

University of New Hampshire
University of New Hampshire Scholars' Repository

Institute on Disability

College of Health & Human Services (CHHS)

10-2015

Diagnosis isn't enough: Understanding the connections between high health care utilization, chronic conditions and disabilities among U.S. working age adults

Amanda Reichard

University of New Hampshire, Durham

Stephen P. Gulley

Brandeis University

Elizabeth K. Rasch

National Institutes of Health

Leighton Chan

National Institutes of Health

Follow this and additional works at: https://scholars.unh.edu/iod_chhs

Recommended Citation

Reichard, A., Gulley, S., Rasch, B., & Chan, L. (2015) Diagnosis isn't enough: Understanding the connections between high health care utilization, chronic conditions and disabilities among U.S. working age adults. *Disability and Health Journal*, 8(4): 535-546.

This Article is brought to you for free and open access by the College of Health & Human Services (CHHS) at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Institute on Disability by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact nicole.hentz@unh.edu.



HHS Public Access

Author manuscript

Disabil Health J. Author manuscript; available in PMC 2016 October 01.

Published in final edited form as:

Disabil Health J. 2015 October ; 8(4): 535–546. doi:10.1016/j.dhjo.2015.04.006.

Diagnosis isn't enough: Understanding the connections between high health care utilization, chronic conditions and disabilities among U.S. working age adults

Amanda Reichard, Ph.D., M.S.¹, Stephen P. Gulley, Ph.D., MSW^{2,3}, Elizabeth K. Rasch, PT, Ph.D.³, and Leighton Chan, MD, MPH³

¹The University of New Hampshire, Institute on Disability

²The Heller School for Social Policy and Management, Brandeis University, Waltham, MA

³National Institutes of Health, Clinical Research Center, Rehabilitation Medicine Department, Bethesda, MD

Abstract

Background—Under the ACA, new programs are being developed to enhance care coordination and reduce healthcare costs among people with chronic conditions, disabilities, and high utilization of healthcare. However, the relationships between these groups are not well understood.

Objectives—Our aims were to (1) identify high utilizers of healthcare in the U.S. working-age (18-64) population, (2) examine the overlap between this group and people with chronic conditions and/or disabilities, (3) identify predictors of high service use or cost among these subpopulations, and (4) recommend approaches for stratification of individuals with high healthcare utilization.

Methods—Using pooled national data from the Medical Expenditure Panel Survey (2006–2008), we created indices to identify elevated or high utilization and cost groups. We performed descriptive analyses, bivariate comparisons and multivariate analyses to examine the relations between these populations and individuals with chronic conditions and/or disabilities.

Results—While the large majority of persons with high use/cost had chronic conditions, the minority of persons with chronic conditions had high healthcare utilization. However, among persons with chronic conditions, disability was a significant predictor of high utilization. Annual expenditures were significantly elevated among people with disabilities, particularly when activities of daily living were limited.

Corresponding author: Stephen P. Gulley, Ph.D., MSW, c/o National Institutes of Health, Mark O. Hatfield Clinical Research Center, Rehabilitation Medicine Department, 6100 Executive Boulevard, Suite 3C01, MSC 7515, Bethesda, MD 20892-7515, Phone: 508-883-4178, gulley@brandeis.edu.

Conflicts: The authors have no funding or other conflicts of interest to report.

Prior dissemination: None.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions—We conclude that medical diagnosis alone is insufficient for the development of eligibility criteria for, or the evaluation of, programs intended to better the delivery or coordination of services for high utilizers of health care services. New approaches are needed to assess functional limitations and identify ongoing needs for services and supports.

Keywords

people with disabilities; chronic conditions; health service utilization; health care needs

Introduction

In the United States, it is well known that a small percentage of the population accounts for the majority of annual healthcare service use and spending^{1,2}. As the Affordable Care Act (ACA) continues to be implemented in coming years, new programs will be rolled out to this population with the aims of reducing rates of preventable conditions, improving chronic disease management programs, building patient centered medical homes, and developing new approaches to improve long term health outcomes for individuals with ongoing, elevated healthcare needs. Consequently, a more thorough understanding of the demographics, health conditions and functional limitations that drive the demand for care in this high utilization population will be needed, whether to develop new tools to identify target populations, to tailor interventions to their needs, or to predict costs. At present, much of the research in this area is hampered by the conflation of chronic disease with disability and distorted by analyses that focus on particular service “silos,” such as frequent hospitalizations or high emergency department use.

For example, many studies follow high utilizers on the basis of specific kinds of care they receive, such as pharmacy services^{3,4}, primary care^{5,6}, emergency department care^{7,8}, hospitalizations⁹⁻¹¹, or other types of services^{12,13}. While these analyses elucidate some pockets of service requiring special focus, they tend to undercount or misclassify individuals who are in fact high utilizers in the larger system, just not of the particular service examined in the study. Other studies identify high utilizers on the basis of underlying diagnoses, such as persons with one or more chronic conditions¹⁴⁻¹⁸ or on the basis of functional limitations, such as those associated with disability¹⁹⁻²². However, the former constitute upwards of half of the adult population and not all such individuals are actually high utilizers. While the smaller size of the disability population may provide a more accurate starting point, it too is a complex group with differing levels of healthcare service needs²³. Furthermore, these two groups overlap with one another and only a few studies conceptualize and quantify the degree and nature of this overlap²⁴⁻²⁶.

While valuable, none of these approaches to studying high healthcare utilizers takes a population-level perspective to identify these users across multiple types of services while accounting for the relationships between chronic conditions and disability. Further, much of the available literature focuses upon elders (65 and over) and does not address the concerns of working-age (18-64) individuals despite the large size of this age group. Consequently, the purposes of this study are to (1) identify healthcare users in the U.S. working-age (18-64) population on the basis of elevated or high utilization and cost, (2) examine the

extent of overlap between this group and people who have chronic conditions and/or disabilities; (3) identify specific patterns and predictors of service use among these subpopulations; and (4) recommend approaches for stratification of this large group of Americans. We discuss our findings with a particular focus upon eligibility for, and evaluation of, new programs being implemented under the ACA.

Methods

Data source

In order to insure sufficient sample sizes for all analyses, we created a pooled annual file from the 2006-2008 Medical Expenditure Panel Survey Household Component (MEPS-HC)²⁷ and the related files for medical conditions and medical events during those years. We obtained a final sample size of 53,586 upon which we based our estimates of 185 million working aged adults in the United States.

Identifying elevated and high healthcare population groups

In the available literature, there is no one agreed upon cutpoint for distinguishing high healthcare use (or cost) from “normal” utilization. Furthermore, for some programmatic interests, it could be desirable to focus eligibility on a small group with extremely high service needs (for example, home based primary care), while in other programs it could be more appropriate to target interventions more widely (for example, care coordination). We thus created two different algorithms to capture individuals with what we called elevated, or high, healthcare utilization respectively. In the first algorithm, we defined individuals with *elevated* healthcare utilization as those who reported use in any given service at or above the 75th percentile when compared to all other users of that service area. The services included in the algorithm consisted of: a) total ambulatory visits to doctors, mental health or other healthcare providers, b) total days hospitalized during the year, c) emergency department visits, d) total prescription fills/refills during the year and e) number of home health days. In the second algorithm, we identified individuals with *high* healthcare utilization in precisely the same manner, but raised the threshold to the 90th percentile in each service area.

Separately, we also identified individuals with elevated and high healthcare *costs*. After adjusting for inflation using the consumer price index for medical services, we calculated cost as the total annual expenditure over the same service areas listed above. If an individual amassed expenditures at or above the 75th percentile when compared to others with at least some expenditure, we flagged that case as having *elevated* cost. Individuals at or above the 90th percentile were flagged as *high* cost.

Identifying the population with one or more chronic conditions

We adapted a list of conditions from the AHRQ HCUP chronic condition indicator²⁸ and applied it to the International Classification of Disease (ICD-9) codes provided in MEPS. This list includes medical and mental health conditions expected to last at least 12 months. The conditions are clinically expected to result in a need for ongoing intervention (including regularly prescribed medications, therapies from health professionals, specialized medical equipment or protocols affecting diet or physical activity) and/or limitations (in age

appropriate task performance, Activities of Daily Living [ADLs], Instrumental Activities of Daily Living [IADLS] or social interactions). Persons reporting one or more of the listed conditions were flagged as having chronic condition(s).

Identifying people with disabilities

Disability was assessed using the limitation measures in the MEPS-HC, including the following domains: physical functioning, sensory impairment, cognitive difficulties, activities such as work, housework or school, social limitations, use of assistive devices, and ADLs/IADLs (help or supervision with activities such as dressing, bathing, meals, taking medications, etc.). Using these measures, we split the population into three mutually exclusive groups: 1) people without disabilities (no limitations in any of the measures above); 2) people with non-ADL/IADL disabilities (no report of need for help or supervision with activities of daily living or instrumental activities during the year, but one or more limitations in the other disability measures) and 3) people with ADL/IADL disabilities (individuals who, in addition to any other limitations reported, experienced a need for help or supervision with ADLs/IADLs during the year).

Stratifying the population on the basis of chronic health care needs

In addition to analyzing the overlap between chronic conditions, disability and healthcare utilization / cost, we specifically examined the utility of the “Adults with Chronic Healthcare Needs” (ACHCN) stratifying measure²³ as a predictor of heavy healthcare use and as a means of segmenting the service utilization patterns among high use populations in the MEPS. We follow methods previously published for identifying ACHCN using the same variables on chronic conditions and disabilities detailed above to yield four mutually exclusive groups: 1) those without chronic conditions (contrast group) and three subgroups of ACHCN with at least one chronic condition including 2) those without self-reported limitations; 3) those reporting limitations but not requiring help or supervision with ADL or IADLs; and 4) those requiring help or supervision with ADLs or IADLs.

Measures

We assessed differences within the population groups described above on the basis of sociodemographic characteristics, including: age, gender, race/ethnicity, poverty, and education. We further examined number and type (chronic/non-chronic) of medical conditions, overall health (fair or poor during the year), and overall mental health (fair or poor during the year). We analyzed specific services utilized by calculating annual means (primary care doctor visits, specialty doctor visits, Rx fills, ED visits and days hospitalized) or percentages (any/no use of PT, OT or speech therapy during the year; any/no mental health visits, any/no home health visits), in addition to a count of the number of service areas used. Finally, we examined measures of access to and costs of care, including annual medical expenditures, annual out of pocket expenses, insurance coverage status (insured all year, part year, or uninsured all year) and source (any private versus public only), as well as delay in or non-receipt of needed medical care or prescription medications.

Statistical Analysis

We conducted descriptive analyses (means, medians, percentages and associated standard errors) of sociodemographics, health, conditions, disability status, service use and access to/cost of care among the working age as a whole, among adults with elevated and high service utilization, and among adults with elevated and high cost (table 1); These were weighted to produce pooled annual estimates of the US non-institutionalized, civilian, working age population for the period of 2006-2008, following methods recommended by AHRQ. We then conducted a series of bivariate analyses to examine differences between adults with and without chronic conditions, and separately, between persons without disabilities, with non-ADL/IADL disabilities, and with ADL/IADL disabilities (table 2). Pairwise t-tests and chi square analyses were conducted to determine statistical significance while controlling the false discovery rate²⁹. We graphed the weighted size and overlap of working age individuals with chronic conditions, disabilities and high healthcare utilization in an area proportional venn diagram (figure 1) and documented the size of the ACHCN strata among persons with elevated or high use and cost in a stacked bar graph (figure 2).

Next, we conducted a series of multivariate analyses, controlling for age, gender, race/ethnicity, poverty status, education, insurance coverage status, census region and metropolitan statistical area (MSA) status. We first modeled the relationship between the ACHCN strata and elevated utilization, high utilization, elevated cost and high cost in separate logistic regressions. Second, selecting only those individuals with elevated utilization as the population for analysis, we examined the relationships between the ACHCN strata and the predicted number of chronic and acute conditions using loglink models. Third, we conducted a series of models to predict the number of visits, the use of particular services and the total number of service areas used during the year on the basis of the ACHCN strata; Logistic regression was used for services measured as percentages and loglink models were fit for services measured as means. Finally, these same models were fit for adults with high utilization, for adults with elevated cost, and for adults with high cost. The results from all models were expressed as predicted marginal estimates in, and tested for statistical significance among, the ACHCN strata while holding the covariates constant at their weighted population levels (table 3). All estimates, standard errors, and tests of significance were produced using SUDAAN software and were based on a Taylor-series linearization that adjusts for the complex sampling plan in the MEPS-HC. Missing data was less than 3% on most variables and sensitivity analyses on key outcomes demonstrated no significant differences in the findings when missing data were included or excluded.

Results

A brief profile: The demographics, health and healthcare use of working age adults

As shown in Table 1, our weighted sample represented 185 million working age US adults with an average age of 41.3. Sixty-six percent were non-Hispanic white, 12% were non-Hispanic black and 15% were Hispanic; about one quarter lived near the federal poverty line ($\geq 125\%$ of FPL). Twenty percent reported their overall health to be fair or poor. Overall, 17% reported some degree of disability (13% with limitations not affecting ADLs or IADLs, and 4% with ADL/IADL level disabilities). We found that just over one half (53%) of the

working age had one or more chronic conditions and 10% reported four or more such conditions concurrently. Overall, the study population made one primary care doctor visit, two visits to specialty doctors and filled (or refilled) their prescriptions about ten times in the average year. Other services, such as mental health, home health, hospitalizations, ED visits and therapies were more rarely used. Altogether, working age adults used approximately 1.8 of the services we followed during the year, for an average of \$3,234 in medical expenditures.

Populations with elevated or high utilization and cost

We use the term “elevated” to describe that portion of the working age population that used any (one or more) of the key services at or above the 75th percentile of use. This results in a population of 55 million, or about a third of all working age persons. This population differs from the working age population as a whole in a number of important respects. Thirty-seven percent reported their health to be fair or poor (compared to 20% in the working age population generally). Eighty-six percent of individuals with elevated utilization reported one or more chronic conditions and 29% specifically noted four or more concurrent chronic conditions (compared to 53% and 10% in the general population, respectively). Thirty-six percent reported a disability (26% with limitations not affecting ADLs or IADLs, and 10% with ADL/IADL level disabilities) while in the general population, 16.8% reported a disability (13% with limitations not affecting ADLs or IADLs, and 4% with ADL/IADL level disabilities). The elevated utilization group had an average of two primary care doctor visits, six specialist visits and 26 prescription medication fills/refills. As also shown in table 1, 19% used therapies, 10% used mental health and 4% used home health. Importantly, the average person with elevated healthcare utilization used 3 of the services we followed concurrently. It should also be noted that approximately 19% of elevated users reported at least one month without insurance coverage during the year and ten percent reported that needed medical care was delayed or not received. Altogether, this group amassed an average of \$8,911 per person in annual medical expenditures, \$1,229 of which was paid for out of pocket.

We use the term “high” to refer to the population that used one or more key services at or above the 90th utilization percentile. This was a smaller group (23 million or approximately 12% of the working age) with substantially higher service use and expenditures across the board, whether compared to the general working age population or the individuals with elevated service utilization (above). Ninety-one percent of this group had at least one chronic condition and almost half reported four or more such conditions concurrently. Half of this group had a disability, and 17% specifically had a disability affecting ADLs or IADLs. Average annual medical expenditures among high healthcare utilizers were \$14,103, \$1,712 of which paid for out of pocket.

The elevated and high *cost* populations were smaller than their utilization counterparts, at 35 and 14 million individuals, respectively. As above, these two groups contained progressively higher rates of disability and chronic conditions and poor overall health.

The primary differences between the populations gathered on the basis of utilization versus cost was that the latter utilized more care from specialty doctors, hospitals and home health,

which were indeed expensive services. Average annual expenditures also ran higher when using cost as the primary basis for identifying the population in the first place; among individuals with elevated costs, annual expenditures ran \$13,822 (compared to \$8,911 for the elevated utilization group), while the high cost population amassed \$25,419 (compared to \$14,103 for the high utilization group).

Chronic conditions and disability

We separately examined two other overlapping groups: people with chronic conditions and people with disabilities (Table 2). The former were a large and heterogeneous population which, at 99 million persons, comprised a bit over half the working age. When compared to their counterparts without chronic conditions, people with chronic conditions reported significantly poorer health and mental health. They also reported significantly elevated utilization of primary and specialty doctors, prescription medications, therapies, mental health care, ED visits, days hospitalized and home health than their counterparts did. However, it would be a mistake to characterize this as a monolithic, medically vulnerable group; Over 70% reported good to excellent health (data not shown). Moreover, poverty ran somewhat lower, education somewhat higher, and health insurance coverage substantially higher among people with chronic conditions compared to people without them.

By contrast, many people with disabilities *can* be fairly characterized as medically vulnerable. Though this was also a diverse population group, at a bit over thirty million, it was a good deal smaller than the chronic condition group and it evidenced higher rates of poverty and lower rates of education. Over half of individuals with disabilities (not requiring help or supervision with ADLs or IADLs) reported fair to poor health. When ADL/IADL help was required, this climbed to over three-quarters. Health service utilization rates and the number of service areas used were both substantially elevated among people with disabilities, relative both to people without disabilities generally, and to people with chronic, non-disabling health conditions. ADLs and IADLs stood apart through all of these analyses, marking a group with extremely high health service utilization patterns.

Exploring the overlap: Chronic conditions, disability and elevated/high healthcare use

In figure one, we provide an area proportional venn diagram, in which the sizes of the circles represent the sizes of a) the working age as a whole, b) persons with 1+ chronic conditions, c) people with disabilities and d) people with high health care utilization. Several important observations can be made using this figure. First, as shown by the location of the circles, the large majority of people with disabilities reported one or more chronic conditions, a finding to be expected given that most people with disabilities have at least one long lasting medical condition related to their functional limitations. Second, due to its large size, it was the minority of persons with chronic conditions (22%) who were among the high healthcare utilization group. However, the very large majority (91%) of high healthcare users had one or more chronic conditions. Third, among people with disabilities, a substantial proportion (38%) were also high health care utilizers, while over half (50%) of high healthcare utilizers reported a disability. Based on table 2, we can also surmise that individuals who specifically report ADL or IADL limitations will be particularly likely to report high healthcare utilization.

Given these interrelationships, we found it sensible to stratify the working age population as follows: 1) No chronic conditions or disability, 2) one or more chronic conditions without disability, 3) one or more chronic conditions with disability not requiring help or supervision with ADLs/IADLs, and 4) one or more chronic conditions with a disability accompanied by need for help or supervision with ADLs/IADLs. We then examined how these strata related to the elevated and high utilization and cost populations, as shown in figure 2.

The working age as a whole are about evenly split between persons with and without at least one chronic condition; about 15% report a chronic condition with any disability, and about 4% specifically report ADL/IADL disability. However, we see a very different profile among those with elevated healthcare utilization, where less than 15% report no chronic condition or disability and where 35% report a disability (almost 10% specifically report an ADL/IADL disability). These differences become more exaggerated still when we raise the bar from elevated to high healthcare use, where in essence, nearly all have chronic conditions, almost half have disabilities, and over ten percent specifically have ADL/IADL disabilities. If we instead shift the focus to elevated or high costs, there are some minor differences, but the overall relationships remain the same: the most expensive population groups are disproportionately composed of people with chronic conditions and disabilities.

At the intersection: stratifying the population with the greatest healthcare utilization and cost

In table 3, we provide covariate adjusted estimates of the likelihood of elevated or high utilization (and cost) among the four strata just described. We were also interested to know whether these strata predict different rates of health conditions or different service use patterns *specifically among those with elevated or high utilization and cost*.

After controlling covariates, we found that while 18% of persons with no chronic condition had elevated utilization, over 40% of individuals with chronic condition(s) absent disability had elevated service use. This rose higher still for persons reporting both chronic conditions and non-ADL/IADL disabilities (65%) and as high as 85% among persons with ADL/IADL involvement. When we raised the bar from elevated to high utilization, just 5% of those without a chronic condition were estimated to be high service utilizers, while 58% of those with a chronic condition and ADL/IADL needs were predicted to fall within the high utilization group. When we examined cost, this same pattern was clear; moving from the first strata (no chronic condition or disability) to the fourth strata (1+ chronic condition with disability involving ADLs/IADLs), we found significantly and progressively higher predicted percentages of elevated and high cost individuals.

Moreover, we found significantly higher rates of both the number of chronic conditions and the number of acute conditions across these strata. In these analyses, we limited the population examined to include only those with, for example, elevated utilization. Controlling covariates, we then recorded the predicted mean chronic conditions for members of each of the four strata. This was separately repeated for persons with high utilization, and both elevated and high cost as well. The results show that multiple chronic and acute conditions are the norm among the strata with chronic conditions and/or disabilities, and that

the number of these conditions rises significantly and substantially with the occurrence of disability – particularly, ADL/IADL disability.

When we further examined persons with elevated or high utilization, or cost, these strata showed promise for identifying different service utilization patterns as well. Compared to people without chronic conditions or disabilities, use of primary care doctors, specialty doctors, prescription medications, and mental health visits was consistently, and progressively, higher among persons with chronic conditions (absent disability), chronic conditions with non-ADL/IADL disabilities, and chronic conditions with ADL/IADL related disabilities. This last strata (ADL/IADL) also accounted for the majority of the estimated home health utilization and consistently experienced the highest number of ED visits and days hospitalized as well. Finally, the predicted number of service areas used rose significantly with the presence of chronic conditions and the extent of disability; even among high healthcare utilizers, these remain markers for the breadth of services or supports required.

Discussion

This examination of the interrelationships between chronic conditions, disability, service use and cost reveals much about the challenges we face in healthcare reform. Many of the changes in policy or practice recommended under the ACA are targeted at the coverage or delivery of services to one or more of these four population groups, typically with the goals of decreased morbidity, increased prevention and associated cost savings^{30,31 32}. While the data provided could be useful for many specific purposes, we focus upon two: eligibility and program evaluation.

Eligibility

When setting program eligibility criteria, the use of clinical diagnoses alone may not efficiently identify individuals with ongoing healthcare needs, especially given the prevalence of chronic conditions. As shown here, individuals with chronic conditions constitute over half of the working age and over thirty percent have two or more such conditions. Hence, whether one opts to set the bar at 1+ or even 2+ chronic conditions, the result will still be a very large group with diverse healthcare needs. New programs which are being designed to serve people with high or expensive service utilization patterns will certainly reach some of them if eligibility is based on chronic condition status alone. However, as shown here, roughly 4 in 5 people with chronic conditions do not report high utilization during the average year and almost 9 in 10 do not report high expenditures, making chronic condition status itself a weak predictor of current use or cost. Hence, the use of broad condition lists *alone* as a means for eligibility determinations will likely dilute the impact of the program or leave some people with real need underserved.

Policymakers have also turned to particular diagnoses, or classes of diagnoses, in order to limit eligibility. For example, under section 2703 of the ACA, an optional Medicaid State Plan benefit is being established to create “Health Homes” to coordinate care for people with Medicaid coverage who have a mental health or substance abuse condition, as well as asthma, diabetes, heart disease or obesity. Though states can apply to CMS to cover

additional diagnoses, the program is otherwise limited to individuals who have 2 or more of these conditions, or who have one such condition and are at risk for a second, or who have one serious and persistent mental health condition³². But do individuals with asthma and obesity have a higher need for care coordination than patients who would not necessarily be eligible for this program, such as those with cancer or multiple sclerosis? Relatedly, in and of itself, does the presence of two chronic conditions amount to a sufficient justification for extra resource allocations? These are questions for future research.

Based on our findings, we would suggest that in addition to chronic condition status or particular diagnoses, decisions such be based upon information on functional disability, ADLs and IADLs, and where practical, service utilization over the preceding year. When we selected individuals with chronic conditions and ADL/IADL limitations, we obtained a small group (4 percent) in which 85% were estimated to have elevated healthcare utilization and in which 67% had elevated cost, covariates controlled. Relative to individuals with chronic conditions generally, people reporting ADL/IADL limitations had service utilization rates orders of magnitude higher across a wider range of needed provider types. Three quarters reported fair to poor health, over half reported fair to poor mental health, delays in needed medical care or prescription medications were common, and both poverty and education rates in this group were of great concern. This is clearly a very high priority group for care coordination and other health interventions as well.

Should a larger population be desired, eligibility could be expanded to include individuals with one or more chronic conditions who have limitations in such areas as physical functioning, sensory impairment or cognitive difficulties, but whom remained independent in ADLs/IADLs over the course of the preceding year. Our analyses of this group identified an additional 11% of the working age (over and above the ADL/IADL limited group discussed earlier), 66% of which with elevated utilization and 44% of which with elevated cost; This too is a high priority group for care coordination, more so than persons with chronic conditions absent disability, and perhaps less so than persons specifically with ADL/IADL involved disabilities.

Program evaluation

The ACA established the Center for Medicare & Medicaid Innovation (CMMI) to conduct a wide range of demonstration projects to test new models of payments and healthcare delivery (such as bundled payments and Accountable Care Organizations), new approaches to care coordination (such as the patient centered medical home) and new ways to support people with chronic conditions or disabilities living in the community (such as the Independence at Home demonstration). Many other organizations are either formulating, testing or evaluating specific programs to better serve the needs of people with chronic conditions or disabilities as well, such as the Center for Medicaid and Chip Services (CMCS), the Office of the Assistant Secretary for Planning and Evaluation (ASPE), and the Administration on Community Living (ACL). As new programs proliferate, how will we know if these approaches to coordination, delivery or reimbursement are effective at improving access, quality or cost effectiveness overall at the population level?

Many of the current population level studies of healthcare outcomes focus upon rates of specific chronic conditions, their cost burden, rates of preventable hospitalizations or ED visits by affected persons, or morbidity/mortality among individuals with a given health condition. Of course, such studies and the metrics they rely upon will continue to be relevant, but the focus on chronic disease management and population health in the ACA, and beyond, calls for new methods and measures as well. With further development, the ACHCN stratifying approach tested here could form the basis for a new way of examining chronic condition status, functional limitations and service use as the overlapping phenomena that they truly are. Such an approach could prove particularly helpful if developed into a screening instrument for use in population-level surveys. Drawing as it does upon information about both chronic condition status and disability status to yield four groups with progressively higher rates of chronic (and acute) health conditions, ambulatory visits, hospitalizations and ED visits, this approach could clarify the interrelationships between each of these major domains. Such a macro-level, non-diagnostic, functionally-oriented measure could provide an agreed upon starting point as policymakers define and identify individuals with ongoing, elevated needs for care, be it for people with chronic conditions that are not yet disabling, or for people who already require daily assistance to manage their disabilities well.

For example, in addition to analyzing the factors that push individuals from one strata to another, this approach could allow us to track the current disparity in delayed access to care (far worse among the groups with disability) to see if it begins to abate as new delivery mechanisms such as Independence at Home are implemented. We could further examine the number and type of health conditions reported among ACHCN with non- ADL/IADL disabilities each year, as well as their overall health, mental health status, and hospitalization or ED visits to see if these markers improve when individuals are served in ACOs. Or, in patient centered medical homes, we could examine measures of disease self-management among persons with chronic conditions that are not yet associated with disabilities in order to gauge their success at reducing functional losses and expensive hospital care over time.

The ACHCN approach examined here also appears to perform well among individuals we already know to have high utilization. Even when we selected individuals using services at the 90th percentile or above, we found that the three groups with chronic conditions and disabilities consistently had higher use of primary and specialty care, prescription medications and mental health visits than did their counterparts without chronic conditions. Moreover, hospitalizations, ED use and home health ran high among the groups with disabilities, particularly when ADL/IADLs were involved.

Study Limitations

This study has several limitations. First, the survey is based on self-report. Respondents may under report service use or health conditions potentially viewed as stigmatizing, while over reporting of some services may also occur due to recall bias. Proxy use for those deemed unable to answer questions may cause bias, particularly when proxy respondents are queried about unobservable processes, such as cognition. This sample does not include people who reside in institutional settings, such that service use and costs may be underestimated.

Finally, the MEPS captures service use rather than *need* for services, which may contribute to undercounting the population who could potentially benefit from healthcare reforms aimed at improving access to care.

Conclusion

Beyond what has been documented in recent studies^{25,26,33-36}, much still remains to be learned about the interrelationships between chronic conditions, disability and high use/cost populations. Chronic health conditions are highly prevalent among the working age, frequently occur two or more at a time, and result in highly variable service use patterns and health status. Though clearly important to monitor as a whole, the population with high utilization or cost cannot be effectively identified on the basis of diagnosis alone. Implementing or evaluating new delivery models, care coordination programs or reimbursement methods one or two diagnoses at a time appears to have limited utility at best. On the other hand, the population of people with disabilities is, for the most part, a subset of people with chronic conditions. Though also a heterogeneous and complex population group in its own right, the report of functional or activity limitations, and particularly the presence of ADL/IADL limitations, are highly and progressively predictive of the number of health conditions reported, the amount and scope of healthcare services used during the year, and total annual medical expenditures as well. Furthermore, among people with chronic conditions, those with disabilities generally experience the highest rates of poverty, the lowest rates of education and the highest rates with problems accessing needed medical care or prescription medications. As such, they are among the most important population groups to define, measure and monitor in health care reform.

Acknowledgments

Support: NIH Intramural Research Program

References

1. The High Concentration of U.S. Health Care Expenditures. Agency for Healthcare Research and Quality, 2006. 2014. at <http://www.ahrq.gov/research/findings/factsheets/costs/expriach/index.html>
2. Berk M, Monheit AC. The Concentration of Health Care Expenditures, Revisited. *Health Affairs*. 2001; 20:9–18.
3. Hudson TJ, Owen RR, Thrush CR, Armitage TL, Thapa P. Guideline implementation and patient-tailoring strategies to improve medication adherence for schizophrenia. *The Journal of Clinical Psychiatry*. 2008; 69:74–80. [PubMed: 18312040]
4. Qato DM, Alexander G, Conti RM, Johnson M, Schumm P, Lindau S. Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. *JAMA*. 2008; 300:2867–78. [PubMed: 19109115]
5. Naessens JM, Baird MA, Van Houten HK, Vanness DJ, Campbell CR. Predicting Persistently High Primary Care Use. *Annals of Family Medicine*. 2005; 3:324–30. [PubMed: 16046565]
6. O'Toole TP, Pirraglia PA, Dosa D, et al. Building care systems to improve access for high-risk and vulnerable veteran populations. *Journal of General and Internal Medicine*. 2011; 26(Suppl 2):683–8.
7. Mandelberg JH, Kuhn RE, Kohn MA. Epidemiologic analysis of an urban, public emergency department's frequent users. *Academic Emergency Medicine*. 2000; 7:637–46. [PubMed: 10905642]

8. Rasch EK, Gulley SP, Chan L. Use of emergency departments among working age adults with disabilities: a problem of access and service needs. *Health services research*. 2013; 48:1334–58. [PubMed: 23278461]
9. Johansen H, Strauss B, Arnold JM, Moe G, Liu P. On the rise: The current and projected future burden of congestive heart failure hospitalization in Canada. *The Canadian journal of cardiology*. 2003; 19:430–5. [PubMed: 12704491]
10. Koproski J, Pretto Z, Poretsky L. Effects of an Intervention by a Diabetes Team in Hospitalized Patients With Diabetes. *Diabetes Care*. 1997; 20:1553–5. [PubMed: 9314634]
11. Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to Reduce 30-Day Rehospitalization: A Systematic Review. *Annals of Internal Medicine*. 2011; 155:520–8. [PubMed: 22007045]
12. Chesher NJ, Cousman CA, Gale M, et al. Chronic illness histories of adults entering treatment for co-occurring substance abuse and other mental health disorders. *American Journal of Addiction*. 2012; 21:1–4.
13. Savageau JA, McLoughlin M, Urgan A, Bai YM, Collins M, Cashman SB. Characteristics of frequent attenders at a community health center. *Journal of the American Board of Family Medicine*. 2006; 19:265–75. [PubMed: 16672680]
14. Boyd, C.; Leff, B.; Weiss, C.; Wolff, J.; Clark, R.; Richards, T. Clarifying multimorbidity to improve targeting and delivery of clinical services for Medicaid populations. Center for Health Care Strategies Inc.; 2010.
15. Decker SL, Schappert SM, Sisk JE. Use of Medical Care for Chronic Conditions. *Health Affairs*. 2009; 28:26–35. [PubMed: 19124849]
16. Kasper, J.; Watts, MO.; Lyons, B. Chronic Disease and Co-Morbidity Among Dual Eligibles: Implication for Patterns of Medicaid and Medicare Service Use and Spending. Washington, DC: The Henry J. Kaiser Family Foundation; 2010.
17. Willey VJ, Pollack MF, Lednar WM, Yang WN, Kennedy C, Lawless G. Costs of severely ill members and specialty medication use in a commercially insured population. *Health Affairs*. 2008; 27:824–34. [PubMed: 18474976]
18. Laditka JN, Laditka SB. Race, ethnicity and hospitalization for six chronic ambulatory care sensitive conditions in the USA. *Ethnicity and Health*. 2006; 11:247–63. [PubMed: 16774877]
19. Krahn GL, Hammond L, Turner A. Disabilities and health. *Journal of Disability Policy Studies*. 2006; 17
20. Rasch EK, Hochberg MC, Magder L, Magaziner J, Altman BM. Health of community-dwelling adults with mobility limitations in the United States: Prevalent health conditions. Part I *Arch Phys Med Rehabil*. 2008; 89:210–8. [PubMed: 18226643]
21. Rasch EK, Magder L, Hochberg MC, Magaziner J, Altman BM. Health of community-dwelling adults with mobility limitations in the United States: Incidence of secondary health conditions. Part II. *Arch Phys Med Rehabil*. 2008; 89:219–30. [PubMed: 18226644]
22. Chan L, Beaver S, Maclehorse RF, Jha A, Maciejewski M, Doctor JN. Disability and health care costs in the Medicare population. *Arch Phys Med Rehabil*. 2002; 83:1196–201. [PubMed: 12235597]
23. Gulley SP, Rasch EK, Chan L. If we build it, who will come? Working-age adults with chronic health care needs and the medical home. *Medical care*. 2011; 49:149–55. [PubMed: 21206295]
24. Fox MH, Reichard A. Disability, Health, and Multiple Chronic Conditions Among People Eligible for both Medicare and Medicaid, 2005-2010. *Preventing Chronic Disease*. 2013 Epub ahead of print.
25. Drum CE. The dynamics of disability and chronic conditions. *Disability and Health Journal*. 2014; 7:2–5. [PubMed: 24411500]
26. Gulley SP, Rasch EK, Chan L. The complex web of health: relationships among chronic conditions, disability, and health services. *Public health reports (Washington, DC : 1974)*. 2011; 126:495–507.
27. The Medical Expenditure Panel Survey. [Accessed July 1, 2014, 2014] Agency for Healthcare Research and Quality, 2014. 2014. at <http://www.meps.ahrq.gov/mepsweb/>

28. HCUP Chronic Condition Indicator. Agency for Healthcare Research and Quality, 2011. 2014. at <http://www.hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp>
29. Benjamini Y, Hochberg Y. Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the royal statistical society*. 1995; 57:289–300.
30. Turk MA. The ACA and preventive health care services for people with disabilities. *Disabil Health J*. 2013; 6:69–71. [PubMed: 23507155]
31. Rosenbaum S, Teitelbaum J, Hayes K. The essential health benefits provisions of the Affordable Care Act: implications for people with disabilities. *Issue brief*. 2011; 3:1–16. [PubMed: 21452594]
32. Nardone, M.; Paradise, J. *Medicaid Health Homes for Beneficiaries with Chronic Conditions*. Washington, D.C.: Kaiser Family Foundation; 2012 Aug 1. 2012
33. Krahn G, Reyes M, Fox M. Chronic conditions and disability: Toward a conceptual model for national policy and practice considerations. *Disability and Health Journal*. 2014; 7:13–8. [PubMed: 24411502]
34. Alexih, L.; Shen, S.; Chan, I.; Taylor, D.; Drabek, J. *Individuals Living in the Community with Chronic Conditions and Functional Limitations: A Closer Look*. Washington, DC: Office of the Assistant Secretary for Planning & Evaluation, US Department of Health and Human Services; 2010.
35. Anderson, G. *Chronic Care: Making the Case for Ongoing Care*. Princeton, NJ: Robert Wood Johnson Foundation; 2010.
36. Reichard A, Nary D, Simpson J. Chronic conditions and disability: Research contributions and implications. *Disability and Health Journal*. 2014; 7:6–12. [PubMed: 24411501]

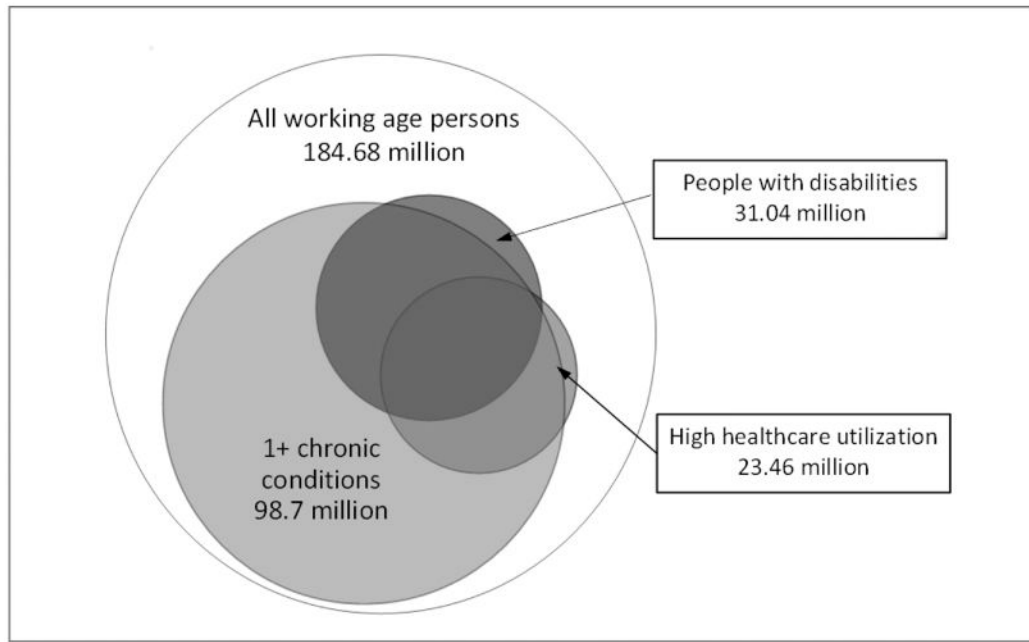


Figure 1. The size and overlap of working age individuals with 1+ chronic conditions, disabilities and high healthcare utilization: Area proportional Venn diagram, pooled annual estimates, MEPS 2006-2008

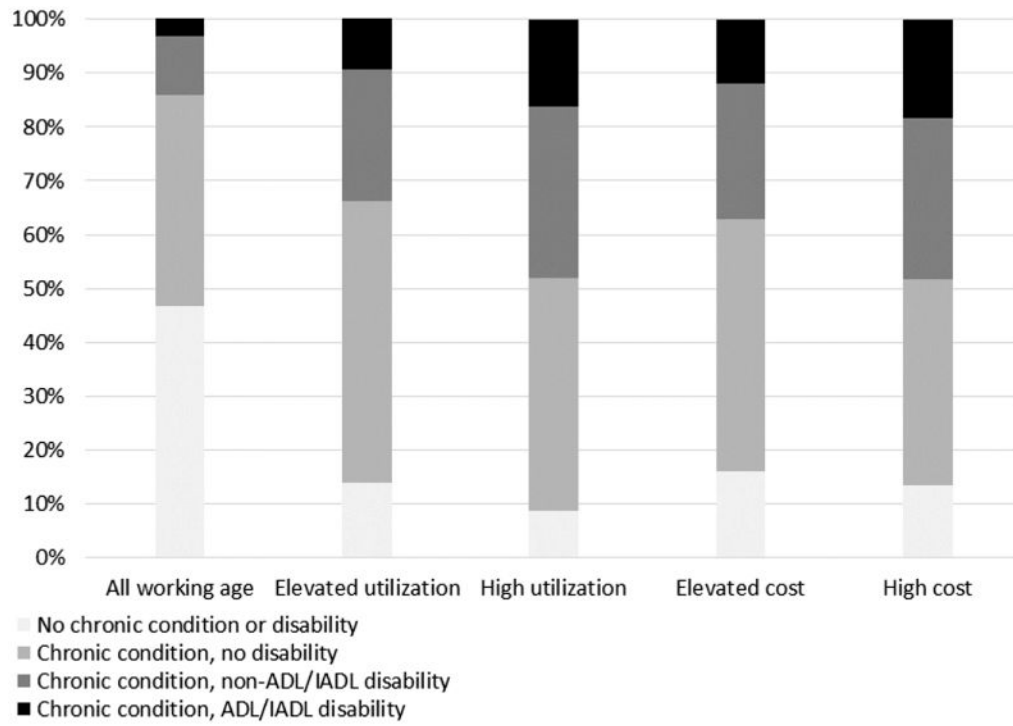


Figure 2. Chronic condition and disability strata among working age individuals with elevated and high healthcare utilization/cost: pooled annual estimates, MEPS 2006-2008

Table 1
Four population distributions of healthcare service use and cost: Sociodemographics, health conditions, disability, services used, annual expenditures, insurance coverage and access to care among persons age 18-65, pooled annual estimates, MEPS 2006-2008

	ALL	Elevated utilization	High utilization	Elevated cost	High cost
N	53,586	15,352	6,683	9,974	3,999
Population size, millions	184.68	55.11	23.46	35.45	14.20
Sociodemographics					
Age, mean	41.31 (.12)	46.87 (.17)	48.78 (.22)	46.74 (.19)	47.41 (.24)
Gender, female	50.76% (.24)	62.37% (.47)	63.10% (.71)	62.73% (.63)	62.49% (.97)
Race and Ethnicity					
NH white	66.70% (.73)	75.47% (.68)	77.01% (.82)	74.87% (.76)	75.09% (.95)
NH Black	11.87% (.48)	10.40% (.48)	10.44% (.59)	10.84% (.52)	11.93% (.67)
Hispanic	14.54% (.56)	8.95% (.41)	7.80% (.44)	9.12% (.44)	7.84% (.53)
Other/multiple	6.90% (.33)	5.17% (.34)	4.76% (.43)	5.17% (.36)	5.14% (.49)
Poverty, 125% of FPL or lower	26.06% (.42)	26.35% (.59)	29.97% (.87)	26.76% (.65)	29.14% (.96)
Less than high school educ.	13.39% (.31)	11.44% (.36)	13.10% (.56)	11.17% (.41)	11.88% (.62)
Health, disability, conditions					
Overall health fair or poor	19.56% (.31)	37.10% (.58)	49.87% (.91)	40.56% (.70)	51.04% (1.05)
Mental health fair or poor	11.99% (.24)	22.12% (.49)	30.32% (.79)	23.75% (.57)	28.61% (.90)
Disability					
None	83.20% (.33)	64.30% (.63)	49.81% (.95)	60.90% (.70)	49.90% (.99)
Non-ADL/IADL	13.15% (.28)	25.88% (.55)	33.63% (.80)	26.78% (.60)	31.18% (.86)
ADL/IADL	3.65% (.12)	9.82% (.32)	16.57% (.59)	12.32% (.44)	18.92% (.79)
Chronic conditions					
None	46.56% (.41)	13.77% (.38)	8.62% (.45)	15.95% (.47)	13.33% (.63)
One or more	53.44% (.41)	86.23% (.38)	91.38% (.45)	84.05% (.47)	86.67% (.63)
1	23.13% (.24)	19.61% (.41)	14.16% (.54)	17.67% (.47)	15.26% (.70)
2-3	20.44% (.27)	37.75% (.53)	32.17% (.76)	33.24% (.63)	30.57% (.95)
4+	9.87% (.22)	28.87% (.54)	45.06% (.89)	33.14% (.68)	40.84% (1.03)
Acute conditions					
None	26.95% (.36)	6.60% (.27)	4.37% (.31)	5.16% (.30)	4.27% (.38)
One or more	73.05% (.36)	93.40% (.27)	95.63% (.31)	94.84% (.30)	95.73% (.38)
1	25.72% (.26)	15.61% (.39)	11.06% (.52)	14.97% (.47)	12.26% (.66)
2-3	30.88% (.28)	38.14% (.54)	33.04% (.83)	36.92% (.64)	34.21% (.91)
4+	16.44% (.31)	39.64% (.63)	51.53% (.92)	42.95% (.74)	49.26% (1.08)
Insurance and access to care					
Insured all year	70.35% (.42)	81.31% (.47)	83.20% (.60)	84.32% (.51)	86.63% (.64)
Any private	89.77% (.31)	83.58% (.54)	77.10% (.88)	82.37% (.61)	79.37% (.92)
Public only	10.23% (.31)	16.42% (.54)	22.90% (.88)	17.63% (.61)	20.63% (.92)

	ALL	Elevated utilization	High utilization	Elevated cost	High cost
Uninsured part year	12.06% (.21)	10.03% (.33)	9.04% (.47)	9.54% (.42)	8.63% (.54)
Uninsured all year	17.59% (.35)	8.65% (.31)	7.76% (.41)	6.13% (.31)	4.74% (.39)
Medical care delayed or not received	6.30% (.18)	10.04% (.36)	12.47% (.54)	9.32% (.38)	10.38% (.58)
RX delayed or not received	4.34% (.14)	8.62% (.31)	10.91% (.50)	8.18% (.37)	9.51% (.61)
Services used					
Primary care doctor, mean	.99 (.01)	2.08 (.04)	2.64 (.07)	2.10 (.04)	2.31 (.07)
Specialty doctor, mean	2.10 (.03)	5.55 (.08)	8.38 (.17)	7.03 (.11)	9.74 (.23)
RX fills, mean	9.89 (.15)	26.64 (.35)	40.81 (.65)	30.01 (.46)	37.94 (.83)
Therapies, PT, OT or ST	6.95% (.17)	18.59% (.48)	26.99% (.78)	18.10% (.52)	21.38% (.83)
Mental health	3.78% (.13)	9.94% (.36)	15.43% (.65)	10.42% (.42)	12.58% (.71)
ED visits, mean	.18 (.00)	.41 (.01)	.57 (.02)	.48 (.01)	.67 (.02)
Days hospitalized, mean	.34 (.01)	1.04 (.04)	1.86 (.10)	1.68 (.06)	3.42 (.14)
Home health	1.19% (.06)	3.99% (.20)	6.11% (.37)	5.28% (.28)	10.35% (.56)
Total number of services used, mean	1.80 (.01)	3.09 (.01)	3.45 (.02)	3.39 (.01)	3.85 (.02)
Expenditures for care					
Annual medical expenditures, mean, median	\$3,235 (\$62), \$575 (\$14)	\$8,911 (\$181), \$4,180 (\$58)	\$14,103 (\$396), \$7,360 (\$140)	\$13,822 (\$266), \$8,077 (\$96)	\$25,419 (\$575), \$16,928 (\$214)
Out of pocket medical expenditures, mean, median	\$497 (\$8), \$117 (\$3)	\$1,229 (\$21), \$716 (\$11)	\$1,712 (\$39), \$1,093 (\$23)	\$1,630 (\$32), \$952 (\$17)	\$2,192 (\$70), \$1,217 (\$42)

Note: All numbers presented in parentheses are standard errors of the given estimate.

Table 2
Persons aged 18-65 with and without chronic conditions and disabilities: Overlap with high end healthcare users, differences in sociodemographics, and patterns of healthcare service use, access and cost, pooled annual estimates, MEPS 2006-2008

	No chronic conditions	One or more chronic conditions	No disability (a)	Non- ADL/IADL disability (b)	ADL/IADL disability (c)
N	25,891	27,695	44,133	7,190	2,263
Population size, millions	85.98	98.70	153.65	24.29	6.75
Sociodemographics					
Age, mean	36.57 (.13)	45.45 (.14) *	40.03 (.12) <i>bc</i>	47.71 (.24) <i>a</i>	47.45 (.40) <i>a</i>
Gender, female	44.94% (.40)	55.82% (.35) *	49.91% (.26) <i>bc</i>	53.94% (.73) <i>ac</i>	58.62% (1.48) <i>ab</i>
Race/Ethnicity					
NH white	59.96% (.88)	72.57% (.69) *	65.93% (.76) <i>b</i>	71.64% (.92) <i>ac</i>	66.45% (1.53) <i>b</i>
NH Black	12.62% (.54)	11.22% (.48) *	11.41% (.47) <i>bc</i>	13.25% (.67) <i>ac</i>	17.37% (1.20) <i>ab</i>
Hispanic	19.21% (.78)	10.47% (.45) *	15.57% (.60) <i>bc</i>	9.32% (.59) <i>a</i>	9.86% (.82) <i>a</i>
Other/multiple	8.21% (.43)	5.75% (.33) *	7.10% (.36) <i>b</i>	5.78% (.42) <i>a</i>	6.33% (.77)
Poverty: <=125% of FPL	27.82% (.53)	24.54% (.49) *	23.08% (.43) <i>bc</i>	37.29% (.82) <i>ac</i>	53.49% (1.52) <i>ab</i>
Less than high school educ.	15.42% (.44)	11.62% (.31) *	12.37% (.34) <i>bc</i>	16.36% (.61) <i>ac</i>	25.95% (1.26) <i>ab</i>
Health status					
Overall health fair or poor	8.58% (.27)	29.12% (.45) *	12.07% (.25) <i>bc</i>	51.52% (.93) <i>ac</i>	75.22% (1.36) <i>ab</i>
Mental health fair or poor	4.74% (.20)	18.30% (.37) *	6.79% (.19) <i>bc</i>	32.28% (.80) <i>ac</i>	57.68% (1.47) <i>ab</i>
Insurance and access to care					
Insured all year	62.43% (.91)	77.26% (.42) *	70.11% (.47) <i>c</i>	69.49% (.74) <i>c</i>	79.05% (1.10) <i>ab</i>
Any private	92.69% (.38)	87.72% (.39) *	94.30% (.25) <i>bc</i>	75.27% (.92) <i>ac</i>	44.21% (1.79) <i>ab</i>
Public only	7.31% (.38)	12.28% (.39) *	5.70% (.25) <i>bc</i>	24.73% (.92) <i>ac</i>	55.79% (1.79) <i>ab</i>
Uninsured part year	13.38% (.30)	10.91% (.26) *	12.02% (.23) <i>c</i>	12.92% (.51) <i>c</i>	9.98% (.69) <i>ab</i>
Uninsured all year	24.19% (.55)	11.83% (.30) *	17.88% (.39) <i>c</i>	17.59% (.64) <i>c</i>	10.97% (.84) <i>ab</i>
Medical care delayed or not received	3.64% (.18)	8.62% (.26) *	4.46% (.16) <i>bc</i>	14.75% (.60) <i>ac</i>	17.89% (1.00) <i>ab</i>
RX delayed or not received	1.29% (.09)	6.99% (.23) *	2.69% (.12) <i>bc</i>	11.57% (.48) <i>ac</i>	15.77% (.90) <i>ab</i>

	No chronic conditions	One or more chronic conditions	No disability (a)	Non- ADL/IADL disability (b)	ADL/IADL disability (c)
Services Used					
Primary care doctor, mean	.38 (.01)	1.51 (.02) *	.78 (.01) <i>bc</i>	1.81 (.05) <i>ac</i>	2.64 (.11) <i>ab</i>
Specialty doctor, mean	.83 (.02)	3.21 (.05) *	1.56 (.03) <i>bc</i>	4.18 (.13) <i>ac</i>	7.09 (.31) <i>ab</i>
RX fills, mean	1.44 (.03)	17.25 (.23) *	6.48 (.11) <i>bc</i>	22.48 (.50) <i>ac</i>	42.21 (1.32) <i>ab</i>
Therapies, PT, OT or ST	3.91% (.18)	9.59% (.25) *	5.37% (.16) <i>bc</i>	13.66% (.53) <i>ac</i>	18.60% (1.15) <i>ab</i>
Mental Health	.61% (.08)	6.55% (.23) *	2.50% (.12) <i>bc</i>	8.43% (.44) <i>ac</i>	16.14% (1.15) <i>ab</i>
ED visits, mean	.10 (.00)	.24 (.01) *	.13 (.00) <i>bc</i>	.35 (.01) <i>ac</i>	.63 (.03) <i>ab</i>
Days hospitalized, mean	.14 (.01)	.52 (.02) *	.18 (.01) <i>bc</i>	.63 (.04) <i>ac</i>	2.92 (.23) <i>ab</i>
Home health	.20% (.03)	2.05% (.11) *	.29% (.03) <i>bc</i>	1.88% (.17) <i>ac</i>	19.17% (1.21) <i>ab</i>
Total number of services used, mean	1.02 (.01)	2.49 (.01) *	1.61 (.01) <i>bc</i>	2.60 (.02) <i>ac</i>	3.44 (.05) <i>ab</i>
Expenditures for care					
annual medical expenditures, mean, median	\$1,017 (42), \$62 (4)	\$5,167 (103), \$1,704 (30) *	\$2,148 (52), <i>bc</i> \$394 (11) <i>bc</i>	\$6,654 (216), <i>ac</i> \$2,442 (86) <i>ac</i>	\$15,673 (763) <i>ab</i> \$7,015 (389) <i>ab</i>
OOP medical expenditures, mean, median	\$168 (5), \$4 (<1)	\$783 (14), \$341 (7) *	\$394 (8), <i>bc</i> \$84 (3) <i>bc</i>	\$914 (27), <i>ac</i> \$398 (16) <i>ac</i>	\$1,322 (61), <i>ab</i> \$519 (34) <i>ab</i>
Overlap with elevated and high utilization groups					
Elevated utilization	8.83% (.25)	48.15% (.43) *	23.06% (.33) <i>bc</i>	58.73% (.81) <i>ac</i>	80.19% (1.20) <i>ab</i>
Elevated expenditures	6.58% (.19)	30.19% (.39) *	14.05% (.24) <i>bc</i>	39.09% (.79) <i>ac</i>	64.72% (1.36) <i>ab</i>
High utilization	2.35% (.13)	21.72% (.36) *	7.60% (.21) <i>bc</i>	32.47% (.80) <i>ac</i>	57.57% (1.44) <i>ab</i>
High expenditures	2.20% (.11)	12.47% (.27) *	4.61% (.14) <i>bc</i>	18.23% (.61) <i>ac</i>	39.81% (1.36) <i>ab</i>

Notes: All numbers presented in parentheses are standard errors of the given estimate. Statistical significance was determined with pairwise t-tests and the results are noted with the following superscripted labels

* differs significantly from the estimate for persons without chronic conditions.

^a differs from the estimate for persons without disabilities.

^b differs from the estimate for persons with non-adl/iadl disabilities.

^c differs from the estimate for persons with adl/iadl disability. Significance was determined at the p<.05 level after controlling the false discovery rate.

Table 3
Elevated or high utilization and cost among persons aged 18-65: Prevalence, conditions and service use patterns stratified by chronic condition and disability status: Covariate controlled, predicted marginal estimates, MEPS 2006-2008.

	No chronic condition (a)	Chronic condition with no disability (b)	Chronic condition with non-ADL/IADL disability (c)	Chronic condition with ADL/IADL disability (d)
Utilization				
Elevated	18.12% (.47) <i>bcd</i>	40.82% (.50) <i>acd</i>	65.66% (.84) <i>abd</i>	84.95% (1.23) <i>abc</i>
High	4.99% (.26) <i>bcd</i>	14.15% (.37) <i>acd</i>	34.68% (.90) <i>abd</i>	57.51% (1.61) <i>abc</i>
Elevated utilization group				
Acute conditions, mean	3.02 (.06) <i>cd</i>	2.94 (.04) <i>cd</i>	3.88 (.06) <i>abd</i>	4.63 (.12) <i>abc</i>
Chronic conditions, mean	(N/A)	2.61 (.024) <i>cd</i>	3.68 (.05) <i>bd</i>	4.41 (.10) <i>bc</i>
Services used:				
Primary care MD, mean	1.19 (.06) <i>bcd</i>	1.90 (.04) <i>acd</i>	2.56 (.07) <i>abd</i>	2.97 (.13) <i>abc</i>
Specialty MD, mean	4.76 (.14) <i>cd</i>	4.52 (.09) <i>cd</i>	7.04 (.21) <i>abd</i>	9.37 (.42) <i>abc</i>
RX fills, mean	6.58 (.29) <i>bcd</i>	23.02 (.36) <i>acd</i>	33.81 (.61) <i>abd</i>	47.43 (1.31) <i>abc</i>
Therapies, PT, OT or ST	27.48% (1.32) <i>bc</i>	14.78% (.57) <i>acd</i>	19.99% (.83) <i>abd</i>	24.87% (1.58) <i>bc</i>
Mental health	2.56% (.54) <i>bcd</i>	8.55% (.37) <i>acd</i>	14.99% (.84) <i>abd</i>	21.50% (1.52) <i>abc</i>
Home health	2.48% (.40) <i>bd</i>	1.15% (.13) <i>acd</i>	3.07% (.29) <i>bd</i>	21.30% (1.60) <i>abc</i>
ED visits, mean	.40 (.02) <i>bcd</i>	.31 (.01) <i>acd</i>	.50 (.02) <i>abd</i>	.70 (.04) <i>abc</i>
Hospital days, mean	1.11 (.12) <i>bd</i>	.60 (.03) <i>acd</i>	.96 (.06) <i>bd</i>	2.91 (.26) <i>abc</i>
Total number of services used, mean	2.76 (.03) <i>bcd</i>	2.93 (.01) <i>acd</i>	3.32 (.02) <i>abd</i>	3.88 (.05) <i>abc</i>
High utilization group				
Acute conditions, mean	3.53 (.10) <i>cd</i>	3.49 (.06) <i>cd</i>	4.36 (.08) <i>abd</i>	5.12 (.15) <i>abc</i>
Chronic conditions, mean	(N/A)	3.12 (.05) <i>cd</i>	4.30 (.07) <i>bd</i>	5.04 (.13) <i>bc</i>
Services used:				
Primary care MD, mean	1.44 (.19) <i>bcd</i>	2.24 (.08) <i>acd</i>	3.03 (.12) <i>abd</i>	3.40 (.17) <i>abc</i>
Specialty MD, mean	6.07 (.37) <i>bcd</i>	6.97 (.20) <i>acd</i>	9.64 (.34) <i>abd</i>	11.64 (.55) <i>abc</i>
RX fills, mean	7.89 (.66) <i>bcd</i>	33.43 (.80) <i>acd</i>	46.57 (.98) <i>abd</i>	59.55 (1.63) <i>abc</i>
Therapies, PT, OT or ST	42.56% (2.78) <i>bcd</i>	23.71% (1.05) <i>a,d</i>	26.24% (1.21) <i>a</i>	29.28% (1.58) <i>ab</i>
Mental health	3.55% (.96) <i>bcd</i>	12.68% (.83) <i>acd</i>	19.71% (1.18) <i>abd</i>	25.06% (1.87) <i>abc</i>
Home health	2.61% (.75) <i>d</i>	1.7% (.29) <i>cd</i>	3.56% (.43) <i>bd</i>	21.77% (1.73) <i>abc</i>
ED visits, mean	.56 (.05) <i>bd</i>	.41 (.02) <i>acd</i>	.66 (.03) <i>bd</i>	.79 (.05) <i>abc</i>
Hospital days, mean	2.04 (.39) <i>bd</i>	1.12 (.09) <i>acd</i>	1.45 (.11) <i>bd</i>	3.94 (.36) <i>abc</i>
Total number of services used, mean	2.96 (.06) <i>bcd</i>	3.21 (.02) <i>acd</i>	3.57 (.03) <i>abd</i>	4.08 (.05) <i>abc</i>
Cost				
Elevated	13.24% (.36) <i>bcd</i>	23.44% (.42) <i>acd</i>	44.15% (.95) <i>abd</i>	67.32% (1.49) <i>abc</i>
High	4.37% (.21) <i>bcd</i>	7.69% (.26) <i>acd</i>	20.91% (.75) <i>abd</i>	40.35% (1.53) <i>abc</i>

	No chronic condition (a)	Chronic condition with no disability (b)	Chronic condition with non-ADL/IADL disability (c)	Chronic condition with ADL/IADL disability (d)
Elevated cost group				
Acute conditions, mean	2.86 (.07) <i>bcd</i>	3.19 (.05) <i>acd</i>	4.14 (.07) <i>abd</i>	4.84 (.14) <i>abc</i>
Chronic conditions, mean	(N/A)	2.76 (.04) <i>cd</i>	3.97 (.06) <i>bd</i>	4.68 (.12) <i>bc</i>
Services used:				
Primary care MD, mean	.89 (.05) <i>bcd</i>	1.88 (.05) <i>acd</i>	2.63 (.09) <i>abd</i>	3.09 (.14) <i>abc</i>
Specialty MD, mean	5.33 (.16) <i>bcd</i>	5.91 (.14) <i>acd</i>	8.75 (.29) <i>abd</i>	10.65 (.50) <i>abc</i>
RX fills, mean	6.17 (.29) <i>bcd</i>	24.60 (.49) <i>acd</i>	39.04 (.82) <i>abd</i>	52.06 (1.56) <i>abc</i>
Therapies PT, OT or ST	16.76% (1.38) <i>cd</i>	14.78% (.66) <i>cd</i>	22.29% (1.07) <i>ab</i>	24.92% (1.70) <i>ab</i>
Mental health	1.05% (.26) <i>bcd</i>	8.88% (.56) <i>acd</i>	15.91% (1.01) <i>abd</i>	23.40% (1.79) <i>abc</i>
Home health	2.34% (.42) <i>cd</i>	1.50% (.21) <i>cd</i>	3.80% (.39) <i>abd</i>	23.60% (1.77) <i>abc</i>
ED visits, mean	.36 (.02) <i>cd</i>	.39 (.02) <i>cd</i>	.59 (.03) <i>abd</i>	.79 (.05) <i>abc</i>
Hospital days, mean	1.76 (.16) <i>bd</i>	1.12(.06) <i>acd</i>	1.44 (.09) <i>bd</i>	3.67 (.31) <i>abc</i>
Total number of services used, mean	2.99 (.03) <i>bcd</i>	3.25 (.02) <i>acd</i>	3.60 (.03) <i>abd</i>	4.09 (.05) <i>abc</i>
High cost group				
Acute conditions, mean	2.92 (.10) <i>bcd</i>	3.50 (.09) <i>acd</i>	4.43 (.10) <i>abd</i>	5.28 (.17) <i>abc</i>
Chronic conditions, mean	(N/A)	2.97 (.06) <i>cd</i>	4.28 (.10) <i>bd</i>	5.09 (.15) <i>bc</i>
Services used:				
Primary care MD, mean	.90 (.09) <i>bcd</i>	1.89 (.08) <i>acd</i>	2.74 (.12) <i>abd</i>	3.19 (.18) <i>abc</i>
Specialty MD, mean	6.83 (.32) <i>bcd</i>	8.09 (.27) <i>acd</i>	11.40 (.52) <i>ab</i>	13.01 (.73) <i>ab</i>
RX fills, mean	6.94 (.58) <i>bcd</i>	26.55 (.87) <i>acd</i>	47.06 (1.44) <i>abd</i>	59.56 (2.37) <i>abc</i>
Therapies PT, OT or ST	16.48% (2.17) <i>cd</i>	16.93% (1.25) <i>cd</i>	24.18% (1.45) <i>abd</i>	30.54% (2.27) <i>abc</i>
Mental health	1.12% (.51) <i>bcd</i>	9.55% (1.02) <i>acd</i>	16.62% (1.45) <i>abd</i>	24.68% (2.20) <i>abc</i>
Home health	3.47% (.74) <i>cd</i>	3.35% (.60) <i>cd</i>	7.08% (.81) <i>abd</i>	31.35% (2.29) <i>abc</i>
ED visits, mean	.46 (.04) <i>cd</i>	.53 (.03) <i>cd</i>	.78 (.06) <i>ab</i>	.94 (.07) <i>ab</i>
Hospital days, mean	3.56 (.47) <i>bd</i>	2.61(.16) ^{a,d}	2.77 (.17) ^d	5.52 (.45) <i>abc</i>
Total number of services used, mean	3.33 (.05) <i>bcd</i>	3.63 (.03) <i>acd</i>	3.97 (.04) <i>abd</i>	4.45 (.05) <i>abc</i>

After controlling covariates, superscripted letters indicate a significant ($p < .05$) difference from the estimated mean or percentage for persons

^a without chronic conditions,

^b with chronic condition(s) and no disability,

^c with chronic condition(s) and non-ADL/IADL disability,

^d with chronic conditions and ADL/IADL disability. Standard errors of the estimates are given in parentheses.