

Original Article

Using Routinely Collected Data to Ascertain Concordance With Advance Care Planning Preferences



Woan Shin Tan, MSocSc, Ram Bajpai, PhD, Chan Kee Low, PhD, Andy Hau Yan Ho, EdD PhD, and Josip Car, MD, PhD, DIC, MSc, FFPH, FRCP (Edin)

Centre for Population Health Sciences (W.S.T., R.B., A.H.Y.H., J.C.), Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore; NTU Institute for Health Technologies (NTU HealthTech) (W.S.T.), Interdisciplinary Graduate School, Nanyang Technological University, Singapore, Singapore; Health Services and Outcomes Research Department (W.S.T.), National Healthcare Group; Economics Programme (C.K.L.), School of Social Sciences, Nanyang Technological University, Singapore, Singapore; Psychology Programme (A.H.Y.H.), School of Social Sciences, Nanyang Technological University, Singapore, Singapore; Palliative Care Centre for Excellence in Research and Education (A.H.Y.H.), Singapore, Singapore; and Global eHealth Unit (J.C.), Department of Primary Care and Public Health, School of Public Health, Imperial College London, United Kingdom

Abstract

Context. One of the key outcomes of advance care planning is whether patients had received care that was consistent with their expressed goals and preferences.

Objectives. The aims of this study were to illustrate the feasibility of using routinely collected health care data that include hospital procedural codes, diagnosis-related codes, health services utilization, and death registry data and to ascertain the level of concordance between care received and the stated goals.

Methods. In this retrospective cohort study, medical treatments were ascertained using a combination of hospital procedural codes and diagnosis-related codes. Places of care were obtained by reviewing the sequence of health services used, and the place of death was obtained from the national death registry. To ascertain concordance, medical treatment, places of care, and place of death were compared against the individual's preferences.

Results. The sample includes 1731 decedents (aged 21 years and above) who completed their advance care planning documentation as part of a national program. Ninety-eight percent who wished for comfort measures met their preferences. Sixty-five percent of individuals who wished to be cared for at home received care at home. Nearly 40% of all individuals who opted to die at home achieved their wishes, whereas 76% of those who opted for home or hospital and home or hospice had their preferences fulfilled.

Conclusion. Administrative data offer a cost-efficient and powerful method for assessing outcomes for a large population-based national program. However, this approach is still at an early stage of development and needs to be further validated before it can be used at scale. *J Pain Symptom Manage* 2018;56:659–666. © 2018 American Academy of Hospice and Palliative Medicine. Published by Elsevier Inc. All rights reserved.

Key Words

Place of care, place of death, advance care planning, concordance, preferences

Introduction

One of the main objectives of advance care planning (ACP) is to allow patients to maintain autonomy

in relation to current and future health care decisions. In 2011, a national advance care planning program, called “Living Matters,” was launched in Singapore to meet this specific aim. The program aimed to

Address correspondence to: Woan Shin Tan, MSocSc, Centre for Population Health Sciences, Nanyang Technological University, Clinical Sciences Building, 11 Mandalay Road, 308232, Singapore. E-mail: woan_shin_tan@nhg.com.sg

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ensure systematic conduct of end-of-life care discussions, supported by a consistent documentation of preferences. One of the first to be introduced in Asia, “Living Matters” was adapted from the Respecting Choices® program in the Gunderson Health System in Wisconsin, U.S. In the U.S., the program was associated with improvements in patient-surrogate congruence¹ and also resulted in a 98% compliance with treatment preferences of 540 decedents.²

Given that the goal of ACP is primarily to “ensure that individuals receive medical care that is consistent with their values, goals, and preferences during serious and chronic illness,”³ the paucity of evaluation studies examining whether choices were respected represents a significant gap in current ACP evaluation frameworks. In a systematic review of 55 studies examining the efficacy of ACP,⁴ only three studies measured and reported the level of concordance with treatment preferences.^{5–7} Few studies have examined the level of concordance with preferences for place of care,⁸ which is distinct from the place of death.⁹

In the aforementioned studies, the occurrence of treatment procedures at the end of life were ascertained through medical records review and supplemented by surveying attending nurses⁷ or surrogate family caregivers or decision makers.⁶ Other studies examined concordance outcomes associated with do-not-resuscitate orders,¹⁰ advance directives, and end-of-care discussions¹¹ have relied on similar methods. However, such data collection approaches could be time consuming and might not be scalable to population-based evaluations. The literature suggests that studies with large sample sizes have primarily examined concordance with only the place of death.^{12,13} In a recent publication by Turley et al., the authors advocated for, and demonstrated the utility of, defining end-of-life care events based on medication and procedural codes that were captured routinely as part of electronic medical records documentation.¹⁴ This approach allowed a systematic assessment of the level of concordance between documented preferences and actualized end-of-life care treatments.

Since its implementation, the outcomes of “Living Matters” have not been evaluated nationally. Discussions about death and dying are considered taboo with little communication about these preferences between family members. Doctors are also often requested to withhold poor prognosis from patients by their families.¹⁵ Little research has been conducted in Asian settings regarding the effectiveness of ACP in promoting adherence with individual treatment preferences. To better support the assessment of ACP outcomes at the population level, administrative

data collected at the national level were used to compare stated preferences against actualized outcomes.

Methodology

Study Design and Population

The “Living Matters” program involves a coordinated approach to ACP whereby trained nonmedical facilitators, in collaboration with treating physicians, assist patients and their families to reflect on the patient’s goals, values, and beliefs and to discuss and document their future choices about health care. Similar to the Respecting Choices® program, the Singaporean program aims to 1) increase awareness about ACP among health care professionals, and the public; 2) recruit and train ACP facilitators to facilitate conversations in health and social care organizations; and 3) establish and strengthen systems to support ACP implementation, including the development of a national ACP IT system.¹⁶

Different ACP processes and documentation requirements are applicable to adults who are healthy, diagnosed with complex chronic illnesses, or diagnosed with a life-limiting/advanced illness. This study focuses on the last group. We adopted a retrospective cross-sectional design to profile the end-of-life preferences of deceased individuals and to ascertain the extent of concordance between stated preferences and end-of-life care. Individuals who had completed their ACP and died between 2011 and 2015 were included.

Data Source

As part of “Living Matters,” a coordinated approach to ACP was adopted, whereby trained facilitators, who may not necessarily be medically trained, support patients and their families to discuss and document their future choices about health care. The preferences were then documented in an ACP form that specifies preferences about cardiopulmonary resuscitation during cardiopulmonary arrest, and preferences about intubation, mechanical ventilation, cardioversion, and transfer to intensive care. The patient was also asked about their preferred place of medical treatment, and care if their medical condition were to deteriorate. Finally, the preferred place of death (nursing home, acute hospital, home, inpatient hospice, no preference) was also documented. The completed form was then uploaded into the national ACP information technology system, and/or the electronic medical records of the individual hospitals.

We extracted ACP participant profile and preference data from the aforementioned databases. Other

data variables were obtained from the Ministry of Health: acute hospital diagnosis, procedural, and service codes were extracted from administrative databases that captured case-mix information from all public-sector hospitals in Singapore; long-term care service usage was extracted from administrative databases that captured information for individuals who received government subsidies for services provided by dialysis centers, day care centers, home care providers, nursing homes, and inpatient hospices; and place of death data were extracted from the national death registry. To safeguard data confidentiality, a project unique identifying number was generated for each National Registration Identify Card number that identifies every Singapore resident, and this was used to link data across data sets.

Preference Statements

The ACP document contained information about individual preferences related to the administration of cardiopulmonary resuscitation (CPR), medical intervention (full treatment, limited additional interventions, comfort measures), place of care, and place of death. Full treatment includes intubation, mechanical ventilation, and cardioversion, and transfer to intensive care units if indicated. Limited additional interventions include oral or intravenous medications as well as noninvasive ventilation support but excludes endotracheal intubation or long-term life support measures or intensive care unit admissions. Comfort measures include reasonable measures made to offer food and fluids. Medications, oxygen, and other measures may be used as needed for comfort.

For the preferred place of medical treatment or care, individuals could opt for home, hospice, nursing home, hospital, as well as a trial of treatment in their own home or nursing home or hospice before considering transfer to hospital or hospice. The documentation also allowed individuals to indicate “no preferences” or “others.” To reflect the sequential or conditional options inherent in the preferences for place of care, we mapped out 10 permutations ([Supplementary Material 2](#)).

For place of death in the event of deterioration, the options include home, the hospital, hospice, or nursing home. They could also state two or more alternatives, such as home or hospital, and home or nursing home or hospital. A “no preference” option was also available.

End-of-Life Care Events

To identify incidences of tracheostomy, intubation, mechanical ventilation, noninvasive ventilation, electrical cardioversions, and CPR, we used a combination of the International Classification of Diseases, Ninth Revision, Clinical Modification codes, diagnosis-

related group codes, and the Australian Classification of Health Interventions, Version 6. First, two researchers with training in health services research created the initial list of codes, based on a combination of a literature review¹⁷ and checking through the relevant code books. Second, three physician-researchers independently reviewed the list of procedural and diagnosis-related codes for final inclusion. The time frames used for collating the information were 14, 30, and 90 days before death. (Refer to [Supplementary Material](#) for the codes used.) Although the reliability of the coding has not been explored or ascertained, we expect the diagnosis-related group codes to be reliably coded since this is monitored by the Ministry of Health, as part of the annual review of health care utilization and performance.¹⁸

To locate the places where care was received, we identified admissions to inpatient acute care facilities, community hospitals, nursing home, and inpatient hospices. Records of utilization of home care (medical, nursing, palliative care) and day care services were used to determine whether the patient was cared for at home. In addition, if we could identify no formal care service usage, we assumed that the patient was cared for at home. Given that an individual could access and consume different types of services at various sites before death, we first ascertained the sequence of health service usage, based on the date of admission or attendance and date of discharge, whichever is applicable for the service type, in the 14, 30, and 90 days before death.

To identify the actual place of death, the official classification of “residential home,” “nursing home and clinic,” “public and charitable institutions” (aged care facilities), “licensed sick receiving house” (inpatient hospices), and “others,” were extracted.

Concordance Mapping

The four ACP preferences (CPR, full treatment, limited additional intervention, comfort measures) were mapped onto eight end-of-life care procedures or treatments ([Fig. 1](#)), which were each coded

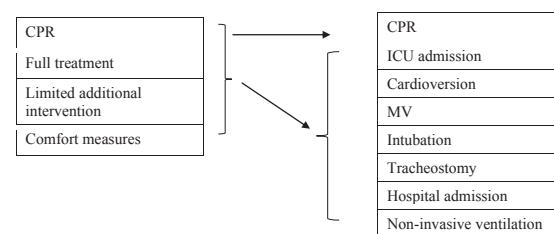


Fig. 1. Preferences mapped to end-of-life care treatments. CPR = cardiopulmonary resuscitation; ICU = intensive care unit; MV = mechanical ventilation.

dichotomously. For each patient, concordance occurred when recorded end-of-life care treatments matched the documented preferences of full treatment, limited additional interventions, and comfort care. For example, if the patient had opted for comfort care but had received tracheostomy and/or mechanical ventilation and intubation and/or noninvasive ventilation or CPR, this would have been identified and coded as a nonconcordant case. For each patient, the date difference between the procedure administration and date of death was also computed, to ascertain concordance at 14, 30, and 90 days before death. Our mapping algorithm is, however, limited because a lack of concordance for individuals who opted for full treatment or limited additional intervention could reflect low clinical need, rather than discordance.

To compute the level of agreement for place of care, where preferences could be for a single site, or be conditional for everyone, we mapped the actual care transitions to the preferred place of care, as indicated by the 10 identified possible permutations. Concordance is achieved when the preceding-succeeding relationships were met. For example, the location(s) of care would be considered concordant with the preference to receive “a trial of treatment in their homes before considering transfer to a hospital,” if the care transition reflected that the patient had received medical, nursing, or palliative care at home, before being admitted to an acute hospital. For the place of death, concordance was determined by comparing the place of death category with the stated preference. For any preferences that included two or more options, we have considered agreement using a summative approach. For instance, there is concordance with the preference “home or hospital” if the patient had either died at home or in an acute hospital. Data on individuals who had stated “unsure,” “no preference,” or “depends on the situation for place of medical treatment or place of death” were not considered in the computation of the level of agreement.

All data analyses were carried out using Stata Version 12 (StataCorp LP, College Station, TX).¹⁹

Results

Patient Demographics and Stated Preferences

The demographics of the 1731 decedents are summarized in Table 1. More than half of the sample was aged 75 years and above. Females account for half of the sample, and individuals of Chinese ethnicity were overrepresented in this sample, compared with the national average (83% vs. 77%).²⁰ In terms of preferences, more than 90% opted for “no CPR during cardiac arrest and is not

Table 1
Demographics and Documented Preferences of Patients
(N = 1731)

Variables	Number (%)
Age group (yrs)	
<45	30 (1.7)
45–54	75 (4.3)
55–64	181 (1.5)
65–74	306 (17.7)
≥75	1139 (65.8)
Gender	
Male	902 (52.1)
Ethnic group	
Chinese	1447 (83.6)
Malay	160 (9.2)
Indian	96 (5.6)
Others	28 (1.6)
CPR	
Attempt	56 (3.2)
Do not attempt	1661 (96.0)
Unsure	14 (0.8)
Medical treatment	
Full treatment	44 (2.5)
Limited additional intervention	1160 (67.0)
Comfort care	514 (29.7)
Unsure	13 (0.8)
Preferred place of medical treatment	
Home	193 (11.1)
Hospital	407 (23.5)
Hospice	122 (7.0)
Nursing home	129 (7.5)
Trial of treatment at home before transfer to hospital or hospice	458 (26.5)
Trial of treatment before transfer to hospital	
Home	142 (8.2)
Hospice	35 (2.0)
Nursing home	159 (9.2)
Others (no preferences, unsure)	86 (5.0)
Preferred place of death	
Home	680 (39.4)
Hospital	214 (12.4)
Hospice	133 (7.7)
Nursing home	120 (6.9)
Home or hospital	46 (2.7)
Home or hospice	12 (0.7)
Hospital or hospice	27 (1.6)
Hospital or nursing home	73 (4.2)
Hospice or nursing home	10 (0.6)
Other combinations	17 (1.0)
Others (no preferences, unsure)	399 (23.0)

CPR = cardiopulmonary resuscitation.

breathing or has no pulse.” Only 44 of 1731 patients opted for full treatment, with the remaining stating a preference for limited additional interventions or comfort measures. Approximately 46% would prefer to be cared for at home or to have a trial of care at home, before considering care in the hospital, and 24% outrightly preferred to be care for in the hospital. For the preferred place of death, approximately 40% expressed a distinct preference for dying at home, and about 30% expressed a preference for death in an institutional setting (hospital, nursing home, hospice). While only 5% of the sample had no preferences or were unsure about the place of care, 23% indicated they had no preference or were unsure about the place of death.

Table 2
Concordance With Medical Treatment, by Time Before Death (N = 1731)

Preferences	Number	Concordance by Time Before Death (%)		
		14 Days	30 Days	90 Days
CPR				
Did not prefer	1661	100.0	100.0	100.0
Medical interventions				
Prefer full treatment	44	9.1	20.5	31.8
Prefer limited additional treatment	1160	31.1	55.9	79.5
Prefer comfort measures	514	99.6	98.8	98.1

CPR = cardiopulmonary resuscitation.

Agreement Between Preferences and Actual Outcomes

Table 2 presents the level of agreement, in terms of medical treatment. The level of concordance for individuals who opted to receive comfort measures was close to 98%. The agreement between preferences for CPR, full treatment, and limited additional treatment and actual treatments was very low, but as clinical need or judgment was not ascertained in this retrospective database study, it might not reflect concordance.

The level of agreement between the preferred and actual place of treatment and care is reflected in Table 3. Of the 193 (11%) individuals who wished to be cared for at home, 57%–65% received care at home. Among the 458 (26%) patients who wished for a trial at home before admission to the hospital, close to half met their preferences. Approximately 24% (407/1731) of individuals wished to be cared for in the hospital. The percentage of concordance with hospital care ranged from 68% at 14 days before death to 90% at 90 days before death. Among the 244

(14%) patients who opted to only receive care in an inpatient hospice or to have a trial of care in the hospice before transfer to the hospital, approximately one in three patients received preference-concordant care. Close to one in two patients who opted for care in the nursing home or a trial in nursing home before admission to the hospital met their preferences, and the concordance reached 100% if the move occurred toward the time frame of 90 days before death.

From Table 4, we observe that the overall concordance with place of death preferences is 50%. The rate of concordance was lower for individuals who opted for a single location, compared to those who preferred more than one alternative. Nearly 40% (680/1731) of individuals who opted to die at home achieved their wishes, whereas 76% of those who opted for home or hospital and home or hospice had their preferences fulfilled. However, a lower level (45%) of concordance was observed among those who wished to die in the hospice or nursing homes.

Discussion

We presented administrative data, collected at the national level, to evaluate whether care received by an individual was in agreement with their goals and preferences. One of the strengths of our approach is its declarative nature, where the mapping of preferences to actual care and the determination of concordance are explicitly defined, rendering the process repeatable. Concordance with the goals of care has been recognized as a key ACP outcome measure by an international consensus study²¹; but the usual methods for ascertaining concordance through medical records review could be costly. When family members or health care professionals were surveyed after bereavement, recall bias might reduce the accuracy

Table 3
Place of Care Concordance, by Time Before Death (N = 1731)

Preferred Location	Number	Concordance by Time Before Death (%)		
		14 Days	30 Days	90 Days
Home	193	65%	63%	57%
Hospital	407	68%	78%	90%
Hospice	122	35%	35%	35%
Nursing home	129	58%	58%	100%
Trial of treatment at home before transfer to hospital or hospice	458	56%	53%	48%
Trial of treatment before transfer to hospital from				
Home	142	59%	53%	49%
Hospice	35	37%	37%	40%
Nursing home	159	50%	51%	100%
Others (no preference, unsure)	86	—	—	—

Table 4
Place of Death Concordance

Preferred Location	Number	Concordance
Single option	1147	48%
Home	680	51%
Hospital	214	54%
Hospice	133	45%
Nursing home	120	22%
Multiple options	185	57%
Home or hospital	46	83%
Home or hospice	12	50%
Hospital or hospice	27	69%
Hospital or nursing home	73	51%
Hospice or nursing home	10	45%
Others	416	—
Others (relative's home, health care institution, three or more options)	17	—
No preferences or unsure	399	—
Total	1731	50%

and reliability of the outcomes. These methods also do not support outcomes monitoring at the system level. With stronger reliance on electronic medical records, eventually, algorithms can be designed and implemented to determine individual-level concordance.

We found the level of agreement, in terms of preferences for CPR and comfort measures, to be very high among the deceased population who completed their ACP. The treatment concordance for participants who have opted for full or limited additional treatments was relatively lower. Another study found that the rates of intubation and defibrillation/electrical cardioversion among a sample of 683 inpatient decedents were 10.1% in the last 24 hours of life,¹⁰ which is comparable to the 9.1% who received full treatment (intubation, mechanical ventilation, and cardioversion) in the 14 days before death in our study.

In terms of the level of agreement with place of care, there were differences depending on the time frame of analysis. Invariably, we introduced more episodes of institutional care as the time frame of analysis moved further away from the time of death. This reduces the concordance with home as one of the preferred place of care, while at the same instance, concordance increases for institutional care. There is no consensus in the literature on the time frame to consider for the computation of concordance with this set of preferences. To the best of our knowledge, no published studies have examined concordance with the preferred place of care.

Using the location of death recorded in the death certificates, we found that approximately 50% of the sample died at their preferred place of death. The percentage of individuals with a home preference dying at home (51%) is double that of the national share of deaths at home (25%).²² Our results on concordance fell within the range of 33% to 67%, reported by studies conducted in Australia,⁹ Italy,²³ and the U.S.^{24–26} Factors influencing concordance with place of death preferences could be multifactorial and often nonmodifiable.²⁷ The concordance rate in our study was lower for individuals who preferred to die in the hospice or nursing homes. This contrasts with the findings by Agar et al., who found 77% and 64% of concordance for palliative care patients who preferred to die in a hospice or aged care facility, respectively. The availability of home care and alternative care facilities within each country or geographical region could have influenced the level of concordance. In Singapore, the projected expansion of home palliative care places, from 5000 in 2014 to 6000 in 2020, could support individuals and families to fulfill the wishes to die at home.²⁸ Similar efforts to expand the capacity of nursing homes and hospices will likely increase the concordance with the wishes of patients who prefer these facilities as their place of death.²⁸

Policy and Research Implications

There is a substantial research gap pertaining to the measurement and assessment of whether preferences are met. We would recommend future work in this area to improve our understanding of the importance of and the meaning placed by health care professionals, patients, and their family members on achieving concordance for each category of preferences. For instance, do they place equal weightage on achieving concordance with medical treatments and place of medical treatment or place of death.

With the anticipated expansion of the ACP program from the coverage of 10,000²⁹ to 25,000 Singaporeans from 2017 to 2020,³⁰ there needs to be a cost-efficient and reliable method for ascertaining the effects of policy in respecting the wishes of the participants. In this study, we have illustrated that administrative data can support the assessment of population-level concordance with preferences stated in an ACP. This approach can be generalized to other health care systems, using similar coding mechanisms. With the advent of electronic medical records, text-mining techniques could be applied to enable a systematic monitoring of outcomes at the population level. However, this must be accompanied with further validation to ascertain the degree of potential misclassification, and overcoding and undercoding for life-sustaining treatments in the routine coding of data. Additional data including service codes for intravenous medications, antibiotics, and artificially administered nutrition should be included for future studies. In addition, further research is required to support the development of reliable and valid measurement tools, especially in terms of agreement with the preferred place of care.³¹

In this study, there was a slight overrepresentation of individuals belonging to the Chinese ethnic group compared to its national representation (84% vs. 73%).³² The difference in ACP adoption rates across ethnic groups should be examined in future studies.

Study Limitations

Potential limitations of this study include the use of administrative data to determine the incidence of life-sustaining treatments. The current method, although useful for determining the extent of concordance for comfort treatment, can be limited in determining concordance for individuals who opted for full and limited additional treatments because the use of aggressive treatment needs to be clinically indicated. We were also unable to conduct a systematic assessment of clinical relevancy in this study.^{5,6}

This approach is still at an early stage of development and needs to be further validated.³³ Because we have relied on documented preferences, we were

unable to account for shifts in patient preferences that were not documented. Future research could compare the accuracy of relying on administrative database versus other methods of data collection, such as health care professional reports, bereaved family member surveys, and medical records review.

Conclusions

Routinely collected data on health care service utilization and place of death can support the assessment of concordance between end-of-life care preferences and actual treatments. Administrative data offer a cost-efficient and powerful method for assessing the outcomes for a large population-based sample, compared to traditional methods, such as medical records review and key informant interviews. Therefore, further research is required to validate this method to move toward a data-driven approach for ACP outcomes monitoring and assessments.

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Appendix

Supplementary Material 1 Procedural and Diagnosis-Related Codes to Identify Life-Sustaining Treatments

ICD-9-CM	Description	ACHI	Description	DRG	Description
Cardiopulmonary resuscitation					
99.60	Cardiopulmonary resuscitation	9205200	Cardiopulmonary resuscitation		
99.63	Closed chest cardiac massage	9205300	Closed chest cardiac massage		
		9204200	Nonmechanical methods of resuscitation		
Mechanical ventilation and intubation					
96.04	Insertion of endotracheal tube	1388200	Management of continuous ventilatory support, ≤24 hours	A06 C	Ventilation >95 hours W/O catastrophic CC
96.05	Other intubation of respiratory tract	1388201	Management of continuous ventilatory support, more than 24 hours and less than 96 hours	B42 A	Nervous system diagnosis W ventilator support W catastrophic CC
96.7	Other continuous invasive mechanical ventilation	1388202	Management of continuous ventilatory support, 96 hours or more	B42 B	Nervous system diagnosis W ventilator support W/O catastrophic CC
96.70	Continuous invasive mechanical ventilation of unspecified duration			E40 A	Respiratory system diagnosis W ventilator support W catastrophic CC
96.71	Continuous invasive mechanical ventilation for less than 96 consecutive hours			E40 B	Respiratory system diagnosis W ventilator support W/O catastrophic CC
96.72	Continuous invasive mechanical ventilation for 96 consecutive hours or more			F40 A	Circulatory system diagnosis W ventilator support W catastrophic CC
				F40 B	Circulatory system diagnosis W ventilator support W/O catastrophic CC
				T40Z	Infectious and parasitic diseases W ventilator support
				W01Z	Ventilation or cranial procedures for multiple significant trauma
				X40Z	Injuries, poisoning, and toxic effects of drugs W ventilator support
				Y01Z	Ventilation for burns and severe full-thickness burns
Tracheostomy					
31.1	Temporary tracheostomy			A06 A	Tracheostomy W ventilation >95 hours W catastrophic CC
31.21	Mediastinal tracheostomy			A06 B	Trach W Vent >95 hours W/O Cat CC or Trach/Vent >95 hours W Cat CC
31.29	Other permanent tracheostomy			A06D	Tracheostomy W/O catastrophic CC
Noninvasive ventilation					
93.90	Noninvasive mechanical ventilation			E41Z	Respiratory system diagnosis W noninvasive ventilation
				F43Z	Circulatory system diagnosis W noninvasive ventilation

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; ACHI = Australian Classification of Health Interventions codes; DRG = diagnosis-related group.

Supplementary Material 2: Place of Medical Treatment Concordance Mapping

1. Coding Preferences for Place of Medical Treatment/Care

The preferences for a single place of medical treatment were first coded from A to E, whereas conditional preferences were indicated by the same letters of the alphabets in accordance to the sequence.

Preferences for Place of Care	Code
Home	A
Hospice	B
Nursing home	C
Hospital	D
Trial of treatment in own home before considering transfer to hospital	AD
Trial of treatment in own home before considering transfer to hospital or hospice	AD, AB
Trial of treatment in hospice before considering transfer to hospital	BD
Trial of treatment in nursing home before considering transfer to hospital	CD
Unsure	E
No preference	E
Others	E

2. Coding Transitions in Places of Medical Treatment/Care

Transitions in places of care were established by looking through the service records obtained from

the MOH case-mix and subvention database, and intermediate- and long-term care information system. For each of the services used, the date of admission or discharge was compared with the date of death of the individual to ascertain whether the patient had used the service within 14, 30, and 90 days. A sequence of services used within each of these time frames was constructed. The table below illustrates the sequence generated for an individual with a unique identifying number "1234."

3. Coding of the Match Between Preferences and Transitions in Care

In the example above, if the individual "1234" had opted for a "trial of care at home before transfer to hospital" (coded as "AD") as his/her preferred place of care, the level of concordance would have been coded as 1 since the individual indeed transitioned between care at home and the hospital in the last 14 days before death (coded as "AAD"). However, if the individual "1234" had opted for hospital (coded as "B") as the preferred place of care, the level of concordance would have been coded as 0 for nonconcordance.

4. Deriving Aggregate Level of Concordance

To obtain the final level of concordance number of individuals for preferred place of medical treatment/care, the number of individuals who received care at their preferred locations was divided by the number of individuals for each category of place of medical treatment/care.

PUIIN	Service Description	Code	Date of Admission	Date of Discharge	Date of Death	14-Day Transition
1234	Home medical	A	01/06/2016	31/01/2017	31/01/2017	A
1234	Home palliative care	A	01/09/2016	31/01/2017	31/01/2017	AA
1234	Hospital	D	15/01/2017	31/01/2017	31/01/2017	AAD