Brief Methodological Report

Identifying Older Adults With Serious Illness: Transitioning From ICD-9 to ICD-10

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Abstract

Context. Identifying the seriously ill population is integral to improving the value of health care. Efforts to identify this population using existing data are anchored to a list of severe medical conditions (SMCs) using diagnostic codes. Published approaches have used International Classification of Diseases, Ninth Revision (ICD-9) codes, which has since been replaced by ICD-10.

Objectives. We translated SMCs from ICD-9 to ICD-10 using a refined code list. We aimed to test the hypothesis that people identified by ICD-9 or ICD-10 codes would have similar Medicare costs, health care utilization, and mortality.

Methods. Using data from the National Health and Aging Trends Study linked to Medicare claims, we compared samples from periods using ICD-9 (2014) and ICD-10 (2016). We included participants with six-month fee-for-service Medicare data before their interview date who had an SMC identified within that period. We compared the groups' demographic, functional, and medical characteristics and followed up them for six months to compare outcomes.

Results. Among subjects in the 2016 (ICD-10) sample, 19.9% were hospitalized, 24.6% used the emergency department, 7.2% died, and average Medicare spending totaled $9902.04 over six months of follow-up. We observed no significant differences between the 2014 and 2016 samples ($P > 0.05$); both samples represent 18% of Medicare fee-for-service beneficiaries.

Conclusion. Identifying the seriously ill population using currently available data requires using ICD-10 to define SMCs. Routine measurement of function, quality of life, and caregiver strain will further enhance the identification process and efficiently target palliative care services and appropriate quality measures.   J Pain Symptom Manage 2019;57:1137–1142. Published by Elsevier Inc. on behalf of American Academy of Hospice and Palliative Medicine.

Introduction

Improving the value of health care has been a major focus of health care reform in recent years. Health care costs are most concentrated among adults with serious illness—a group for whom many innovative care models may improve quality and reduce costs.[1–10] For persons with serious illness to benefit from the additional services available in many of these innovative models, payers, health systems, and practices need to have a way to more effectively identify those who need these services.

Serious illness is a health condition that carries a high risk of mortality and either negatively impacts a person's daily function or quality of life or excessively

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strains their caregivers.[10−12] The majority of this population is not in the last year of life, and thus, the definition is not constrained by short-term prognosis.[10,13−17] Efforts to operationalize this definition within existing data sources have used combinations of Medicare claims data, electronic medical record data, and patient and caregiver survey data, all with varying levels of restriction and associated tradeoffs in sensitivity and specificity.[11,12] These approaches all begin with a list of severe medical conditions (SMCs), that is, diagnoses that carry an increased risk of mortality, hospitalization, and emergency room visits.

To date, published research aiming to prospectively identify the population with serious illness within the U.S. has used International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes.[11,12] However, ICD-9 has now been supplanted by International Classification of Diseases, Tenth Revision (ICD-10), a transition that was completed in the U.S. during the last quarter of 2015. ICD-10 includes a vast expansion of diagnostic codes and far greater specificity than was available in ICD-9. ICD-10 has approximately 68,000 available diagnostic codes, compared with approximately 13,000 codes in ICD-9; it also includes additional characters that allow for specification of disease severity, etiology, and anatomic site.[18] For example, "malignant hypertensive heart disease with heart failure" (ICD-9 code 402.01) can now be specified as "end-stage heart failure" (ICD-10 I50.84).

Thus, we aimed to translate our approach to identifying SMCs from ICD-9 to ICD-10 and test the hypothesis that people identified by each approach would have similar Medicare costs, rates of health care utilization, and mortality. Although our methods do not address all components of the serious illness definition (e.g., negative impact on daily function, caregiver strain), we used widely available health outcomes as a necessary foundational step toward the goal of creating a new operational definition of SMCs.

Methods

As previously described, the ICD-9 codes used to identify SMCs include cancer (metastatic or hematologic); end-stage renal disease; advanced liver disease or cirrhosis; diabetes with severe complications (ischemic heart disease, peripheral vascular disease, renal disease); amyotrophic lateral sclerosis; acquired immune deficiency syndrome (AIDS); hip fracture; dementia; chronic obstructive pulmonary disease or interstitial lung disease only if using home oxygen or hospitalized for the condition; and congestive heart failure only if hospitalized for the condition.[11,12]

The ICD-10 approach was created and refined through the following steps. First, we attempted a direct translation of diagnostic codes using publicly reported code lists from the Chronic Conditions Warehouse, online ICD-10 codebooks, and peer-reviewed literature using ICD-10 codes to identify these conditions.[19−22] Beginning with an inclusive list of codes from these sources, three authors (A. S. K., L. C. H., and C. S. R.) reviewed each entry and retained only those codes consistent with the conceptual definition: "Serious illness is a health condition that carries a high risk of mortality and either negatively impacts a person's daily function or quality of life, or excessively strains their caregivers." Thus, the SMCs included may have a "high risk of mortality" and "negatively impact… quality of life" due to hospitalization and emergency room visits. The code list was additionally refined through expansion of the neurodegenerative disease category, the use home oxygen as a marker of advanced congestive heart failure, the introduction of a category for stroke only if hospitalized for the condition, and the inclusion of chronic kidney disease stage 5. In addition, owing to both advancements in the treatment of human immunodeficiency virus (HIV) and greater specificity in ICD-10 codes, we selected only those codes consistent with advanced complications of AIDS. With multiple rounds of review, we confirmed consensus in all cases. A detailed list of codes is available in Appendix 1.

We drew our study samples from the National Health and Aging Trends Study (NHATS), a population-based longitudinal survey of individuals aged 65 years and older living in the contiguous U.S., drawn from the Medicare enrollment file, which represents 96% of all older adults in the U.S.[23] Specifically, our samples were drawn from 2014 to 2016 NHATS data, linked to individual Medicare claims. We selected these years because they are the most recent years for which we have a complete calendar year of data for ICD-9 (2014) and ICD-10 (2016). To capture complete claims data with diagnosis codes and directly reported expenditures, we included only those participants with six months of continuous fee-for-service (FFS) Medicare coverage before the NHATS interview date. Within the 2014 and 2016 samples, we then included only those participants with an SMC—as defined by the ICD-9 or ICD-10 approaches described previously—identified within that six-month period. This yielded samples of 494 persons for 2014 and 807 persons for 2016. NHATS survey weights were used to calculate population estimates.

We compared the groups' baseline demographic, functional, and medical characteristics at the time of the NHATS interview. We then followed up these individuals for six months from interview date to assess outcomes including Medicare expenditures (total

and by category), prevalence of hospital and emergency department admission, hospice enrollment, and mortality. Claims data censored at December 31, 2016, fell short of six full months of follow-up for 27.9% of the 2016 sample; the mean length of follow-up for this group was 5.5 months, compared with six months for the 2014 sample. Expenditures were inflation adjusted to 2016 dollars. We completed all analyses in Stata, version 15 (StataCorp, College Station, TX). The Johns Hopkins University Institutional Review Board approved the NHATS protocol, and all participants provided written informed consent. The Icahn School of Medicine at Mount Sinai's Institutional Review Board and the Centers for Medicare & Medicaid Services Privacy Board approved the study.

Results

As shown in Table 1, compared with the 2016 (ICD-10) sample, the 2014 (ICD-9) sample was slightly older (80.1 vs. 78.9 years) and less likely to be in the bottom quartile of income (30.4% vs. 36.7%). These samples were not significantly different ($P > 0.05$) in terms of other sample characteristics including gender, race/ethnicity, marital status, education level, Medicaid and Medigap coverage, and self-reported health. Both the 2014 (ICD-9) sample and the 2016

(ICD-10) sample represent a population estimate of 18% of the Medicare FFS population.

As shown in Table 2, six-month outcomes were not significantly different ($P > 0.05$ for all outcomes) between the 2014 (ICD-9) and 2016 (ICD-10) samples. For the 2014 (ICD-9) sample, the mean total Medicare spending was $10,292.05 (median: $3227.14), with 18.6% experiencing a hospitalization, 26.4% experiencing an emergency department visit, and 7.9% dying within six months of follow-up. For the 2016 (ICD-10) sample, the mean total Medicare spending was $9902.04 (median: $3284.87) with 19.9% experiencing a hospitalization, 24.6% experiencing an emergency department visit, and 7.2% dying within six months of follow-up.

Discussion

Prospectively identifying the population with serious illness is integral to maximizing health care value and effectively meeting the care needs of this vulnerable population. A refined list of SMCs, based on ICD-10 codes, is a fundamental component to this process.

The approach described herein uses ICD-10 to define SMCs and performs as well as the ICD-9 approach, used previously as a component of a published approach to identify the seriously ill population. Specifically, one

Table 1
Characteristics of People With Serious Medical Conditions, Identified by ICD-9 and ICD-10

Characteristics	2014 (ICD-9)	2016 (ICD-10)	P-value
N	494	807	
Population estimate (n)	3,348,362	4,275,997	
Medicare FFS population estimate, (%)	18.0	18.2	
Months of follow-up observed			
Time period observed, mean months	5.8	5.4	<0.01[a]
Medicare data available, mean months	6.00	5.5	<0.01[a]
Age, mean years	80.1	78.9	0.01[a]
Married (%)	42.8	45.6	0.39
Female (%)	53.2	55.9	0.35
Race/ethnicity			
Non-Hispanic white (%)	80.4	76.4	0.13
African American (%)	11.2	9.3	0.23
Hispanic (%)	4.4	6.7	0.05
Other (%)	3.4	4.9	0.41
Education (% with high school or higher)	75.5	78.5	0.29
Income			
% in bottom quartile	30.4	36.7	0.02[b]
% in second quartile	27.8	26.3	0.48
% in third quartile	26.7	22.0	0.07
% in top quartile	15.1	14.9	0.94
Self-reported health, fair/poor (%)	44.9	43.7	0.69
Independent in Activities of Daily Living (%)	59.1	56.9	0.47
Medicaid, self-report (%)	22.3	25.3	0.28
Medigap, self-report (%)	68.6	70.1	0.66
Nursing home resident (%)	9.34	7.3	0.23

ICD = International Classification of Diseases; NHATS = National Health and Aging Trends Study; SMC = serious medical condition.
NHATS participants, 6+ months of FFS Medicare before interview and one or more SMCs.
All measures are adjusted for survey weights to provide nationally representative estimates.
[a]$P < 0.01$.
[b]$P < 0.05$.

Table 2
Six-Month Outcomes Among People With Serious Medical Conditions, Identified by ICD-9 and ICD-10

Six-Month Outcomes	2014 (ICD-9)	2016 (ICD-10)	*P*-value
Cumulative Medicare expenditures over six months			
Total, mean	$10,292.05	$9902.04	0.72
median	$3227.14	$3284.87	
Inpatient, mean	$3546.93	$3227.55	0.65
median	$0.00	$0.00	
Skilled nursing facilities, mean	$1094.61	$769.43	0.25
median	$0.00	$0.00	
Home health, mean	$700.79	$712.30	0.91
median	$0.00	$0.00	
Hospice, mean	$647.37	$517.15	0.63
median	$0.00	$0.00	
Outpatient, mean	$4021.91	$4422.65	0.42
median	$2057.76	$2144.18	
Durable medical equipment, mean	$280.44	$252.97	0.65
median	$0.00	$0.00	
Any hospital admission (%)	18.6	19.9	0.58
>1 hospital admission (%)	6.8	7.2	0.74
Total hospital days, mean	1.9	1.7	0.60
median	0.00	0.00	
Any emergency department outpatient visits (%)	26.4	24.6	0.53
Any intensive care unit admission (%)	7.0	7.2	0.84
Hospice enrollment (%)	5.2	4.4	0.63
Died (%)	7.9	7.2	0.70

ICD = International Classification of Diseases; SMC = serious medical condition.
6+ months of FFS Medicare before interview and one or more SMCs.
All measures are adjusted for survey weights to provide nationally representative estimates.
Expenditures have been inflation adjusted to 2016 dollars.

study used this ICD-9 approach (or a report of a functional impairment) to identify people with serious illness and followed up participants for 12 months (as opposed to six months in the present work). That study identified a seriously ill population that had $20,566 mean Medicare spending and 12.9% mortality during 12-month follow-up, compared with other beneficiaries, among whom 12-month total Medicare costs averaged $7789 and 2% died.[12]

The present work has important limitations. First, because the analyses required complete claims data including diagnoses and costs, the sample was restricted to participants with FFS Medicare coverage. Thus, our results are not directly generalizable to Medicare beneficiaries enrolled in Medicare Advantage Plans. In addition, there have been great strides in treatment of HIV,[24] and it is unclear whether it is still appropriate to classify AIDS as an SMC. Within our sample of Medicare beneficiaries, the prevalence of AIDS is so small that this question cannot be addressed. Therefore, we continue to include the ICD-10 codes indicating advanced complications of AIDS, while noting that further research is warranted.

We specifically focused this work on identifying SMCs associated with increased mortality and episodes of acute care use. Although this is a critically important first step used in identifying a seriously ill population, it does not capture other key components of the serious illness definition (e.g., negative impact on daily function, quality of life, or caregiver strain).

Notably, over half of the people identified in this study are functionally independent, indicating a limitation in the specificity of this approach. Yet—despite strong evidence that these other components of illness help to identify a population with inadequately addressed care needs—measures of function, quality of life, and caregiver strain are unavailable in most health care data sources. We also recognize that this approach to identifying SMCs does not fully capture illness severity, degree of multimorbidity, or medical complexity. Thus, a specialized program designed to support persons with serious illness may require more restrictive and specific criteria. In such cases, additional requirements, such as a recent hospitalization, may be added to this approach. For example, limiting our 2016 sample to only those with a hospitalization in the last six months, we identify 6.0% of the Medicare FFS population, among whom 31.6% are hospitalized and 11.3% die within six months. Such additional restrictions, however, may result in the unintended exclusion of seriously ill individuals with substantial supportive or palliative care needs.

Many opportunities currently exist to apply this approach toward improving the care of the seriously ill.[25] First, health care policy may be designed to ensure access to and incentivize high-quality palliative care programs for this population. At the federal level, the Center for Medicare and Medicaid Innovation is currently considering a demonstration project in response to advanced alternative payment models for

the provision of palliative care.[26,27] At the state level, in 2014, California passed legislation (an act to add Section 14132.75 to the Welfare and Institutions Code, relating to health care) that requires provision of palliative care services to those with advanced illness.[28] Current definitions of advanced illnesses, however, include condition characteristics that are difficult for many health systems to extract from their electronic medical records. A standardized list of SMCs with utilization indicators may increase feasibility of identifying populations eligible for palliative care. Next, entities seeking to improve the value of care for a population, such as accountable care organizations or Medicare Advantage programs, could deploy outreach or screening efforts to assess and address the needs of seriously ill beneficiaries.[29–31] This approach could also be used as a basis for quality measurement and accountability for those providing care to seriously ill people.[32]

Identifying the population with serious illness is a critical step toward achieving high-value health care in the U.S. Doing so within the constraints of currently available health care data requires the use of ICD-10 diagnostic codes to identify SMCs. The present work establishes a foundation for population health programs and palliative care providers that aim to improve care for adults with serious illness.

Disclosures and Acknowledgments

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jpainsymman.2019.03.006.

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