

Determining the Perceived Relative Importance of Physician Roles in Palliative Care
through Best-Worst Scaling

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Introduction: A wide of range of physician roles in palliative care have been recognized by doctors in many countries. However, while the demand for palliative care keeps increasing in Singapore, there is a lack of understanding of Singaporean physicians' perceptions on their roles in palliative care. Assessment on the perceived relative importance of these physician roles is also needed for a thorough understanding of physicians' views on palliative care.

Method: Nine physician roles were evaluated through twelve best-worst tasks. The worst counts were subtracted from best counts to develop a B-W score for each physician role. Paired model and marginal model were adopted to obtain an estimation of the coefficient of each role through conditional logit regression. Covariate-adjusted latent class cluster analysis was performed to investigate the heterogeneity among physicians and explore what physician characteristics are associated differences in perception patterns.

Results: "Treating pain and physical symptoms" (1), "discussing end-of-life care preferences with patients" (2) rank top two, while "extending the patient's life as long as possible (8) and "withholding diagnosis if asked by family members" (9) are at the bottom regarding their perceived relative importance by respondents. The three data analysis methods generated exactly the same result in terms of the rank of role importance. Latent class cluster analysis shows that the largest discrepancies regarding

physicians' perceptions lie in "addressing patients' psychological needs", "addressing patients' spiritual needs" and "extending life as long as possible", and those who are lower in clinical grade ($P < 0.05$) place higher values on the former two roles. Palliative care training status are also found to have statistically significant association ($P < 0.05$) with different patterns of perceptions among physicians.

Conclusion: Singaporean physicians attach high importance to treating pains and symptoms, and value communicating with patients about treatment preferences based on effective information exchange. Experience (reflected by clinical grade) and palliative care training influences physicians' perceptions on their roles in palliative care.

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1. Introduction

1.1 Introduction to palliative care

Palliative care encompasses two basic components: symptom management and end-of-life (EOL) care (WHO). According to the WHO definition, palliative care focuses on improving the quality of life for both patients with advanced serious diseases and their families, relieving their sufferings and addressing the physical, psychosocial and spiritual problems associated with the diseases (WHO). The Gold Standard Framework (GSF) for palliative care, which has been implemented across UK, has stated five goals for palliative care: symptom control, advanced care planning, communication, career support and patients' freedom to choose where to live and die (Pease & Dorman, 2007). Traditionally, cure-oriented medicine dominated health care, and palliative care would be provided to patients only when treatment to cure diseases and prolong life has failed. Nevertheless, patients with advanced serious illness (ASI) are in need of, and will benefit more from a combination of life-prolonging and palliative treatments (Fox, 1997; Morrison & Meier, 2004; Murray, Kendall, Boyd, & Sheikh, 2005). Nowadays, palliative care has become an established medical specialty, and it is recognized by WHO as "an essential part of cancer control" and also "an essential component of a comprehensive package of care for people living with HIV/AIDS" and for those with other life threatening illnesses (WHO). There is an increasing recognition of the importance of

palliative care, and resources have been devoted to improving palliative care capability, mainly in developed countries.

1.2 Singapore and its palliative care status quo

Like other developed countries, Singapore has been able to establish and develop its palliative care system with its stable investment in health care (Singapore in Figures, 2013). According to the World Bank classification, Singapore is a high-income country with a gross national income per capita of US \$52,051 in 2012 (Time Series on Per Capita GDP at Current Market Prices, 2013). Life expectancy at birth has reached 79.9 for Singaporean male and 84.5 for female in 2012, and it is predicted that by 2030 over 25% of its population will be older than 65 (Lee, 2001; Population Trends 2013, 2013). The burden of disease in Singapore also shows the typical pattern of a developed country. While infectious diseases are almost under control or eliminated, non-communicable diseases now contribute to 78% of Years of Life Lost (YLLs) in 2008. Among the non-communicable diseases it is notable that cancer has become the second largest contributor of Disability Adjusted Life Years (DALYs) in Singapore in 2004, and statistics also show that the number of new cases diagnosed keep increasing (Ho, 2011; Phua, Chua, Ma, Heng, & Chew, 2009).

Aging and the rising burden of chronic non-communicable diseases, especially those that can cause tremendous pain like cancers, have stimulated a growing demand for palliative care in Singapore. Originated from the hospice movement started in 1985,

palliative care services in Singapore have experienced a significant improvement during the last twenty years, and have been recognized as a fundamental part of the healthcare system in Singapore (Goh, 1993; "Report on the National Strategy for Palliative Care," 2011). Currently palliative care in Singapore are not only provided by specialized palliative care physicians, but also by physicians across diversified medical specialities.

1.3 Physician roles in palliative care

As palliative care involves a holistic approach and multidisciplinary efforts to address the multiple needs of patients, physician roles also cover a wide range of aspects.

According to Physicians Guide to End of Life published by American College of physicians, the management and alleviation of physical symptoms, including pain, nausea, weakness, etc., is a major concern for physicians. Nevertheless, physicians should also respond to the psychological and spiritual needs of those patients approaching the end of their lives (End-of-Life Care Consensus, 2001). The American Board of Internal Medicine (ABIM) also released a list of physician competencies in end-of-life (EOL) care, which include not only medical knowledge on treating and relieving symptoms, but also interpersonal skills as well as humanistic qualities such as being sensitive to patients' needs for comfort and dignity (DeWitt, Jr, & Md, 1999). Besides, communicating prognosis in intensive care unit (ICU) family conferences, discussing end of life care with patients and assisting patients in making decisions are also highlighted as responsibilities for physicians in delivering EOL care (Shanawani, 2008).

Several surveys among physicians and patients on their perceptions of physician roles in palliative care showed results that are generally consistent with these guidelines. In one national survey in America, issues such as symptom management, freedom from pain and decisions about treatment preferences are recognized as important factors at the end of life by all subgroups of respondents (patients, families members, physicians and other health care workers) (Steinhauser et al., 2000). Another focus group study among patients, family members and physicians in Seattle, Washington identifies 12 domains of physicians' palliative care skills which also include symptom management, communication, emotional support and respect (Curtis et al., 2001).

In spite of the palliative care guidelines for physicians and some degree of consensus on this issue, differences still exist regarding how physicians perceive their roles in palliative care, and physicians' perceptions tend to vary systematically by ethnicity, medical specialty and cultural background. One focus group study of Caucasian, African American and Hispanic physicians identified some responsibilities that are agreed on across ethnic background: 1) effective communication to help patients make informed decisions, 2) persuading patients to reconsider their unreasonable requests and 3) initiating EOL discussions. Nevertheless, disagreements are found over 1) surrogate decision making, 2) responding to families' requests to "do everything to save life", 3) the importance of the cultural/ethnic match of physicians and patients 4) truth-telling and 5) the influence of their spiritual and religious beliefs on patient decision-

making (Braun, Ford, Beyth, & McCullough, 2010). Some studies also investigate how physicians from different medical departments view palliative care. It is revealed that for cardiologists and pulmonary physicians their major challenges include difficulties in giving prognostication due to the unpredictable nature of diseases, and effective communication with patients and families during the transition from intensive care to palliative focus (Brännström, Forssell, & Pettersson, 2011; Shanawani, 2008). As for oncologists, relieving pain and other symptoms and improving quality of life are highly prioritized, while for family physicians the lack of training hinders them from effectively managing symptoms and providing emotional support (Cherny, 2010; Librach, 2001). Several studies also explore physicians' perceptions on some specific roles of palliative care. One survey on EOL decision making across USA suggests that percentages of physicians' choices between "give recommendation and facts" and "give facts only" in the decision-making process are both near 50% (Johnston & Pfeifer, 1998). In another survey in USA on the contents of EOL discussions, the majority of physicians are more willing to discuss prognosis than do-not-resuscitate (DNR) status or hospice, and most would not initiate such discussion until all life-prolonging treatments fail. This study also discovers that young doctors are more likely to initiate EOL discussion earlier (Keating et al., 2010). As for addressing patients' psychological issues in palliative care, one study among American physicians reveals discrepancies in physicians' attitudes: while some physicians clearly identify it as their role, others think they do not have

enough time or specialized knowledge for this responsibility (Schulman-Green, 2003). Studies on EOL spiritual care (SC) reveals similar results that in spite of the recognition of its importance and benefits, physicians do not frequently provide spiritual care as they think it is not their profession. Besides, those who have received SC training are more likely to provide spiritual care. (Balboni et al., 2013; Phelps et al., 2012).

Previous studies have recognized and identified a wide range of physician roles in palliative care through surveys among physicians in several countries. Nevertheless, most of studies were conducted in America or European countries, and no study on this topic has ever been conducted in Singapore, an Asian country where there is a fast growing demand for palliative care. As studies have shown that physicians' perceptions vary across ethnic groups and cultural background, it is possible that Singaporean physicians' views might differ from European or American physicians'. The further development of palliative care in Singapore also requires a comprehensive understanding of the current views from physicians, the major care providers. Besides, previous studies are either qualitative or just focusing on some specific roles, and there is a lack of overall evaluation on physicians' attitudes towards all these potential responsibilities. Moreover, in current literature there is an absence of assessment on the perceived relative importance of these multiple roles, which may imply physicians' priorities in their current practices. Comparing physicians' perceptions of their

responsibilities and established guidelines would shed light on the design of future training programs and help improve physicians' clinical performance.

In this study the Best-Worst Scaling (BWS) design is used, which enables a quantitative comparison of the perceived relative importance across different roles. More elaboration on this design is in the method section. Since its first introduction into health research by McIntosh and Louviere in 2002, BWS has been widely applied to illicit people's perceptions and preferences of health-related issues, for example, patients' preferences for treatment options, physicians' perceptions of medical products as well as general public's opinions on health policies such as health care reform (Lancsar, Louviere, Donaldson, Currie, & Burgess, 2013; Weisberg et al., 2013).

1.4 The overall project and the author's roles

This project is a national survey of Singaporean physicians on their knowledge and attitudes towards palliative care conducted by the Lien Centre for Palliative Care at Duke-NUS Medical School. Dr. Chetna Maholtra is the principal investigator of this project. The survey instrument consists of three major parts: physicians' preferences for treatment, physicians' perceptions of their roles in palliative care and their knowledge about palliative care, and this thesis only includes the analysis of the second part.

When I started working on this project, the instrument had already been designed by the researchers at the Lien Centre for Palliative care, and I made several suggestions to the knowledge part. In Singapore I worked with Dr. Chetna Malhotra, and Hannah Dalager

on testing the survey instrument. Most of the data was collected when I left Singapore and my role is mainly data analysis and writing this thesis.

2. Study Objectives

This study aims to evaluate Singaporean physicians' perceptions on the relative importance of their roles in palliative care through best-worst scaling choice tasks, and explore whether physicians' perceptions are heterogeneous across various characteristics such as age, training and clinical grade. . The possible physician roles under (table 1) study are identified based on guidelines and previous studies. A secondary objective of this study is to compare the three data analysis methods for best-worst scaling design: count analysis, paired model and marginal model analysis, and see if they yield similar results.

Table 1: Nine possible roles physician roles in palliative care

1 Discussing end-of-life care preferences with the patient.
2 Treating the patient's pain and physical symptoms.
3 Addressing the patient's psychological issues.
4 Addressing the patient's spiritual issues.
5 Referring the patient to palliative care services.
6 Extending the patient's life as long as possible.
7 Withholding the diagnosis or prognosis from the patient if the patient's family members ask me to do so.
8 Making medical decisions for the patient if the patient is no longer competent to do so.
9 Discussing treatment costs with the patient.

3. Hypothesis

This study hypothesizes that Singaporean physicians would generally regard “treating patient’s pain and physical symptoms” as a relatively important role in palliative care, while underrate the importance of “withholding information from patients if asked by family members.” As for the physician characteristics that may be associated different patterns of perceptions, it is also hypothesized that physicians who are younger in age, who received some palliative care training may place higher values on “Discussing end-of-life care preferences with the patient”, “addressing the patient’s psychological issues” and “addressing patient’s spiritual issues.

4. Methods

4.1 Instrument Design and Data Collection

The original survey instrument consists of four sections: A) respondents demographic information, B) EOL treatment recommendations, C) physician roles in palliative care and D) knowledge and attitude towards palliative care, and this study utilizes information from section A and section C. In section C nine potential physician roles are presented as options. The best-worst choice tasks follow the balanced incomplete block design (BIBD) that each of the nine roles appears four times in a total of 12 twelve tasks, and each time it co-appears with two different roles from the rest of eight. Respondents are required to choose one best and one worst from a set of three roles in every task. An example of the choice task is presented as follows:

Task 1:

Which **one** of these **3 roles** do you believe is **MOST important** in your position as the patient's physician? Which **one** of these **3 roles** do you believe is **LEAST important**?

Most Important	Roles	Least Important
<input type="checkbox"/>	Making medical decisions for the patient if patient is no longer competent to do so.	<input type="checkbox"/>
<input type="checkbox"/>	Treating the patient's pain and physical symptoms.	<input type="checkbox"/>
<input type="checkbox"/>	Addressing the patient's spiritual issues.	<input type="checkbox"/>

The instrument was piloted before the survey was formally launched. The survey was conducted from May 2013 to Dec 2013 in Singapore. Survey questionnaires were

distributed through two approaches: 1) emailing the web link to potential respondents (online) and asking physicians to forward the link to their colleagues 2) distributing the paper version directly to physicians at major medical institutions in Singapore where the research team presented the study aims at department meetings and invited physicians from different medical specialties to take the survey. All potential respondents were provided with written informed consent, and those who completed the survey received a \$25 gift card or voucher. The survey was approved by Institutional Review Board (IRB) of National University of Singapore (NUS).

4.2 A theoretical presentation of Best-Worst Scaling

The theoretic foundation of Best-Worst scaling, also named as Max Difference Scaling, is the random utility model developed by Thurstone and McFadden (Cohen, 2009; Louviere, Lings, Islam, Gudergan, & Flynn, 2013; Mcfadden, 1974). It assumes each individual has a latent scale of “utility” or “importance”, and the scale value of objects will determine a person’s choice over these objects. This scale value consists of two parts: one systematic part which can be understood as “intrinsic”, and one random error component. Therefore the probability of a certain project chosen as the best given other K options can be expressed as:

$$P(U = best|A, B, C \dots) = P(S_A > S_k) = P[(V_A + \varepsilon_A) > (V_k + \varepsilon_k)]$$

in which S_k , V_k and ε_k represent the scale value, the systematic component of the scale value and the error term respectively. McFadden further developed the conditional logit

model under the independently and identical distribution (i. i. d.) assumption of the error terms, and the choice probability can be expressed as below (Louviere et al., 2013; Mcfadden, 1974).

$$P(A = best|A, B, C \dots K) = \exp(V_A) / \sum_{i=1}^k \exp(V_k)$$

Based on this model many types of choice experiments (CEs) have been devised to collect data and analyze respondents' preferences, among which the Best-Worst Scaling (BWS) approach was first developed by Louviere and Woodworth and published by Finn and Louviere in 1992 (Finn & Louviere, 1992). Compared with other designs there are several advantages of BWS. It is suggested that choosing the "best" and the "worst" from a set of options can generate relatively consistent results compared to the ranking task and it offers more information than simply choosing the "best". Besides, when attributes under evaluation have multiple levels, best-worst scaling approach enables a comparison of all attribute levels on a single scale by setting only one level as reference (Flynn, Louviere, Peters, & Coast, 2007; Louviere et al., 2013). In general, the BWS design is capable of providing reliable estimates of respondents' rank of preferences.

4.3 Data analysis

The data analysis of this study consists of three parts. First a simple tabular analysis was performed upon the respondents' demographic data from Section A to obtain the distribution of physician characteristics. Then the best-worst scaling data was analyzed

through three approaches --count analysis as well as paired model and marginal model using conditional logit regression to determine the rank of the relative importance of physician roles. Latent class cluster model was used to explore latent heterogeneity among respondents.

4.3.1 Count Analysis

For each of the physician roles, the number of times it was selected as best and worst were counted. Then the worst count was subtracted from the best count to generate a total B-W score for each role. Individual B-W scores for all the nine roles, ranging from -4 to 4, were also calculated; their means and standard deviations across respondents were also summarized.

4.3.2 Paired Model Analysis

In this method, each task scenario was extended to six best-worst (B-W) pairs following the instructions in Louviere et al's article (Louviere et al., 2013). For example, a scenario with role1, role2, role3 was extended to 6 B-W pairs: 1-2, 1-3, 2-1, 2-3, 3-1, 3-3. The chosen pair was coded as 1 and the remaining pairs were coded as 0. For each B-W pair, the best role was coded as 1 and the worst role was coded as -1. For every scenario of each respondent a group tag was added as an indicator of group in the conditional regression. Table 2 is an example of the coding scheme which shows that for respondent 1, in his task1 he chose role1 as the best and role2 as the worst, and in his task2 he chose role2 as the best and role5 as the worst.

Table 2: Coding scheme for paired model analysis

Group Tag	B-W Pair		Choice Indicator	Attributes								
	Best	Worst		1	2	3	4	5	6	7	8	9
1	1	2	1	1	-1	0	0	0	0	0	0	0
1	1	3	0	1	0	-1	0	0	0	0	0	0
1	2	1	0	-1	1	0	0	0	0	0	0	0
1	2	3	0	0	1	-1	0	0	0	0	0	0
1	3	1	0	-1	0	1	0	0	0	0	0	0
1	3	2	0	0	-1	1	0	0	0	0	0	0
2	2	4	0	0	1	0	-1	0	0	0	0	0
2	2	5	1	0	1	0	0	-1	0	0	0	0
2	4	2	0	0	-1	0	1	0	0	0	0	0
2	4	5	0	0	0	0	1	-1	0	0	0	0
2	5	2	0	0	-1	0	0	1	0	0	0	0
2	5	4	0	0	0	0	-1	1	0	0	0	0
...												

The regression model is expressed as below, and role9 is selected as reference and omitted to avoid collinearity.

$$\text{logit}(p_i) = \text{const} + \sum_{i=1}^m \alpha_i X_i + \sum_{i=1}^8 \beta_i \text{Role}_i$$

Here \mathbf{X} denotes a set of physician characteristics. Conditional logit regression was performed to estimate the value of coefficients of physician roles. The constant and the coefficients of physician characteristics could not be estimated through conditional regression here, as in each task the probability of choosing a certain pair conditions on given physician characteristics.

4.3.3 Marginal Model Analysis

In this method, each scenario was extended to 3 best and 3 worst choices of roles also following the instructions in Louviere et al's article (Louviere et al., 2013). For example, a scenario with role1, role2, role3 was extended to best-role1, best-role2, best-role3 and worst-role1, worst-role2 and worst-role3. The outcome variable was coded as 1 if the attribute was chosen, and 0 if not. For independent variables, the best attribute chosen was coded as 1 while the worst chosen was coded as -1. For every scenario of each respondent a group tag was added as an indicator of the group in the conditional regression, which is the same with paired model approach. Table 3 is an example of the coding scheme which shows that for respondent 1, in his task1 he chose role1 as the best and role2 as the worst, and in his task2 he chose role2 as the best and role5 as the worst.

Table 3: Coding scheme for marginal model analysis

Group Tag	Best	Worst	Choice Indicator	Attributes								
				1	2	3	4	5	6	7	8	9
1	1		1	1	0	0	0	0	0	0	0	0
1	2		0	0	1	0	0	0	0	0	0	0
1	3		0	0	0	1	0	0	0	0	0	0
1		1	0	-1	0	0	0	0	0	0	0	0
1		2	1	0	-1	0	0	0	0	0	0	0
1		3	0	0	0	-1	0	0	0	0	0	0
2	2		1	0	1	0	0	0	0	0	0	0
2	4		0	0	0	0	1	0	0	0	0	0
2	5		0	0	0	0	0	1	0	0	0	0
2		2	0	0	-1	0	0	0	0	0	0	0
2		4	0	0	0	0	-1	0	0	0	0	0
2		5	1	0	0	0	0	-1	0	0	0	0
...												

The equation is expressed as follows:

$$\text{logit}(p_i) = \text{const} + \sum_{i=1}^m \alpha_i X_i + \sum_{i=1}^9 \beta_i \text{Role}_i$$

Conditional logit regression was also conducted here to obtain the estimates of coefficients of physician roles, and it was the same as the paired model that the constant and coefficients of physician characteristics could not be estimated. Due to the different coding scheme the problem of collinearity does not exist here so all roles were included in the model. Then the results from the three approaches were compared in terms of the rank of role importance, and the correlation between B-W scores and the coefficients obtained from the two models were examined using linear regression. Data analysis was performed using SAS 9.3 and Stata 12.

4.3.4 Latent Class Cluster Analysis

In this study latent class (LC) cluster analysis was used to investigate the unobserved heterogeneity of answer patterns among respondents, and explore what physician characteristics are associated with different choice patterns. Latent class cluster analysis is a “model-based probabilistic clustering approach” which assumes an underlying probability distribution of data (Umberger, Stringer, & Mueller, 2010; Vermunt & Magidson, 2002). In this study the nine individual B-W scores for all physician roles were used as dependent variables. Six physician characteristics, including age, gender, clinical grade (classified as consultant or higher/other), countries where they receive basic medical training (classified as Singapore/other Asian countries/USA or

European/other), palliative care training status and the percentage of patients with advanced illness were chosen as potential predictors of cluster membership, and used as covariates in the model. The influence of ethnicity was not studied here due to the homogeneity of respondents regarding ethnicity (4/5 are Chinese descendants). The mathematical model is expressed in a form of likelihood function as below:

$$f(\mathbf{y}_i|\mathbf{z}_i, \theta) = \sum_{k=1}^K \pi_{k|\mathbf{z}_i} \prod_{j=1}^J f_k(y_{ij}|\mathbf{z}_i, \theta_{jk})$$

Here \mathbf{y}_i denotes one respondent's set of B-W scores of the 9 roles; \mathbf{z}_i denotes the respondent's value set of covariates; θ denotes the model parameters, and $f(\mathbf{y}_i|\mathbf{z}_i, \theta)$ denoted the probability of getting score \mathbf{y} given physician characteristics and model parameters. K is the number of clusters (predefined before running the analysis), $\pi_{k|\mathbf{z}_i}$ means the prior probability of belonging to cluster k given covariate values \mathbf{z}_i ; J means the total number of covariates (Vermunt & Magidson, 2002). Maximum likelihood estimation was applied to obtain estimates of model parameters.

The LC cluster analysis was performed using LatentGold 4.5 (*Statistical Innovations Inc.*). Models with 1-6 clusters were tested. Four information criteria – AIC (Akaike Information Criterion), AIC3, CAIC (Bozdogan's consistent AIC) and BIC (Bayesian Information Criterion) were all considered to select the most suitable model. These information criteria can be all expressed as $-2 * LL + A_n * p$, where LL is the log-

likelihood, A_n is a “penalty weight” and p means the number of parameters in the model (Dziak, Coffman, Lanza, & Li, 2012). The A_n of each criteria is listed in Table 4

Table 4: Penalty weight of four commonly used information criteria

	AIC	BIC	AIC3	CAIC
A_n	2	$\ln(n)$	3	$\ln(n)$

(n is the number of observations in the sample)

5. Results

5.1 Demographics

A total of 285 responses, including 106 paper versions and 179 online were obtained during the 7 months of data collection and table 5 shows the characteristics of these respondents. It can be seen from the table most doctors (89%) participating in this survey are less than 45 years old, and a majority of them (63%) complete their basic medical training in Singapore. These respondents cover a wide range of medical specialties, and most of them (68%) have some experience of treating patients with advanced illness (over 10% of their patients are with ASI, self-reported). Nevertheless, only 33% of respondents have ever received some form of palliative care training, and this percentage is slightly higher (44%) for doctors who frequently treat patients with advanced illness (defined as over 50% of their patients are with ASI, self-reported).

Table 5: Characteristics of respondents

	Percent			Percent	
Gender	Number	(%)	Medical Specialty	Number	(%)
Female	129	45.42	Cardiology	18	6.32
Male	155	54.58	Family medicine	27	9.47
Age			Geriatrics	18	6.32
<30	124	43.51	Internal med	74	25.96
30-34	61	21.40	Nephrology	2	0.70
35-39	45	15.79	Neurology	13	4.56
40-44	24	8.42	Oncology	42	14.74
>=45	31	10.88	Palliative Med	1	0.35
Ethnicity			Surgery	17	5.96
Chinese	229	80.35	Other	43	15.09
Malay	6	2.11	None	30	10.53
Indian	29	10.18	Country of Basic Medical Training		

Other	21	7.37	Singapore	171	62.18
Clinical Grade			Other Asian	53	19.27
			Euro/North		
Medical officer	128	44.91	American	50	18.18
Registrar	56	19.65	Other	1	0.36
Associate Consultant	17	5.96	% Patients with ASI		
Consultant	26	9.12	<10%	92	32.28
Senior Consultant	30	10.53	10-25%	93	32.63
Other	28	9.82	25-50%	48	16.84
Palliative Care					
Training			50-75%	30	10.53
Received	94	32.98	>75%	22	7.72
			Location		
Workshop	63	22.11	Hospital	255	89.79
Certificate course	13	4.56	Other	2	0.07
Diploma	3	1.05	Polyclinic	8	2.82
Advanced Specialist	10	3.51	Private Clinic	19	6.69
Other	21	7.37			
No	191	67.02			

5.2 Physicians' perceptions on the relative importance of palliative care roles

Table 6 summarizes the results of simple count analysis. The relative importance of each role is indicated by its B-W score, and the standard deviation suggests the degree of heterogeneity of physicians' perceptions on this role. The result shows that "treating pain and physical symptoms" and "discussing end-of-life preferences" are substantially more highly valued than the rest of the roles, while "extending patients' life as long as possible" and "withholding diagnosis with prognosis when asked by family members" are underrated by most respondents. Most physicians are inclined to hold more positive attitudes towards "referring patients to palliative care services", "addressing psychological needs" and "surrogate decision making", and understate the importance

of “addressing spiritual needs” and “discussing treatment costs with patients”.

Nevertheless, physicians’ perceptions on the importance of several roles ,such as “surrogate decision making”, “addressing spiritual needs” and “extending patients’ life as long as possible” tend to diverge as reflected by the large standard deviations of their B-W scores, which also suggests the need to further explore respondent heterogeneity.

(For the following tables please refer to table1 for a complete description of each role)

Table 6: Relative importance of physician roles estimated from count analysis

<i>Rank</i>	Physician roles	Best	Worst	B-W	Mean	SD
1	Treating pain and physical symptoms	853	34	819	2.87	1.19
2	Discussing end-of-life care preferences	831	48	783	2.75	1.22
3	Referring the patient	480	178	302	1.06	1.57
4	Addressing psychological needs	435	204	231	0.81	1.36
5	Surrogate decision making	387	263	124	0.44	1.73
6	Addressing spiritual needs	178	471	-293	-1.03	1.71
7	Discussing treatment costs with the patient.	113	539	-426	-1.49	1.52
8	Extending the patient’s life as long as possible	89	803	-714	-2.51	1.69
9	Withholding diagnosis if asked by family	24	857	-833	-2.92	1.07

Table 7 shows the estimates of coefficients from paired model and marginal model analysis, and table 8 compares the relative importance of physician roles derived from the three data analysis methods. Both the paired model analysis and marginal model yield statistically significant estimation for all physician roles, and from table 7 it is clear that the paired model and marginal model generate exactly the same rank of the role importance as the simple count analysis. OLS regression of coefficients of each role estimated from each conditional logit model (CLM) on the mean B-W scores also

indicates strong linear correlation between them (figure 1). These results suggest that simple count analysis is an acceptable approximation to the conditional logit regression analysis, and in this case the paired model and marginal model do not differ in their estimation of relative importance.

Table 7: Paired model and marginal model estimates

Physician roles	Paired model	95% CI	Marginal model	95% CI
Discussing end-of-life care	2.48	2.32, 2.64	1.72	1.60, 1.83
Treating pain and physical symptoms	2.57	2.41, 2.73	1.85	1.73, 1.97
Addressing psychological	1.24	1.11, 1.37	0.44	0.36, 0.53
Addressing spiritual	0.26	0.13, 0.38	-0.55	-0.64, -0.46
Referring the patient	1.38	1.24, 1.51	0.57	0.48, 0.66
Extending patient's life as long as possible	-0.63	-0.76, 0.49	-1.50	-1.61, -1.40
Withholding diagnosis if asked	-0.96	-1.11, -0.82	-1.89	-2.01, 1.77
Surrogate decision making	1.03	0.90, 1.16	0.23	0.15, 0.31
Discussing treatment costs	0.00	--	-0.82	-0.91, -0.73

Table 8: Comparison of the estimates from three approaches

Physician roles	Paired model	Rank1	Marginal model	Rank2	Mean B-W	Rank3
Treating pain and physical	2.57	1	1.85	1	2.87	1
Discussing end-of-life care with the patient	2.48	2	1.72	2	2.75	2
Referring the patient	1.38	3	0.57	3	1.06	3
Addressing psychological	1.24	4	0.44	4	0.81	4
Surrogate decision making	1.03	5	0.23	5	0.44	5
Addressing spiritual	0.26	6	-0.55	6	-1.03	6
Discussing treatment costs with the patient	0.00	7	-0.82	7	-1.49	7
Extending patients' life as long as possible	-0.63	8	-1.50	8	-2.51	8
Withholding diagnosis if asked by family	-0.96	9	-1.89	9	-2.92	9

(The p values of all coefficients are less than 0.001)

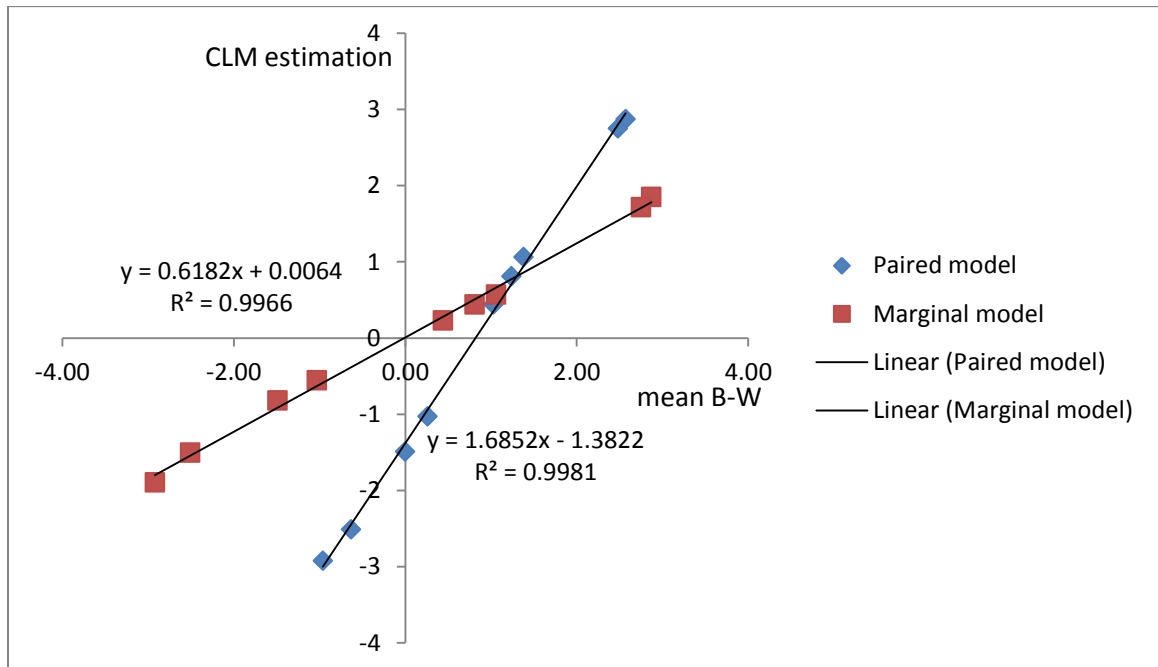


Figure 1: Regression of mean B-W score on CLM estimations

5.3 Different patterns of perceptions and associated physician characteristics

Table 8 shows the values of the four information criteria of the covariate-adjusted LC cluster models with 1-6 clusters. It can be seen from the table that the 2-cluster model has the smallest BIC and CAIC, while the 5-cluster model has the smallest AIC and AIC3. This result is consistent with literature that using BIC and CAIC tends to underfit (select an over-simplified model) while AIC may overfit (select an over-complicated model) (Dziak et al., 2012), and the best model is likely to lie somewhere in between. Though literature also mentions that AIC3 performs well in choosing the best fit model in latent class analysis (Dziak et al., 2012), the 4-cluster model, which is suboptimal in terms of AIC3, was selected for this study considering the fact that the 5-cluster model

results in one smallest cluster with only 7 observations and it seems unnecessary for such a meticulous classification.

Table 9: Information criteria for different models

	1-cluster	2-cluster	3-cluster	4-cluster	5-cluster	6-cluster
Log-likelihood	-4135.2	-4073.7	-4036.9	-4001.3	-3966.0	-3953.5
AIC	8394.4	8307.4	8269.7	8234.6	8200.0	8211.0
BIC	8618.4	8596.5	8623.8	8653.7	8684.1	8760.2
AIC3	8456.4	8387.4	8367.7	8350.6	8334.0	8363.0
CAIC	8680.4	8676.5	8721.8	8769.7	8818.1	8912.2

Table 10 summarizes the rank of the importance of physician roles as well as the distribution of physician characteristics in each cluster. The p value column shows whether the model parameters are statistically significant (The parameters are not listed here as there are 116 parameters for the 4-cluster model). From the table it is clear that the four clusters have some degree of consensus on the importance “treating pain and physical symptoms” and “discussing end-of-life preferences” as they all ranked top two across clusters. The relatively high importance of “referring patients to palliative care services” and low priority of “withholding diagnosis or prognosis if asked by family members” are also agreed on, as is also shown the by their insignificant model parameters ($P > 0.05$). As for “surrogate decision making” and “discussing treatment costs with patients”, physicians from all clusters tend to rank the former middle (4-6) and rank the latter (6-8) lower. The between-cluster differences for these two roles are statistically significant and nevertheless moderate considering the similarity in their ranking across clusters. The largest discrepancies regarding perceived importance were

discovered in “addressing patients’ psychological needs”, “addressing patients’ spiritual needs” and “extending patients’ life as long as possible”, and the latter two are also the ones with large variances in terms of the B-W score. Physicians in cluster 1 place relatively high values on responding to patients’ psychological and spiritual needs and disregard extending life as an ultimate goal, while physicians in cluster 4 prioritize the latter over the former two roles. The perceptions on these three roles from physicians in cluster 2 and cluster 3 seem to lie between the two typical patterns. The mean B-W score of each physician role for all the 4 clusters are plotted as figure 2, which clearly shows that diverging perceptions on “addressing psychological and spiritual needs” as well as “extending life as long as possible” are the major drivers of clustering among respondents (The number of the roles refers to the rank of roles for cluster 1).

As for the influence of physician characteristics on cluster membership, results show that only the parameters for clinical grade and palliative care training status are statistically significant ($P < 0.05$). As is shown in the table, physicians who attach more importance to extending life than addressing psychological issues (cluster 4) are those who are higher in clinical grade, possibly older and seeing a higher percentage of patients with ASI, though the latter two factors are not statistically significant. It can also be observed that both cluster 1 and cluster 4 have higher percentage of respondents who have received palliative care training compared to cluster 2 and cluster 3, which may imply that perceptions on addressing psychological or spiritual patients’ needs

versus extending life in palliative care are more of a personal value issue than formed from specialized training.

Table 10: Results of the covariate-adjusted LC cluster model

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	P value
Percent of physicians	33.2%	33.9%	18.6%	14.2%	
	mean B-W	mean B-W	mean B-W	mean B-W	
Physician roles	(rank)	(rank)	(rank)	(rank)	
Discussing end-of-life care	3.12 (1)	2.83 (2)	2.41 (2)	2.38 (2)	0.001
Treating pain and physical	2.68 (2)	3.03 (1)	2.72 (1)	2.95 (1)	0.270
Addressing psychological	1.52 (3)	0.63 (5)	0.59 (5)	-0.17 (6)	0.000
Referring the patient	0.65 (4)	1.37 (3)	1.27 (3)	1.03 (3)	0.089
Addressing spiritual	0.37 (5)	-2.11 (7)	0.01 (6)	-2.94 (9)	0.000
Surrogate decision making	-0.21 (6)	0.78 (4)	0.96 (4)	0.50 (4)	0.005
Discussing treatment costs	-1.81 (7)	-0.54 (6)	-2.69 (8)	-1.27 (7)	0.000
Withholding diagnosis	-2.87 (8)	-2.79 (8)	-3.29 (9)	-2.92 (8)	0.210
Extending patient's life	-3.42 (9)	-3.32 (9)	-1.94 (7)	0.43 (5)	0.000
Covariates	Mean	Mean	Mean	Mean	
Basic medical training					
Other Asian countries	0.19	0.08	0.43	0.17	0.970
Singapore	0.69	0.68	0.33	0.68	0.980
European/North American	0.12	0.23	0.24	0.15	0.980
Age	32.85	32.38	31.83	36.32	0.810
Gender	0.45	0.58	0.61	0.62	0.450
Clinical grade	0.20	0.26	0.12	0.51	0.024
Over 50% of patients with advanced illness	0.20	0.12	0.09	0.33	0.140
Received training	0.49	0.21	0.15	0.47	0.006

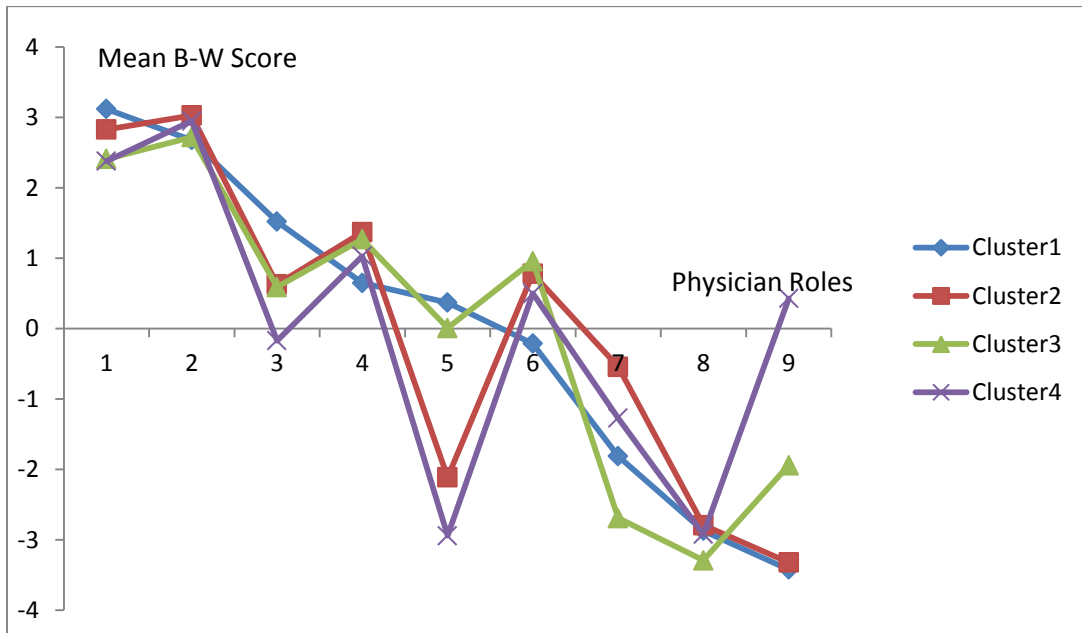


Figure 2: Mean B-W score of each physician role for the four clusters

6. Discussions

6.1 Physicians' perceptions, associated factors and implications

Patients with advanced severe illness often suffer from not only physiological pains but also psychological distress and burden, therefore in palliative care multidisciplinary efforts are necessary to address patients' needs and relieve their sufferings. A wide range of physician roles in palliative care have been proposed and recognized in many countries, and this study explored how physicians in Singapore perceive the relative importance of these roles through best-worst scaling . The results show some degree of consistency with studies in western countries, which indicates some common beliefs about priorities in palliative care among physicians from different cultural backgrounds. It is not surprising that survey respondents generally regard "treating pain and physical symptoms" as the most important role, which is in concordance with the long-existing emphasis on physicians' responsibility to treat physiological symptoms. Besides, the result that physicians value discussing treatment preferences and underrate withholding information from patients also suggests that physicians recognize the importance of physician-patient interaction based on effective information exchange. This is also in agreement with the themes of "truth telling" and "talking about prognosis" revealed in previous surveys. Nonetheless, physicians are not so willing to discuss treatment costs with patients, which may be due to some cultural factors that do not favor directly talking about money during the treatment process.

Another issue stands out in this study is physicians' diverging perceptions towards extending life as long as possible versus patients' overall well-being. Nowadays the development of technology has enabled the sustainment of patients' life even under extremely bad conditions. Although there are established guidelines on making medical decisions at the terminal stage, some physicians may still feel psychologically burdened to make decisions on withdrawing life-sustaining machines (Wheatley & Finlay, 2011). Nevertheless, there is a call for increasing the awareness that some acute treatment approaches aimed at extending life may bring more harm than benefit at the end of life. The overall quality of life, including psychological state and spiritual wellbeing, has also been emphasized at the terminal phase (Bowman, Martin, & Singer, 2000; Brown, 2012). This study also shows that despite of the discrepancies in opinions, most physicians do not prefer extending patient's life as long as possible as reflected by its low general rank. Besides, the fact that less experienced (lower in clinical grade) and possibly younger respondents (cluster 1) place lower values on extending life as long as possible may reflect a transition of Singaporean physicians' perception on this issue across generations.

The major outcome of this study also sheds light on the focus of future palliative care training, and informs how to effectively increase current palliative care capacity. For the roles which are highly valued by most physicians, it is highly probable that physicians would often practice them. Therefore training programs concerning these roles, like pain

management and communication skills, would be very efficient in improving current palliative care quality. As for the roles which rank in the middle, we may need to investigate why physicians prefer or not prefer this role, and consider whether there are better alternative approaches than training physicians to fulfill it. For example, “addressing patients’ spiritual needs” ranks in the middle, which is consistent with previous findings that while physicians’ confirmed the needs and the effectiveness of spiritual care, some regard spiritual issues as beyond their scope of profession (Balboni et al., 2013; Phelps et al., 2012). An assessment of the feasibility and cost-effectiveness of offering spiritual care training to physicians comparing to alternative approaches such as including a specialized spiritual counselor (like a chaplain) in the medical team would be necessary before deciding the best way to provide spiritual care (Fitchett et al., 2011; Higuera, Gonzalez, Durban, & Vela, 2013; Phelps et al., 2012). Besides, it is delighted to see that the two lowest ranking items are not encouraged in current palliative care guidelines (End-of-Life Care Consensus, 2001).

6.2 Reflections on data analysis methods

At the methodology level, the three analysis methods used in this study—count analysis, paired model and marginal model using conditional logit regression all yield the same result regarding the rank of the relative importance of each physician role. This outcome shows that in this study count analysis can serve as a good substitute for paired model or marginal model analysis which involves difficult dataset manipulation.

However, in cases where each attribute has multiple levels, count analysis cannot assess the impact of certain attribute and the utility scale of its levels separately, while paired model or marginal model analysis using effect coding can perform such evaluation (Flynn, Louviere, Peters, & Coast, 2008). As for the comparison between paired model analysis and marginal model analysis, theoretically the latter is a simplified approximation to the former and may result in larger standard errors (Flynn et al., 2007, 2008). The two strong assumptions underlying the marginal model – the symmetric distribution of error terms on the latent utility scale and the independence of making the best and worst choices are likely to undermine the validity of results from the marginal model (Flynn et al., 2008). One alternative method to analyze best-worst scaling data through the two types of models is OLS regression, which uses the natural logarithm of the total number of times each best-worst pair is chosen (paired model) or certain attribute level is selected as best/worst (marginal model) as dependent variables. The coding of independent variables is similar to the conditional logit approach except that there is no group indicator (Flynn et al., 2007; Louviere et al., 2013).

As mentioned in the method section, the coefficients of variables indicating physician characteristics cannot be directly estimated through conditional logit regression when examining the influence of physician characteristics on their perceptions. In this study covariate-adjusted LC cluster analysis is used to explore the association between physician characteristics and choice patterns. One alternative approach is to include

interaction terms of physician roles and characteristics as covariates in the conditional logit regression (Flynn et al., 2008). However, this method is not adopted as the interpretation of these coefficients is not as intuitive as the outcome of LC cluster analysis, which shows the mean value of each covariate for every cluster. Moreover, results from LC cluster analysis clearly depict the patterns of heterogeneity among respondents by showing the rank of roles for all subgroups. Nevertheless, the conflicting results of information criteria can make it confusing to select a best-fit model. Another possible defect of the LC cluster approach is the relatively large number of model parameters (116 in this 4-cluster model), which results in small variations in the outcome when running maximum likelihood estimation every time.

6.3 Limitations and future improvements

There are also several limitations to this study. First of all, as respondents are self-selected into the study, the outcome may be biased in that those physicians who participated in the study are those who have more knowledge and experience regarding palliative care. Also due to the strategy that physicians were asked to forward the online survey links to their colleagues, we were not able to estimate how many physicians we reached in this study. Thus the generalizability of the study outcome to general physicians in Singapore is compromised. Besides, Singapore is a country of mixed ethnic groups which mainly include Chinese, Malay and Indian. However, the relatively homogeneous racial component of the convenient sample in this study fails to facilitate

quantitative exploration into the possible racial differences in physicians' perceptions. Another limitation common to attitude surveys is that respondents may report what they expect researchers would like to hear instead of what they actually think. In this case, physicians may make choices based on palliative care guidelines. We are also cautious in our suggestions about future training programs as physicians may not necessarily often perform the roles they think are important, and other surveys are needed to determine the most suitable contents of future training programs.

Additionally, framing and wording of these roles may have extra influences on physicians' choices, and thus affecting the evaluation of role importance. For example, while most statements provide positive descriptions of physician responsibility, "withholding diagnosis if asked by family members" is a relatively negative statement regarding communicating diagnosis, and physicians consistently underrate it. However, this negative statement may hinder us from developing objective estimation of the relative importance of communicating diagnosis by causing confusions, as this low rank could be either due to physicians' strong preferences to tell truth or simply the possibility that they think this role is trivial. It is reasonable to expect a different rank of "informing people true diagnosis or prognosis", and thus a different conclusion in terms of the importance of communicating diagnosis relative to other roles.

In terms of these limitations, future studies could improve the understanding of physicians' perceptions on their palliative care responsibilities and better inform future

training programs through several approaches. First more systematic sampling strategies can be used to enhance the representativeness and racial diversity of the sample. Besides, a more consistent framing and wording pattern of physician roles can be adopted, for example, using positive statements for all roles, to avoid confusions when analyzing reasons contributing to the ranking. Qualitative studies can also be included to investigate why physicians make such choices about the importance of roles, and how their working and training experience shape their perceptions.

7. Conclusion

This study shows that Singaporean physicians attach high importance to treating pain and symptoms, and value communicating with patients about treatment preferences during the treatment process. On the other hand, they do not prefer discussing treatment costs with patients or withholding information from patients even if asked by family members. Physicians in general tend to focus more on patients' overall quality of life, such as psychological and spiritual issues, than just extending patients' life though their perceptions on this issue still diverge to some degree. Experience, as reflected by clinical grade, as well as palliative care training may influence physicians' perceptions on their roles in palliative care. Future palliative care training programs for physicians can focus on symptom management and communication skills to effectively improve clinical performance.

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