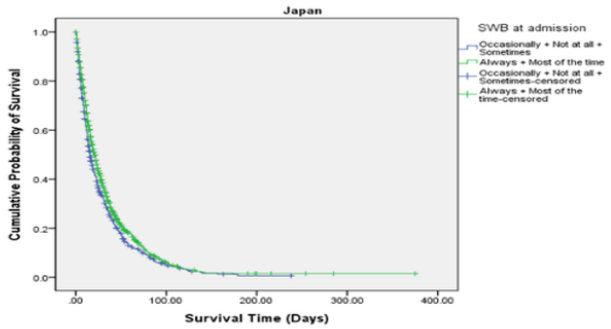
Table 3. Results of multivariate analysis to identify factors associated with survival time (n = 2,638)

	Japan				Korea				Taiwan			
Variables	HR(95% CI)	β	SE	p value	HR(95% CI)	β	SE	p value	HR(95% CI)	β	SE	p value
KPS (10-30)	1.85 (1.65-2.07)	0.62	0.06	<0.01	2.04 (1.52-2.75)	0.71	0.15	<0.01	1.41 (1.10-1.81)	0.34	0.13	<0.01
KPS > = 40	referent				referent				referent			
SWB at admission (Occasionally/Not at all/Sometimes)	1.10 (1.00-1.22)	0.10	0.05	0.06	1.02 (0.77-1.35)	0.20	0.14	0.89	1.27 (1.01-1.59)	0.24	0.11	0.04
SWB at admission. (Always /Most of the time)	referent				referent				referent			
Marital status (Married)	1.12 (1.01-1.24)	0.11	0.05	0.03	1.37 (1.06-1.77)	0.31	0.13	0.02	-			
Marital status (Unmarried /Divorced/Widowed)	-				referent				-			
Intake (≤ Mouthfuls)	1.76 (1.56-1.98)	0.56	0.06	<0.01	1.38 (1.03-1.86)	0.33	0.15	0.03	1.74 (1.36-2.22)	0.55	0.13	<0.01
Intake (Normal/Reduced but more than mouthfuls)	referent				referent				referent			
Dyspnea (Yes [at rest])	1.68 (1.48-1.90)	0.52	0.06	<0.01	1.56 (1.05-2.33)	0.45	0.20	0.03	1.73 (1.35-2.22)	0.55	0.13	<0.01
Dyspnea (No/ Yes [exertional only])	referent				referent				referent			

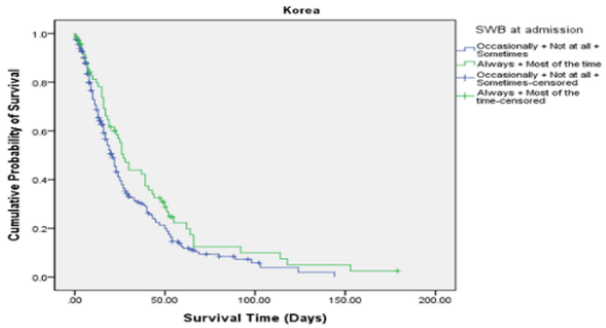
Abbreviations: HR, Hazard ratio; CI, Confidence interval; SE, Standard Error; KPS, Karnofsky Performance Scale; SWB, Spiritual Well-being

Figures

a) Japan



b) Korea



c) Taiwan

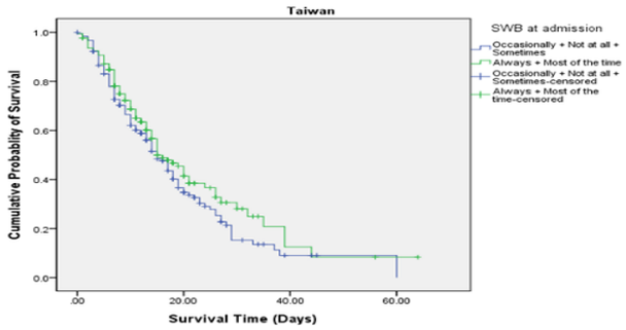


Figure 1

Kaplan-Meier plots of survival time vs. spiritual well-being of patients in different countries. Abbreviation: SWB, Spiritual well-being

Supplementary Files

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- STROBEchecklist.docx