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Disability Stage and Receipt of Recommended Care among Elderly Medicare Beneficiaries

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Abstract

Background—Receipt of recommended care among older adults is generally low. Findings regarding service use among persons with disabilities supports the notion of disparities but provides inconsistent evidence of underuse of recommended care.

Objective—To examine the extent to which receipt of recommended care among older Medicare beneficiaries varies by disability status, using a newly developed staging method to classify individuals according to disability.

Methods—In a cohort study, we included community-dwelling Medicare beneficiaries aged 65 and older who participated in the Medicare Current Beneficiary Survey between 2001 and 2008. Logistic regression modeling assessed the association of receiving recommended care on 38 indicators across different activity limitation stages.

Results—Nearly one out of every three elderly Medicare beneficiaries did not receive overall recommended care. Adjusted odds ratios (ORs) revealed a decrease in use of recommended care with increasing activity limitation stage. For instance, ORs (95% CIs) across mild, moderate, severe and complete limitation stages (stages I–IV) compared to no limitation (stage 0) in ADL

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were 0.99 (0.94–1.05), 0.89 (0.83–0.95), 0.81 (0.75–0.89) and 0.56 (0.46–0.68). Disparities in receipt of recommended care by disability stage were most marked for care related to post-hospitalization follow-up and, to a lesser degree, care of chronic conditions and preventive care.

Conclusions—Elderly beneficiaries at higher activity limitation stages experienced substantial disparities in receipt of recommended care. Tailored interventions may be needed to reduce disparities in receipt of recommended medical care in this population.

Keywords

disability; activity limitation stages; Medicare; receipt of recommended care; health care quality

Introduction

Persons with disabilities are increasingly recognized as vulnerable to disparities in health and health care. Findings from the Healthy People 2020 initiative indicate that persons with physical or cognitive disabilities experience difficulties or delays in getting needed health care.¹ In its most recent Health Disparities and Inequalities report, the Centers for Disease Control and Prevention (CDC) identified disability as an “at risk” demographic characteristic that should be described in ongoing population surveillance for health disparities.² In 2011, the Agency for Healthcare Research and Quality (AHRQ) designated people with disabilities as a priority population, calling for “major efforts to understand and close the quality gap.”³

Despite the increasing recognition that persons with disabilities are vulnerable to health care disparities, the literature on patterns of service use among persons with disabilities has provided inconsistent evidence of underuse. Earlier studies suggested that disability, defined in a number of ways, was a risk factor for underuse of certain preventive care services, such as mammography,⁴ pap tests,⁴ and fecal occult blood tests,⁵ but not for pneumococcal vaccination.⁴ The trajectory of disability was also found to influence receipt of recommended care, and the pattern varied across specific quality indicators.⁶ Persons becoming more highly disabled, for example, were more likely to attend an annual doctor’s visit and receive recommended care for angina, but less likely to receive recommended care for diabetes, breast cancer, and eye health. While these results may reflect true variation in provision of care by disability, we speculate that the lack of systematic patterns reported in previous studies may be an artifact of the methods used to classify disability, which in these studies relied solely on counts of activity limitations.⁶

In this study, we sought to apply a recently developed and validated International Classification of Functioning, Disability and Health (ICF)-based approach that characterizes activity limitation stages of basic and instrumental activities of daily living (ADLs and IADLs). The approach to disability measurement was used to examine the provision of recommended care to elderly Medicare beneficiaries at various activity limitation stages.⁷ Stages of ADLs and IADLs were derived to describe specific patterns of ADL and IADL limitations, recognizing that even for people with the same number of limitations, an understanding of the qualitative differences associated with each pattern might improve the tailoring of care. In these staging systems, individuals are classified hierarchically from

stage 0 to stage IV, with higher stages generally indicating more severe functional loss. Stage III was designed as a non-fitting stage to accommodate atypical patterns of activity limitations.

Receipt of recommended care was based on the underuse monitoring system approach established by Asch and colleagues⁸ among elderly Medicare beneficiaries, and modified by Chan et al⁶ for those with disabilities--a clinically valid, comprehensive, and well-tested approach. We focused on indicators of recommended care that span several processes of care, including prevention, initial evaluation, diagnostic tests, therapeutic interventions, follow-up, and monitoring for acute, chronic, medical, and surgical conditions.

Documenting variations in (under)use of these medical services as a function of activity limitation stage is paramount to properly addressing health needs, to reducing disparities, as well as preventing excess morbidity and premature death among persons with disabilities.

Conceptual Framework

A number of factors might place persons with disabilities at higher risk of reduced access to recommended health care services. Compared to those without disabilities, disabled elderly persons are more likely to be ethnic minorities,⁹ have lower incomes, and poorer overall health.¹⁰ While having greater healthcare needs, persons with disabilities also face greater environmental and physical barriers to care (e.g., difficulty organizing or travelling to healthcare) than those without any such limitations.^{11,12} Finally, older adults with functional limitations are more likely than those without such limitations to report dissatisfaction with care coordination and with access to medical care.¹³ Based on these findings, our underlying conceptual framework postulates that, as the burden of disability increases, a person's ability to access timely and coordinated health care decreases, resulting in reduced receipt of recommended care among persons with disabilities. Specifically, we hypothesize that persons with disability will be less likely to receive recommended care across all domains (acute, chronic, preventive, and diagnostic-related care). We further hypothesize that a higher activity limitation stage is associated with lower likelihood of receipt of recommended care (with the possible exception of non-fitting stage III).

Methods

Data Sources and Study Population

We used data from the Medicare Current Beneficiary Survey (MCBS), a nationally representative, rotating longitudinal panel survey of Medicare beneficiaries.¹⁴ Survey participants are interviewed three times per year for four consecutive years, and provide self- or proxy- reported information on sociodemographic characteristics, health and functioning, access to care, and satisfaction with care. The survey sample is replenished annually with newly eligible beneficiaries. Survey data are linked to beneficiaries' Medicare claims data, from which information on health services utilization is readily available. For each survey respondent, inpatient, outpatient, and non-institutional claims data are available for three consecutive years, starting on the first calendar day of the year following the initial survey wave.

Our sample was comprised of elderly (65+ years old) community-dwelling beneficiaries who participated in the MCBS from 2001 to 2008. Individuals were excluded from the assessment of a given indicator if they did not have enough follow-up time for that indicator, died during the follow-up period, were not enrolled in Medicare Parts A or B, or were enrolled in an HMO during the follow-up period.

Activity Limitation Stages

Using a validated algorithm,⁷ we classified all beneficiaries hierarchically, based on the nature and severity of their disability, into one of five possible activity limitation stages: stage 0 (no limitation), stage I (mild limitation), stage II (moderate limitation), stage III (severe limitation), and stage IV (complete limitation). ADL and IADL stages were determined by respondents' self- or proxy-reported ability to perform without difficulty each of the six ADL activities (eating, toileting, dressing, bathing/showering, getting in and out of bed/chairs, and walking) and IADL activities (using the telephone, managing money, preparing meals, doing light housework, shopping, and doing heavy house work). Detailed methods and validation of stages are documented elsewhere.^{7,15} (A brief description of the classification of stages is presented in appendix A.)

Receipt of Recommended Care

We built on the work of Asch and colleagues⁸ for identifying recommended care. Asch's list, later modified by Chan⁶ for Medicare beneficiaries with disabilities (1992–2001), was developed using a series of rigorous expert panel methods that relied on clinical trials and observational studies to ensure that the proposed measures were both evidence-based and clinically valid.

Assessment of receipt of recommended care was performed using inpatient and outpatient data from Medicare Parts A, B, and Carrier claims. In contrast to the original metrics developed by Ash et al. and Chan et al., we excluded the small number of cases in which recommended care was received during an Emergency Department (ED) visit since ED visits suggest a higher level of acuity and are not designed to provide routine, preventive or follow-up, medical services. Furthermore, recommended care received during an ED visit may be unrelated and incidental to the presenting reason for the ED visit. For indicators with a relatively short observation period (four weeks or less), we further excluded persons who experienced a hospitalization or ED visit during this short observation period for the same reason.

The resulting set of 38 indicators captures dimensions of recommended care in the areas of initial evaluation, diagnostic tests, therapeutic interventions, hospitalization follow-up, and routine care. While three of these metrics apply to the general population-- annual visit, biennial visual impairment assessment, and biennial mammography (for women aged between 65 and 75 years), the remaining indicators reflect necessary care associated with specific acute and chronic conditions including myocardial infarction, anemia, angina, breast cancer, cerebrovascular accidents (CVA), transient ischemic attack (TIA), cholelithiasis, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), depression, diabetes, gastrointestinal bleeding, or hypertension. Respondents with multiple chronic

conditions (e.g., hypertension and diabetes; CHF and COPD) were, therefore, eligible for multiple indicators.

We characterized receipt of recommended care in three complementary ways: overall receipt of recommended care, receipt of recommended care by type of care, and receipt of recommended care by number of eligible indicators. *Overall receipt of recommended care* is represented by the total number of indicators where recommended care was actually received, divided by total number of indicators for which respondents were eligible. For instance, assuming X individuals were eligible for Y indicators ($Y \geq X$), based on their underlying morbidities, and received care on Z indicators ($Z \leq Y$), then overall receipt of recommended care can be represented as (Z/Y) .

In order to capture the nature of recommended care and to offset the sample size deficiency of certain individual indicators, in our second measure, we aggregated these 38 indicators into four groups to represent different *types of recommended care*: post-hospitalization follow-up, care for chronic conditions, preventive care, and diagnosis-related care. (The complete list of indicators for each type of care is shown in Appendix B). Post-hospitalization follow-up usually had a short follow-up period (2–4 weeks) among individuals hospitalized for conditions such as acute myocardial infarction, unstable angina, CVA, TIA, CHF, and depression. Care for chronic conditions referred to routine check-up every 6 or 12 months for diagnosed conditions such as diabetes, myocardial infarction (MI), TIA, CVA, CHF, COPD, and breast cancer. Preventive care included annual doctor visits, biennial visual impairment assessments, and biennial mammography among women aged 65–75 years. Finally, diagnosis-related care included care after initial diagnosis and diagnostic tests before or after confirmed diagnosis, usually with an observation interval falling within 6 months.

Our third measure, *receipt of recommended care by number of eligible indicators*, captures more directly the combined effect of multiple morbidities and disability stage on receipt of recommended care. Specifically, this measure was calculated by stratifying the sample into groups defined by the number of eligible indicators and disability stage, and dividing the number of respondents receiving recommended care in each strata by the total number of persons in that strata.

Given the longitudinal nature of our data, beneficiaries might have been assessed for care for one condition (e.g., diabetes) at one wave of the survey and for a different condition (e.g., hypertension) at another wave. To account for the possibility that activity limitation stage might have changed over time, we used the activity limitation stage calculated on the survey date immediately preceding each indicator follow-up period to assess the association between activity limitation stage and receipt of recommended care.

Statistical Analysis

The association of disability stage with overall receipt of care and receipt of specific types of care was expressed in percentages and adjusted odds ratios, with 95% confidence intervals, derived from logistic regression models. In order to account for MCBS' complex design, whereby the survey was administered to random samples of subgroups of the population

resulting in respondents having unequal probabilities of being included in the survey, we applied MCBS' sampling weights in our calculation of the all percentage outcomes so that our results may be interpreted as generalizable to the entire United States.

In addition to sampling weights, survey logistic regression models were adjusted for activity limitation stage, age, gender, race/ethnicity, education, residence in a metropolitan area, living arrangement, dual enrollment in Medicare and Medicaid, number of comorbidities, and year of survey entry). Finally, given that respondents with multiple comorbidities contributed information more than once, our logistic models further adjusted for repeated observations within persons.

In all analyses, ADL and IADL activity limitation stages were examined separately. This approach enabled us to account for the conceptual basis underlying the ICF-based model of stage development, which clearly identified them as separate constructs, and to overcome the relatively high collinearity across the two functional concepts. Data were analyzed in SAS 9.4 (SAS Institute, Cary, NC).

Results

Sample Characteristics

A total of 25,382 Medicare beneficiaries participated in the 2001–2008 MCBS. Table 1 shows the summary characteristics of the sample by ADL and IADL stages.

In the weighted sample of elderly Medicare beneficiaries, 73% had no ADL limitation (stage 0), 15% had mild ADL limitation (stage I), 7% had moderate limitation (stage II), and 1% had the highest level of ADL limitation (stage IV), with the remaining 5% classified as stage III, the non-fitting ADL stage. Prevalence of IADL limitation stages 0 through IV were 67%, 16%, 7%, 9%, and 2%, respectively. The majority of beneficiaries were aged between 65 and 74 (57%), women (56%), non-Hispanic white (82%), living with a spouse (54%), living in metropolitan areas (76%), and graduated from high school (73%). Overall, 11% were dually enrolled in both Medicare and Medicaid.

Summary statistics in Table 1 by ADL stage reveal marked differences across groups by age, gender, race/ethnicity, living arrangement, education, dual enrollment, and number of comorbidities. Most notably, compared to elderly beneficiaries who did not have an activity limitation (stage 0), those at higher stages (most notably stages II–IV) tended to be older, more likely to be female, and of non-Hispanic African American/Black or of Hispanic descent, less likely to live alone or with a spouse only, more likely to be dually enrolled in Medicaid, and to have a greater number of comorbid conditions (all p-values < .05). These patterns also held for staging based on IADL limitations.

Receipt of Recommended Care by Activity Limitation Stage

A total of 16,693 out of 25,382 beneficiaries (66%) were eligible for at least one indicator. Because each Medicare beneficiary could be eligible for multiple quality indicators, these 16,693 beneficiaries triggered 75,061 indicators, and received recommended care on 55,455 (74% of) indicators.

Table 2 reports receipt of recommended care across all indicators, stratified by ADL and IADL stage. Raw weighted percentages as well as unadjusted and adjusted odds ratios are provided. The weighted percentages show a trend of gradual decline in receipt of recommended care with increasing ADL and IADL stages. For ADL stages, for example, the weighted percentage of beneficiaries receiving recommended care declined from a highest of 74.1% among those with no activity limitation to 62.3% among those at ADL stage IV. For IADL stages, receipt of recommended care declined from 71.0–76.1% for stages 0 – III to 64.3% for those most disabled (stage IV).

Adjusted odds ratios revealed a more marked decline with activity limitation, with beneficiaries at a higher stage being less likely to have received recommended care. For ADL stages, the odds ratio (95% CI) for receiving recommended care was 0.93 (0.88–0.98) for stage I, 0.82 (0.76–0.88) for stage II, 0.75 (0.69–0.82) for stage III, and 0.49 (0.40–0.59) for stage IV, each compared to stage 0. Similarly for IADL stages, adjusted odds ratios suggested a pattern of declining odds of receiving recommended care at higher stages of disability (0.86 (0.80–0.93), 0.79 (0.73–0.84) and 0.54 (0.48–0.62) for stages II, III and IV, respectively). Unique to the IADL domain, there were no marked differences in the odds of receiving recommended care among persons with mild (stage I) or no (stage 0) activity limitations.

Receipt of Recommended Care by Type of Care

Table 3 reports the weighted percentage of beneficiaries receiving recommended care, by type of care. Adjusted odds ratios represent the likelihood of receiving recommended care at stages I through IV compared to stage 0. Statistically significant, disability-related disparities in the receipt of recommended care were evident in three of the four sets of indicators capturing different types of recommended care. Specifically, the results indicate substantially lower receipt of recommended post-hospitalization follow-up care, care for chronic illnesses, and preventive care among beneficiaries at higher activity limitation stages. Underuse was especially marked among those at stage IV. Among persons at ADL stage IV who were eligible for such care, 43% received the recommended follow-up care after hospitalization compared to 76% among those with no ADL limitations. Receipt of recommended care for chronic conditions was 64% and of preventive care was 66%, respectively, among persons at the highest ADL activity limitation stage, compared to 77% and 76% for individuals with no ADL limitations. Relative to those with no limitations, individuals with complete limitation (stage IV) were significantly less likely to receive post-discharge follow-up care, care for chronic conditions, and preventive services (adjusted odds ratios and 95% CIs= 0.23 (0.12–0.43), 0.46 (0.36–0.60), and 0.43 (0.33–0.56), respectively). The pattern of reduced use of recommended care among persons at the highest activity limitation stages held for IADL limitations, with 55% of those at stage IV receiving follow-up care after hospitalization, 65% receiving recommended care for chronic conditions, and 68% receiving appropriate preventive care. In contrast, over three-quarters of persons with no IADL limitations received such services, for each type of care. Results from multivariable models were consistent with unadjusted estimates and indicated that individuals at stage IV were significantly less likely to receive recommended follow-up care post-hospitalization, care for chronic conditions and preventive care relative to persons at

stage 0, even after adjustments for covariates, with adjusted odds ratios and 95% CIs of 0.41 (0.26–0.64), 0.52 (0.44–0.61), and 0.46 (0.39–0.55) for each type of care, respectively.

Although there was no evidence of disparities by activity limitation stage in the likelihood of receiving recommended diagnosis-related care, overall receipt of this type of care was generally low across all activity limitation stages (around 50–60%).

Receipt of Recommended Care by Number of Indicators

Figures 1 and 2 depict the average, weighted percentage of respondents receiving recommended care, by number of eligible indicators and activity limitation stage. The pattern of relative underuse of recommended care among elderly beneficiaries with the most severe activity limitation (stage IV) held regardless of the number of indicators for which each beneficiary was eligible during a given year. As shown in Figure 1, among beneficiaries eligible for one indicator, 76% of those with no ADL limitation received recommended care, compared with 56% of those at stage IV who were eligible for a single indicator. Among beneficiaries whose multiple comorbidities made them eligible for five indicators, for example, receipt of recommended care was 74% for those with no ADL limitation compared to 65% among those with complete limitation.

The same held true for the IADL domain, shown in Figure 2, where among beneficiaries eligible for one indicator, 76% and 58% received recommended care if they had no (stage 0) versus complete (stage IV) IADL limitation. Similar figures for those eligible for five indicators were 74% and 64%, in the presence of no versus complete IADL limitation.

Discussion

A number of clinical prevention and surveillance recommendations have been developed to enhance the quality of care provided to Medicare beneficiaries. Evidence-based recommendations are believed to improve health outcomes related to targeted medical services, even more so when they are tailored for specific populations. In this study, we examined variation in receipt of recommended care, and disability disparities therein, for a large, longitudinal, nationally representative sample of older Medicare beneficiaries. Adopting and adapting a wide-scope, expert-endorsed set of recommendations developed by Asch et al. and Chan et al., we focused on 38 indicators associated with 14 high-prevalence medical conditions.

Our results suggest that, regardless of disability, slightly over one-quarter of all beneficiaries did not receive recommended care for the indicators considered. Receipt of recommended care tended to decline with increasing activity limitation stages (stage II and higher), and was substantially lower among beneficiaries at the highest activity limitation stage (stage IV). Interestingly, beneficiaries with no activity limitation (stage 0) were no more likely to receive recommended care than those with mild limitations (stage I) for chronic conditions and prevention.

Evidence that persons at higher activity limitation stages are less likely to receive recommended care for their chronic conditions highlights an important missed opportunity

for clinical management of conditions that often lead to increased health service utilization among a group of elderly persons with already complex and challenging healthcare needs. Perhaps most strikingly, persons at higher activity limitation stages were substantially less likely to receive recommended post-hospitalization follow-up care. Evidence suggests that hospitalizations are often associated with deterioration of physical functioning and result in increased ADL disability.^{16–19} Receipt of appropriate post-acute care by persons with disability is, therefore, critical to ensure that health is restored, and to forestall further deterioration of physical functioning, as well as to reduce the risk of hospital readmission or increased utilization of other healthcare services.

Our results suggesting disparities by activity limitation stages are consistent with self-reported satisfaction with care among Medicare beneficiaries. According to Bogner et. al., elderly Medicare beneficiaries were more likely to report dissatisfaction with the overall quality of care as their activity limitation stage advanced.¹³ Jha et al. found a similar pattern of increased dissatisfaction as the number of ADL dependencies increased.²⁰ Higher dissatisfaction among people with greater disabilities, therefore, may in part reflect actual disparities in the receipt of recommended care.

Concerns about disparities in access and quality of care among persons with disabilities are not new. Based on information compiled for Healthy People 2020, persons with complex disabilities are 3 to 4-fold more likely to face barriers that prevent or delay their use of needed medical care.¹ Several factors may explain the observed underuse of recommended care among more severely disabled elderly persons. Individuals with disabilities report greater access barriers to care.²¹ It is plausible, for example, that beneficiaries at higher stages encounter more barriers to transportation making it difficult for them to keep appointments.¹² Lack of social support and experiences of distress have also been shown to influence service use and may be a possible underlying cause for the observed disparities.¹ Finally, older adults with disabilities may experience lower self-efficacy as a result of the lack of a support system. Interventions to increase use of technology, promote transportation coordination, and enhance patient self-efficacy may ameliorate disparities in receipt of recommended care.²²

Our findings bear important implications for policy and practice. Activity limitation stages were developed as a data aggregation technique to identify disabled subpopulations who may face disparities in health and health care. In addition, stages are useful in distinguishing patients in need of accommodations to best meet their health care needs. Combining severity and nature of disability, activity limitation stages are potentially more informative in policy planning and clinical settings than simple counts or binary indicators of disability. However, information necessary to calculate such limitation stages is often unavailable in administrative data. Although Medicare and Medicaid claims data provide detailed information regarding beneficiaries' use of health care services, they do not contain information on beneficiaries' functioning.²³ It is critical, therefore, that health surveillance systems and population-based surveys routinely collect such data to aid clinicians, scientists, and administrators to fully understand and monitor health care disparities based on physical and cognitive functioning.

Our study differs from previous investigations in a number of ways. Rather than relying on counts of ADLs and IADLs, we used a recently developed and validated activity limitation staging system that is based on clinical thresholds and accounts for both severity and type of disability to classify elderly Medicare beneficiaries according to disability stage.⁷ Our sample is comprised of several recent cohorts of MCBS respondents linked to Medicare claims, from which we documented medical conditions and utilization of health services. Accuracy of assessment of receipt of recommended care was enhanced by utilizing standard codes and dates of diagnoses and procedures from inpatient and outpatient claims data. Another important approach was to select activity limitation stages most proximate to the (use of recommended care) assessment period. Evidence suggests that disability,²⁴ and more generally functional status,¹⁹ are fluid, particularly among elderly persons who often transition between stages within a short period of time. Given that different individuals had different follow-up periods for different indicators, our approach of ascertaining ADL and IADL stages immediately preceding the individuals' assessment period enabled us to more precisely capture the relevant stage for each individual and indicator.

Several limitations merit comment. We used a set of recommended care indicators first published in 2000. It is possible that additional indicators might have been implemented in recent years; however, no comprehensive updates have been published since. Certain conditions, such as dementia for example, are not covered in the indicator system. Furthermore, individual indicators are narrowly confined to recommendations regarding a single condition, and do not offer specific guidance or evidence as to how to approach care for patients with multiple co-existing chronic conditions.^{25,26} In order to increase sample size, and allow for the appropriate follow-up time for certain indicators, we relied on pooled MCBS data dating back to 2001 to 2008, with follow-up to 2010. Although there is no reason to suspect that use of earlier data might have changed the observed relationships, future studies may explore the topic with more recent data and with consideration of potentially updated and expanded care guidelines.

Our study evaluated care in the fee-for-service environment, since we excluded HMO-enrolled beneficiaries because HMO plans are not required to submit service claims to Medicare. Chan and colleagues⁴ indicated that Medicare HMO beneficiaries were more likely to receive preventive care, such as Pap tests, mammograms, and influenza vaccination, than those in fee-for-service plans. Although the absence of data on full-year HMO enrollees may have contributed to our findings of low receipt of recommended care overall, it is unclear whether their inclusion would have changed the relative standing of persons by disability stage. Stages were assessed by self- or proxy-reported responses, which may be to some extent subject to bias. In addition, around 18% of Medicare beneficiaries contacted for inclusion in the MCBS do not consent for their initial interview.²⁷ Such non-response reduces generalizability and may potentially bias our findings. Studies of the MCBS data indicate that bias caused by differences between non-responders and responders is generally small and effectively reduced by the non-response procedures employed by the survey.²⁷ By using post-stratification weights, we further minimized any potential effects of differential non-response. Finally, we did not examine temporal trends in the provision of recommended care. A study of state-level quality of care indicators for six conditions (acute myocardial infarction, heart failure, stroke, pneumonia, breast cancer, and diabetes) revealed that 20 out

of 22 indicators had substantial improvement between 1998 and 2001.²⁸ To the extent that receipt of recommended care continued to change during the study period, our results reflect the average, rather than the marginal, rate of recommended care received by beneficiaries at different activity limitation stages.

Conclusion

Our study has identified overall underuse of recommended care across activity limitation stages as well as indicator-specific underuse of care among fee-for-service elderly Medicare beneficiaries. Higher stages, especially stage IV, are at increased risk of underuse of recommended care. Differential receipt of recommended care is suggestive of but distinct from low quality medical care. Greater adherence to recommended care among people with more severe disabilities might be achieved if medical care services were made more accessible. Any successful program targeted to increasing overall use of recommended care and reducing disparities related to activity limitation stage could yield substantial cost savings to public insurance programs. Most importantly, improvements in receipt of recommended care, especially among persons with disabilities, might yield reductions in subsequent hospitalizations and enhance quality of life. Our findings provide a point of departure from which to document variations in access and quality of care and their clinical and economic consequences. In the longer-term, we are hopeful that our results will provide the basis for the development of public policies and programs designed to improve the access and quality of care delivered to persons with disabilities.

References

1. HealthyPeople.gov 2020. [Accessed December 15, 2015] Topics and objectives: Disability and health. at <http://www.healthypeople.gov/2020/topics-objectives/topic/disability-and-health#two>
2. [Accessed December 16, 2015] Morbidity and mortality weekly report. Jan 14. 2011 at <http://Www.cdc.gov/mmwr/pdf/other/su6001.pdf>
3. [Accessed December 16, 2015] Closing the quality gap series: Measuring outcomes of care for persons with disabilities. 2011. at <http://Www.effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=739>
4. Chan L, Doctor JN, MacLehose RF, et al. Do Medicare patients with disabilities receive preventive services? A population-based study. *Arch Phys Med Rehabil*. 1999; 80(6):642–646. [PubMed: 10378489]
5. James TM, Greiner KA, Ellerbeck EF, Feng C, Ahluwalia JS. Disparities in colorectal cancer screening: A guideline-based analysis of adherence. *Ethn Dis*. 2006; 16(1):228–233. [PubMed: 16599375]
6. Chan L, Ciol MA, Shumway-Cook A, et al. A longitudinal evaluation of persons with disabilities: Does a longitudinal definition help define who receives necessary care? *Arch Phys Med Rehabil*. 2008; 89(6):1023–1030. [PubMed: 18503795]
7. Stineman MG, Streim JE, Pan Q, Kurichi JE, Schussler-Fiorenza Rose SM, Xie D. Activity limitation stages empirically derived for activities of daily living (ADL) and instrumental ADL in the U.S. adult community-dwelling medicare population. *PM R*. 2014; 6(11):976–987. [PubMed: 24798263]
8. Asch SM, Sloss EM, Hogan C, Brook RH, Kravitz RL. Measuring underuse of necessary care among elderly medicare beneficiaries using inpatient and outpatient claims. *JAMA*. 2000; 284(18): 2325–2333. [PubMed: 11066182]

9. Centers for Disease Control and Prevention (CDC). Racial/ethnic disparities in self-rated health status among adults with and without disabilities--United States, 2004--2006. *MMWR Morb Mortal Wkly Rep*. 2008; 57(39):1069--1073. [PubMed: 18830209]
10. Census Bureau. Facts for features: 20th anniversary of Americans with Disabilities Act. Washington (DC): Census Bureau; at http://www.census.gov/newsroom/releases/archives/facts_for_features_special_editions/cb10-ff13.html [Accessed at December 16, 2015]
11. Gulley SP, Rasch EK, Chan L. The complex web of health: Relationships among chronic conditions, disability, and health services. *Public Health Rep*. 2011; 126(4):495--507. [PubMed: 21800744]
12. Fried LP, Ferrucci L, Darer J, Williamson JD, Anderson G. Untangling the concepts of disability, frailty, and comorbidity: Implications for improved targeting and care. *J Gerontol A Biol Sci Med Sci*. 2004; 59(3):255--263. [PubMed: 15031310]
13. Bogner HR, de Vries McClintock HF, Hennessy S, et al. Patient satisfaction and perceived quality of care among older adults according to activity limitation stages. *Arch Phys Med Rehabil*. 2015; 96(10):1810--1819. [PubMed: 26119464]
14. Centers for Medicare and Medicaid Services. [Accessed October 10, 2015] Medicare Current Beneficiary Survey (MCBS). at <http://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS/index.html?redirect=MCBS>
15. Kurichi JE, Streim JE, Bogner HR, Xie D, Kwong PL, Hennessy S. Comparison of predictive value of activity limitation staging systems based on dichotomous versus trichotomous responses in the Medicare Current Beneficiary Survey. *Disabil Health J*. 2016; 9(1):64--73. [PubMed: 26590119]
16. Gill TM, Allore HG, Gahbauer EA, Murphy TE. Change in disability after hospitalization or restricted activity in older persons. *JAMA*. 2010; 304(17):1919--1928. [PubMed: 21045098]
17. Mudge AM, O'Rourke P, Denaro CP. Timing and risk factors for functional changes associated with medical hospitalization in older patients. *J Gerontol A Biol Sci Med Sci*. 2010; 65(8):866--872. [PubMed: 20494952]
18. Boyd CM, Landefeld CS, Counsell SR, et al. Recovery of activities of daily living in older adults after hospitalization for acute medical illness. *J Am Geriatr Soc*. 2008; 56(12):2171--2179. [PubMed: 19093915]
19. Wolinsky FD, Bentler SE, Hockenberry J, et al. Long-term declines in ADLs, IADLs, and mobility among older Medicare beneficiaries. *BMC Geriatr*. 2011; 11 43-2318-11-43.
20. Jha A, Patrick DL, MacLehose RF, Doctor JN, Chan L. Dissatisfaction with medical services among Medicare beneficiaries with disabilities. *Arch Phys Med Rehabil*. 2002; 83(10):1335--1341. [PubMed: 12370864]
21. Centers for Disease Control and Prevention. Environmental barriers to health care among persons with disabilities--Los Angeles County, California, 2002--2003. *MMWR Morb Mortal Wkly Rep*. 2006; 55(48):1300--1303. [PubMed: 17159832]
22. Iezzoni, LOB. More than ramps. Oxford, UK: Oxford University Press; 2006.
23. Iezzoni LI. Eliminating health and health care disparities among the growing population of people with disabilities. *Health Aff*. 2011; 30(10):1947--1954.
24. Stineman MG, Zhang G, Kurichi JE, et al. Prognosis for functional deterioration and functional improvement in late life among community-dwelling persons. *PM R*. 2013; 5(5):360--371. [PubMed: 23454447]
25. Boyd CM, Darer J, Boulton C, Fried LP, Boulton L, Wu AW. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: Implications for pay for performance. *JAMA*. 2005; 294(6):716--724. [PubMed: 16091574]
26. Boyd CM, Kent DM. Evidence-based medicine and the hard problem of multimorbidity. *J Gen Intern Med*. 2014; 29(4):552--553. [PubMed: 24442331]
27. Kautter J, Khatutsky G, Pope GC, Chromy JR, Adler GS. Impact of nonresponse on Medicare current beneficiary survey estimates. *Health Care Financ Rev*. 2006; 27(4):71--93. [PubMed: 17290659]
28. Jencks SF, Huff ED, Cuddeback T. Change in the quality of care delivered to Medicare beneficiaries, 1998--1999 to 2000--2001. *JAMA*. 2003; 289(3):305--312. [PubMed: 12525231]

Figure 1.
Receipt of recommended care among elderly Medicare beneficiaries by number of eligible indicators and ADL stage

Figure 2.
Receipt of Recommended Care among Elderly Medicare beneficiaries by number of eligible indicators and IADL stage

Table 1

Sample Characteristics by Activity Limitation Stages

Characteristics N = 25,382		Activity of Daily Living (ADL) Stages				Instrumental Activity of Daily Living (IADL) Stages				Total	
		0	I	II	III	IV	0	I	II	III	IV
Overall		72.7 ±0.4	14.8 ±0.3	6.7 ±0.2	4.8 ±0.2	0.9 ±0.1	66.2 ±0.4	16.1 ±0.3	7.1 ±0.2	8.8 ±0.2	1.7 ±0.1
Age	65–74	62.1 ±0.4	45.4 ±0.9	38.1 ±1.2	39.0 ±1.5	33.0 ±3.4	63.2 ±0.4	49.7 ±0.8	45.2 ±1.2	34.6 ±1.1	26.8 ±2.1
	75–84	31.4 ±0.4	39.7 ±0.8	40.4 ±1.1	38.3 ±1.3	37.3 ±3.1	30.9 ±0.4	37.9 ±0.8	39.6 ±1.1	40.7 ±1.0	35.4 ±2.1
	85 or older	6.5 ±0.2	14.9 ±0.5	21.6 ±0.9	22.7 ±1.1	29.7 ±2.7	5.8 ±0.2	12.3 ±0.4	15.2 ±0.7	24.7 ±0.8	37.7 ±2.0
Sex		46.3 ±0.4	38.8 ±0.8	34.3 ±1.1	34.3 ±1.3	32.4 ±3.1	49.4 ±0.4	25.0 ±0.7	29.2 ±1.1	48.2 ±1.0	37.4 ±2.2
Race	Male	53.7 ±0.4	61.2 ±0.8	65.7 ±1.1	65.7 ±1.3	67.6 ±3.1	50.6 ±0.4	75.0 ±0.7	70.8 ±1.1	51.8 ±1.0	62.6 ±2.2
	Female	82.7 ±0.3	80.9 ±0.7	76.9 ±1.0	74.8 ±1.2	61.3 ±3.3	82.8 ±0.3	83.0 ±0.6	75.0 ±1.1	76.9 ±0.9	65.5 ±2.1
	Non-Hispanic White	7.3 ±0.2	8.1 ±0.5	11.5 ±0.8	11.8 ±0.9	13.6 ±2.1	7.5 ±0.2	7.2 ±0.4	11.6 ±0.8	8.6 ±0.6	15.8 ±1.6
Living arrangement	Non-Hispanic Black	6.9 ±0.2	7.9 ±0.5	8.0 ±0.6	9.5 ±0.9	19.8 ±2.9	6.8 ±0.2	6.7 ±0.4	8.9 ±0.7	10.0 ±0.7	14.6 ±1.5
	Hispanic	3.1 ±0.2	3.1 ±0.3	3.7 ±0.5	3.9 ±0.6	5.3 ±1.5	2.9 ±0.2	3.1 ±0.3	4.5 ±0.6	4.5 ±0.4	4.1 ±0.9
	Other	5.1 ±0.2	9.0 ±0.4	10.3 ±0.7	8.3 ±0.7	6.5 ±1.9	4.9 ±0.2	8.4 ±0.4	9.5 ±0.7	9.5 ±0.6	5.8 ±1.0
Dual enrollment in Medicare and Medicaid	Retirement community	57.3 ±0.4	46.6 ±0.9	39.1 ±1.2	38.5 ±1.4	43.7 ±3.3	58.5 ±0.4	45.0 ±0.8	41.0 ±1.2	44.7 ±1.0	36.8 ±2.2
	With spouse	7.2 ±0.2	11.7 ±0.5	15.9 ±0.9	18.9 ±1.1	27.0 ±2.7	6.5 ±0.2	11.7 ±0.5	13.7 ±0.8	16.8 ±0.7	32.3 ±2.0
	With children	4.3 ±0.2	5.1 ±0.4	7.4 ±0.7	7.1 ±0.8	8.9 ±2.1	4.3 ±0.2	4.8 ±0.3	6.9 ±0.7	5.6 ±0.5	11.0 ±1.4
Education high school diploma or above	With others	26.1 ±0.4	27.6 ±0.7	27.3 ±1.0	27.2 ±1.2	13.9 ±2.3	25.8 ±0.4	30.1 ±0.7	28.9 ±1.1	23.5 ±0.9	14.2 ±1.5
	Alone	8.1 ±0.2	15.3 ±0.6	24.5 ±1.0	23.9 ±1.2	38.8 ±3.2	7.0 ±0.2	14.5 ±0.6	25.7 ±1.1	21.0 ±0.8	35.5 ±2.1
		77.2 ±0.3	67.4 ±0.8	60.3 ±1.2	58.1 ±1.4	51.7 ±3.3	78.4 ±0.3	70.2 ±0.7	60.6 ±1.2	57.1 ±1.0	48.4 ±2.2
Living in metropolitan areas		75.8 ±0.2	76.5 ±0.7	74.5 ±1.0	75.0 ±1.2	80.5 ±2.5	76.3 ±0.3	75.8 ±0.6	74.2 ±1.0	74.2 ±0.9	74.3 ±1.9
Mean number of comorbidities **		2.0 ±0.02	3.1 ±0.03	3.4 ±0.04	3.5 ±0.05	3.8 ±0.12	1.9 ±0.02	2.9 ±0.04	3.4 ±0.05	3.1 ±0.03	3.7 ±0.07
Mean number of comorbidities **		2.0 ±0.02	3.1 ±0.03	3.4 ±0.04	3.5 ±0.05	3.8 ±0.12	1.9 ±0.02	2.9 ±0.04	3.4 ±0.05	3.1 ±0.03	3.7 ±0.07

Note.

* Cell entries represent weighted column percent ± standard error.

** Comorbidities include hypertension, angina/chronic heart disease, other heart disease, stroke, diabetes mellitus, mental retardation, Alzheimer's/dementia, mental/psychiatric disorder, Parkinson's disease, emphysema/asthma/chronic obstructive pulmonary disease, rheumatoid arthritis, non-rheumatoid arthritis, osteoporosis/soft bones, and cancer (other than skin cancer).

Table 2

Receipt of Recommended Care by Activity Limitation Stages at the Aggregated Metric Level

	Activity of Daily Living (ADL) Stage						Instrumental Activity of Daily Living (IADL) Stage					
	Stage 0	Stage I	Stage II	Stage III	Stage IV	P-Value for difference among stage	Stage 0	Stage I	Stage II	Stage III	Stage IV	P-Value for difference among stage
Weighted Percent Receiving Recommended Care (Overall: 73.7%)	74.1	74.5	72.5	70.7	62.3	<.0001	73.8	76.1	73.4	71.0	64.3	<.0001
Unadjusted Odds Ratio	1	1.02 (0.97–1.08)	0.92 (0.86–0.99)	0.85 (0.78–0.92)	0.58 (0.48–0.70)	<.0001	1	1.13 (1.071–1.20)	0.98 (0.91–1.05)	0.87 (0.82–0.93)	0.64 (0.57–0.72)	<.0001
Adjusted Odds Ratio ^{***}	1	0.93 (0.88–0.98)	0.82 (0.76–0.88)	0.75 (0.69–0.82)	0.49 (0.40–0.59)	<.0001	1	1.01 (0.95–1.06)	0.86 (0.80–0.93)	0.79 (0.73–0.84)	0.54 (0.48–0.62)	<.0001

^{***} Adjusted odds ratios are derived from survey logistic regression models controlling for age, gender, race/ethnicity, education, living arrangement, dual enrollment in Medicare and Medicaid, metropolitan residence, comorbidities, and survey cohorts.

Table 3

Receipt of Recommended Care by Activity Limitation Stages and Type of Recommended Care

Types of Recommended Care	Unweighted numerator / denominator *	Overall Weighted Percent Receiving Recommended Care	Receiving Recommended Care by Activity of Daily Living (ADL) Stage						Receiving Recommended Care by Instrumental Activity of Daily Living (IADL) Stage					P-Value for Difference among Stages *
				Stage 0	Stage I	Stage II	Stage III	Stage IV	Stage 0	Stage I	Stage II	Stage III	Stage IV	P-Value for Difference among Stages *
Post-discharge follow-up	2108/2967	72	Weighted Percent	76	69	68	68	43	76	71	70	66	55	<.0001
			Adjusted Odds Ratio *	1	0.73 (0.57–0.93)	0.70 (0.52–0.94)	0.72 (0.52–1.01)	0.23 (0.12–0.43)	1	0.75 (0.57–0.99)	0.72 (0.53–0.96)	0.66 (0.50–0.87)	0.41 (0.26–0.64)	
			Weighted Percent	77	78	75	73	64	76	80	77	73	65	
Care for chronic conditions	22400/29340	76	Adjusted Odds Ratio *	1	0.97 (0.89–1.06)	0.83 (0.75–0.93)	0.74 (0.65–0.84)	0.46 (0.36–0.60)	1	1.12 (1.02–1.22)	0.96 (0.85–1.07)	0.80 (0.72–0.89)	0.52 (0.44–0.61)	<.0001
			Weighted Percent	76	78	75	74	66	76	79	75	74	68	
			Adjusted Odds Ratio *	1	0.90 (0.82–0.98)	0.74 (0.66–0.83)	0.73 (0.64–0.83)	0.43 (0.33–0.56)	1	0.92 (0.84–1.01)	0.75 (0.67–0.85)	0.73 (0.66–0.81)	0.46 (0.39–0.55)	
Preventive care	25486/33053	76	Weighted Percent	76	78	75	74	66	76	79	75	74	68	<.0001
			Adjusted Odds Ratio *	1	0.90 (0.82–0.98)	0.74 (0.66–0.83)	0.73 (0.64–0.83)	0.43 (0.33–0.56)	1	0.92 (0.84–1.01)	0.75 (0.67–0.85)	0.73 (0.66–0.81)	0.46 (0.39–0.55)	
			Weighted Percent	56	57	58	55	54	55	58	56	54	59	
Care related to diagnostic tests	5274/9453	56	Adjusted Odds Ratio *	1	1.03 (0.91–1.17)	1.05 (0.90–1.24)	0.92 (0.76–1.12)	0.86 (0.57–1.32)	1	1.11 (0.98–1.27)	1.00 (0.85–1.18)	0.93 (0.80–1.09)	1.09 (0.84–1.43)	0.27

* P values and adjusted odds ratios are obtained from survey logistic regression models accounting for individuals’ age, gender, race/ethnicity, education, living arrangement, dual enrollment in Medicare and Medicaid, metropolitan residence, comorbidities, and survey cohorts.