Trajectories at the end of life: A controlled investigation of longitudinal Health Services Consumption data

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ABSTRACT

Background: Knowledge of individual-level trajectories of Health Services Consumption (HSC) at End-of-Life (EoL) is scarce. Such research is needed for understanding and planning health expenditures.

Objective: To explore individual-level EoL trajectories in the Israeli population. This approach differs from past studies which aggregated across populations or disease groups.

Data sources: We used HMO (Health Maintenance Organization) longitudinal data for HSC of persons ages 65–90 who died during 2010–2011 (n = 35,887) and of an age by sex matched sample of persons who were alive by mid-2012 (n = 48,560).

Design: HSC per quarter was calculated for each individual. Trajectory-types of HSC were described through k-means cluster analysis.

Extraction methods: Data were extracted from computerized HMO files. HSC was computed as a standardized function of HMO costs for each individual.

Results: In both samples, low HSC trajectories were the most common. However, among the deceased, all trajectories had higher HSC than those who were alive; the low HSC trajectory cluster represented a smaller percentage of the sample; and all relevant trajectories included a HSC peak. In contrast, the most common trajectory among the living was a flat low HSC. Clusters differed significantly by sex, disease status, and age.

Conclusion: This methodology shows the utility of individual-level analysis of HSC at end-of-life and should inform future research and current debates concerning EoL care and resource distribution.

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1. Introduction

At the end of life (EoL), persons are confronted with unique and complex challenges. Research shows that many persons die prolonged and painful deaths, receiving invasive, unwanted, and expensive care [1]. It is important to deepen the understanding of the EoL stage, in order to optimize it, thereby serving both the goals of dying persons (e.g., maintaining emotional, physical, and spiritual integrity), and of society (e.g., organization of EoL care). Knowledge about Health Services Consumption (HSC) at the EoL is also important as it provides a baseline [2] for the ongoing debate on health services utilization and organization at EoL and the time preceding it.

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HSC has been found to rise sharply when life approaches its end [3]. Research shows that about 25% of all Medicare outlay is made in the last year of life; a percentage which has barely changed over the last three decades [4,5]. The major contributors to this rise are thought to be increased single and multiple hospitalizations during the last few months of life as well as skilled nursing facility care and high cost inpatient procedures [5]. Increased HSC at EoL has been the subject of much debate due to the oft-cited view that intensive and expensive life-extending treatment for terminally ill patients is a substantial contributor to this steep rise in HSC at EoL [6]. This in turn has made the subject of health expenditure at EoL an obvious target for investigation among policy makers [3,5].

The majority of previous international research describes average outlay during a certain period of time prior to death. While for most studies this period was the last year of life [4,5,7], some studies chose a shorter interval [8], while others began several years before death [9]. However, these data do not describe individual-based HSC trajectories, i.e., they do not provide details on changes over time within the period before death. Past research that did investigate HSC trajectories predominantly described mean-level trajectories or general HSC changes over time for certain populations [2,3,10,11]. Although important, mean-level HSC trajectories do not take into account individual differences [12].

The goal of the current study is therefore to describe individual-level EoL HSC trajectories. Therein, our specific aims are (i) to characterize different HSC trajectories in the EoL period, including four years prior to death and (ii) to determine whether basic background variables differentiate among these trajectories. Since we are not aware of previous studies on this topic, no firm hypothesis on the amount of HSC trajectories can be made. However, based on studies describing average amount of expenditures in the last period before death, we can hypothesize that trajectory group membership is related to sex [7,9,13], age [7,9,13], health [4,14], ethnic background [4], and poverty [4]. In the current study, trajectories were studied for the last four years of life, including three-monthly measurements (in total 16 quarters). In addition, we investigated if trajectories were unique to the EoL stage, by comparing them to trajectories of an age, sex, and time matched control group of persons who remained alive. The relationship between the different trajectories and background characteristics was also investigated. Finally, by observing a four year pre-death period, we are able to consider the issue of when the EoL stage begins.

This study was based on an Israeli population. Residents of Israel are insured for healthcare under the National Health Insurance Law (1995) and are entitled to universal acute and rehabilitation care through one of four publically financed HMOs. As Israel is an immigrant society with over 3,000,000 immigrants having arrived since its inception in 1948, the absorption experience is diverse resulting in varying ability to navigate the health care system, especially amongst older individuals. Long-term care in both institutions or at home is not covered by this law [15], and therefore is not included in the measure of HSC in this paper.

2. Methods

Data were obtained from the largest of the four Health Maintenance Organizations (HMO) in Israel. Institutional Review Board approval was obtained from the Carmel hospital Helsinki committee. The database includes information concerning HSC by date of all insured persons who were age 65–90 in 2006, for the years from 2006 to 2011. In the analysis we included all persons in this population who died during 2010–2011 (n = 35887). We then prepared an age and sex matched control group which included only persons who lived at least until mid-2012. Matching was done by dividing those who were alive and those who had died in 2010–2011 into subgroups by age (year) and by sex (52 groups). We calculated the ratio of the number of those alive in each subgroup to the number of those dead in the same subgroup. The smallest ratio (1.35) determined the sample size of those alive. For each of the other 'alive' subgroups we randomly selected participants (from the age-sex matched control group) so that the number was equal to the number dead in that same age by sex subgroup times 1.35. This resulted in 48560 matched persons who had not died by mid-2012. The sample (and both subgroups) had a mean age of 78.69 in 2006 and 54.5% were female. Those who died had spent fewer years in Israel (49.87 vs. 54.72, $t_{(73132)} = 34.882$ $p < 0.001$), were more likely to be poor (38.8% vs. 24.6%, $\chi^2 = 1971.33$ $p < 0.001$), and had a higher Charlson score both in 2006 (2.57 vs. 1.61. $t_{(62383)} = 68.70$ $p < 0.001$) and in 2009 (3.65 vs. 2.19, $t_{(61968)} = 86.96$ $p < .001$).

2.1. Measurements

2.1.1. Health Services Consumption (HSC)

HSC was calculated as the total cost per individual per quarter divided by the average of the 2006 median quarterly costs for those who remained alive by mid-2012. As an example; if the average of the median quarterly costs in 2006 was 300 Israeli New Shekel (ILS) and a participant had medical expenses of 1200ILS between January and March 2007 then their HSC for the first quarter of 2007 would be 4 (1200/300). The specific quarterly median is the proprietary information of the HMO and therefore HSC is presented as a proportion of this figure throughout this paper and is a direct function of health expenditure. HSC included costs associated with utilization of hospital care, visits to primary and specialist physicians, pharmaceutical purchase, imaging and utilization of laboratory tests.

2.1.2. Demographics

Demographic data included age in 2006, sex, date of death, number of years lived in Israel, and poverty. Poverty was coded by the HMO if a person was exempted from co-payments.

2.1.3. Medical data

Medical status was computed from a chronic disease registry of the HMO, using the Charlson Comorbidity Index [16], a measure of comorbidity with some rating of severity. The Charlson index includes a total of 19 diseases, where each disease is given a weighted score based on disease