

Emergency Department and Inpatient Utilization among U.S. Older Adults with Multiple Chronic Conditions: A Post-Reform Update

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Abstract

Background The Affordable Care Act (ACA) was enacted to enhance access to care primarily among nonelderly and low-income populations; however, several provisions addressed key determinants of emergency department (ED) and inpatient visits among Medicare beneficiaries over age 65 years. We take stock of the overall changes in these visits among older Medicare beneficiaries, focusing on those with multiple chronic conditions (MCCs), and provide a nationally representative post-reform update. **Methods** We analyzed a sample of 32,919 older adults (65+) on Medicare from the 2006-2015 Medical Expenditure Panel Survey (MEPS). Using survey-weighted logistic regression, we examined changes in ED visits, inpatient visits, and length of stay (LOS) by MCC status, before (2006-2010), during (2011-2013), and after the ACA (2014-2015). **Results** Prior to the ACA, 18.1% of Medicare older adults had ≥ 1 ED visit, whereas 17.1% had ≥ 1 inpatient visits, with an average of 5.1 nights/visit. Following ACA reforms, among those with 2+ chronic conditions, the rate of ever having an ED visit increased by 4.3 percentage points [95% confidence intervals [CI]: 2.5, 6.1, $p < 0.01$], whereas the rate of inpatient visits decreased by 1.4 percentage points [95%CI: -2.9, 0.2, $p < 0.1$], after multivariable adjustment. **Conclusions** We found sizable increases in ED visits and nontrivial decreases in inpatient visits among older Medicare beneficiaries with MCCs, underscoring the continuing need for improving access to and quality of care among older adults with MCCs to decrease reliance on the ED and reduce preventable hospitalizations.

Background

Having multiple chronic conditions (MCCs), the coexistence of two or more chronic conditions [1], has emerged as a serious public health concern among older adults in the United States [2]. More than 8 out of 10 older adults suffered from MCCs in 2014 [3], requiring ongoing disease management over a period of years or decades. MCCs are associated with decreased quality of life and functional decline among older adults [1, 4]. Compared to older adults without a chronic condition, older adults with one, two, and three or more conditions are likely to experience a loss of 4.7, 7.9, and 10.8 quality-adjusted life years (QALY), respectively [5]. The presence of MCCs increases the risk of developing functional limitation [6]; onset of moderate functional limitation is far more likely among 80-year-olds with MCCs than their counterparts without MCCs (50% vs. 22%, respectively) [7].

Further, MCCs are associated with a significant financial burden due to increasing ambulatory, emergency department, and hospital visits [8]. In the Medicare program, the annual Medicare payments for a beneficiary grew from \$7,172, to \$14,931, to \$32,498 when the beneficiary had one, two, and three or more chronic conditions, respectively [9]. As the population ages and Baby Boomers continue to retire on to Medicare, the impacts of MCCs on Medicare spending, especially Medicare Part A whose funds are expected to be depleted by 2026 [10], warrant urgent scrutiny.

The Patient Protection and Affordable Care Act (ACA) of 2010 was enacted to accomplish the Triple Aim: better healthcare, better health outcomes, and better value [11-13]. Although ACA's coverage provisions were primarily focused on the non-elderly population [14], the law had several key provisions that

specifically applied to older adults in Medicare. First and foremost, the law took direct aim at reducing Medicare spending growth through the Independent Payment Advisory Board as well as various provisions related to healthcare quality, utilization, and payment [10, 15]. As of January 2011, the ACA eliminated cost-sharing for preventive services and authorized coverage of personalized prevention plans, including Annual Wellness Visits under Part B [16]. Older Medicare beneficiaries may have also benefitted from innovative payment and delivery models (e.g., accountable care organizations, bundled payment, and patient-centered medical homes) [17-19]. Further, ACA's strict regulations and penalties related to hospital utilization (e.g., ED visits, inpatient visits, and length of stay [LOS]), including the Hospital Readmission Reduction Program (HRRP) [20], may have also affected older Medicare beneficiaries, especially those with MCCs. Table 1 lists these and other key ACA provisions relevant to older adults with MCCs.

Rather than evaluating the specific effects of each of these individual provisions on older adults with MCCs [21-24], which took effect between 2011 and 2014, we took stock of the overall post-ACA changes in two costly and quality-sensitive utilization patterns: emergency department and inpatient visits. By providing a post-reform update with nationally representative estimates, this analysis can inform continuing efforts to improve the quality of care and reduce spending among older Medicare beneficiaries with MCCs in this era with a precarious healthcare future.

Methods

Sample and Data

We analyzed data from the Medical Expenditure Panel Survey (2006-2015), a nationally representative survey of the civilian non-institutionalized population, for 32,919 Medicare beneficiaries 65 years and older. We linked respondents' data in MEPS annual files to their respective records from the Medical Conditions files, and then pooled linked datasets for years 2006-2015. Our data cover three distinct periods with respect to the ACA: pre-ACA (2006-2010), implementation period of ACA provisions relevant to older adults with MCCs (2011-2013), and post-ACA (2014-2015).

Measures

Outcomes: As primary outcomes, we first documented the prevalence of having any (at least one) emergency department (ED) visit, hospital inpatient visit, and overnight inpatient stay. As secondary outcomes, we analyzed counts of ED visits, inpatient visits, and LOS (total and average).

Chronic Conditions: We identified chronic conditions by using the definitions developed by Hwang and colleagues, and adopted by the Agency for Healthcare Research and Quality [25, 26], applied to International Classification of Diseases 9th Revision (ICD-9) 3-digit codes in the MEPS Medical Conditions files. We then calculated the total number of unique chronic conditions for each respondent, and categorized them as having 0, 1, 2, 3, 4, or 5+ chronic conditions. Those with ≥ 2 conditions were classified as having MCCs.

Covariates: Our analysis used data about respondents' characteristics known to be related to ED visits, inpatient services, and having MCCs. Respondent sociodemographic characteristics included age, gender, race/ethnicity, language, marital status, region, income relative to the federal poverty line (FPL), and education. To measure respondents' health status, we included self-rated general and mental health, activity limitations (physical and cognitive), and what chronic condition(s) they had (e.g., high blood pressure, diabetes, heart disease, stroke, and asthma). We also considered respondents' access to care including types of payer (i.e., Medicaid, private insurance), having a usual source of care, receiving needed medical care, and getting needed prescription drugs. These factors are key determinants of ED use and hospitalization.

Statistical Analysis

The goal of our analysis was to provide an update of where levels of ED visits and inpatient stays stand among older adults with MCCs following relevant ACA reforms, relative to the pre-ACA period. In our statistical models, this was accomplished by interacting a period indicator (pre-ACA = 0, post-ACA = 1) with chronic condition categories (having 5+, 4, 3, 2, 1, vs. 0), while including the main effects of these variables as well as the aforementioned confounding covariates. Since we are interested in the specific association of having MCCs with ED/inpatient utilization, we adjusted for potential confounding by the particular conditions respondents have had as well as the key predisposing/enabling sociodemographic and access-related factors, which are likely related to both the need/ability to use the ED/hospital and developing MCCs in the first place.

We analyzed binary outcomes (prevalence of having ≥ 1 utilization event [i.e., visit or night]) in logit models. For count outcomes, we used two-part, logit-negative binomial models, with the negative-binomial part estimated conditional on having ≥ 1 event. Two-part models (known as hurdle models for count data) handle the severely right-skewed nature of count distributions, with a concentrated mass of zeros on the left-hand side of the distribution and a very long right tail [27]. Two-part models also allow recovering population-average estimates of change in outcome levels from the entire sample, as opposed to conditional estimates obtained from models fit only to the subsample with ≥ 1 event [28]. After estimating each of our logit and two-part models, we recovered the adjusted, average marginal probability (of having ≥ 1 event) and count of events, by ACA period and MCC category. Finally, we estimated the pre-post-ACA changes in probabilities and counts for each MCC category. All estimates were adjusted for complex survey design, and were made nationally representative using survey weights. All analyses were performed in Stata 14.2 (StataCorp, College Station, TX).

Results

As Table 2 shows, respondents were 74 years-old on average (± 6.3 years), and 56.5% were female, 79.6% were non-Hispanic White, and 33.5% were poor or low-income ($< 200\%$ FPL). Fifty-eight percent had physical or cognitive limitations, while 80.6% had MCCs, including 32.4% with ≥ 5 chronic conditions. High blood pressure (68.4%) and arthritis (59.0%) were the most prevalent conditions. Besides Medicare,

53% also had private supplementary insurance and 10% received Medicaid. The vast majority (93.9%) had a usual source of care and reported no problems accessing needed care or prescription drugs (97.2%). Sample characteristics were generally stable over the study period.

The rates of having any ED visits and inpatient stays in our sample changed from 18.1% and 17.1% pre-ACA (2006-2010) to 21.0% and 15.6% post-ACA (2014-15), respectively. Among those who ever had a visit, there was an average of 1.4 ED visits and 1.4 inpatient visits, with 5.1 nights spent in the hospital on average per visit, prior to the ACA (Table 2). While there was generally a downward trend in ED visits until 2011 (Figure 1a), rates increased between 2011 and 2013 among all groups (See Supplementary Tables for detailed statistics). The data further reveal some tapering off into 2015, except among those with ≥ 5 conditions who continued to see a potentially steeper increase. Inpatient visit rates (Figure 1b) also trended down from 2006 to 2015 for groups with <4 conditions. However, among those with ≥ 4 conditions, inpatient visit rates increased after 2011 into 2015.

After multivariable adjustment, ED visit rates (having ≥ 1 visits) in 2014-2015 were overall higher than the pre-ACA period among all beneficiaries with ≥ 2 conditions by 4.3 percentage points (95% confidence interval [CI]: 2.5, 6.1) (Figure 2a). For inpatient visits, we detected a drop in rates among all beneficiaries, especially those with just 2 chronic conditions who experienced a decrease in the probability of having at least 1 visit by 3.3 percentage points (95%CI: -6.1, -0.5) (Figure 2b). Overall, those with ≥ 2 conditions saw a marginal drop by 1.4 percentage points (95%CI: -2.9, 0.2) in inpatient visit rates in 2014-2015. Changes in LOS (inpatient nights) also followed a similar pattern (Figure 3).

Discussion

In the first two years following the ACA (2014-2015), we detected sizable increases in ED use and nontrivial decreases in inpatient visits among older Medicare beneficiaries with MCCs. To our knowledge, this is the first study to take a big-picture view and document the overall changes in hospital utilization by MCC status among older Medicare beneficiaries in the context of recent healthcare reform using a large, nationally representative dataset. The ACA was designed to primarily improve access to care among nonelderly and low-income populations, and has been associated with a reduction in the total number of the uninsured from 18.2% in 2010 to 10.4% in 2016 [29]. The reduction in the number of the uninsured was primarily centered on younger age groups: adults ages 19-34 by 42% (8.7 million), 35-54 by 33% (5.6 million), and 55-64 by 33% (2.0 million) [30]. Simultaneously, the total number of Medicare beneficiaries increased by 13.5% from 48.9 million in 2011 to 55.5 million in 2015 [29]. However, there is little evidence about how hospital utilization among older Medicare beneficiaries with MCCs has changed since the ACA was introduced.

Our analysis shows that over time, inpatient visits showed a nontrivial decrease among older Medicare beneficiaries. Such decrease is consistent with existing evidence showing decreasing expenditure on hospital inpatient stays by 6.6%, from 37.8 million in 2005 to 35.4 million in 2014 [31]. There are a couple of plausible explanations for these decreases. First, inpatient visits may have decreased because of the

ACA's enhanced coverage of preventive services under Medicare Part B [32], which eliminated patients' cost-sharing and introduced free Annual Wellness Visits [23]. The second probable reason would be the introduction of the Hospital Readmissions Reduction Program (HRRP), which penalizes hospitals with above-average readmissions for Medicare patients with preventable conditions, including myocardial infarction, pneumonia, and heart failure [36]. The significant penalty (i.e., 3% of Medicare payments) likely prompted hospitals to proactively avert repeated admissions [22] while potentially motivating hospitals to use observation status [37]. Naturally, hospitals spent a great amount of resources to develop and strengthen care coordination [38], transitional care [39], and adopt voluntary value-based reforms [40] to avoid unnecessary readmissions. Further studies are warranted to investigate the roles of the enhanced coverage of preventive services and HRRP in decreasing inpatient care.

Our second main finding is the increase in the probability of having ≥ 1 ED visit by 4.3 percentage points in the post-ACA period among older Medicare beneficiaries with 2+ MCCs. This is a sizable increase of $\sim 25\%$ from pre-ACA levels (17%). We postulate that hospital responses to the HRRP might offer an explanation for this pattern as well. The previous literature speculated that the HRRP may have encouraged hospitals to "game the system" by holding more patients in ED or admitting them for observation [22]. Observation stays significantly increased after the HRRP went into effect for target conditions, but not for the non-target conditions [41]. Another study confirmed that the top 10% of hospitals with the largest drop in hospital readmission increased the use of observation status by 25% among Medicare patients returning within 30 days [42].

Our study has key strengths, including providing nationally representative estimates over policy-relevant time periods, and using a validated scheme for identifying and counting chronic conditions among older adults. However, one key limitation deserves comment. While our goal was to document the changes in ED/inpatient use potentially driven by all ACA reforms relevant to older adults with MCCs, our findings do not necessarily have a causal interpretation as exclusively being due to the ACA. This is because of the lack of an appropriate control group that was not exposed to all of the reforms we discussed. While the non-MCC group in our analysis was arguably the least affected by the ACA, the fact that the non-MCC group is much healthier than their MCC counterparts suggests that they are also potentially different in other important observable and unobservable ways as well, and hence not a good control group. Additionally, while two years following ACA may not be sufficient to detect stable post-reform levels of our outcomes, 2015 is the most recently available year of MEPS data for which chronic conditions can be identified using ICD-9 codes

Conclusions

Our evaluation permits a better understanding of overall hospital use patterns among older Medicare beneficiaries with MCCs throughout the course of the ACA. We documented an increase in ED visits but a decrease in inpatient utilization among the population following the ACA. This seemingly paradoxical relationship warrants further examination over longer post-ACA periods, as well as identification of the

underlying patient- and system-level causes of such change, in order to improve the access to care and quality of care while containing the healthcare cost among older adults.

Abbreviations

ACA: Affordable care act; ED: Emergency visit; MCC: Multiple chronic conditions; MEPS: Medical Expenditure Panel Survey; LOS: Length of stay; CI: Confidence intervals; QALY: Quality-adjusted life years; HRRP: Hospital Readmission Reduction Program; ICD-9: International Classification of Diseases 9th Revision; FPL: Federal poverty line.

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Declarations

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Availability of data and materials: The Medical Expenditure Panel Survey dataset are publicly available in the Agency for Healthcare Research and Quality: Medical Expenditure Panel Survey webpage in https://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp.

Author Contributions to the Manuscript: SA planned the study, supervised the data analysis, and wrote the paper. MH performed all statistical analyses and contributed to revising the paper. AM helped to critically revise the manuscript. And MS helped to plan the study, including the instrumentation, and to revise the manuscript.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not application

Competing interests

The authors declare that they have no competing interests.

Tables

Table 1. Key Affordable Care Act (ACA) Provisions Relevant to Older Adults with Multiple Chronic Conditions

Quality	Effective Date
Improve <u>care coordination for dual eligibles</u> by creating a new office within the CMS services.	March 2010
Reduce Medicare payments to certain hospitals for <u>hospital-acquired conditions</u> by 1%.	October 2015
Reduce Medicare payments that would otherwise be made to hospitals by specified percentages to account for excess (preventable) <u>hospital readmissions</u> .	October 2012
Provide incentives to Medicare and Medicaid beneficiaries to complete <u>behavior modification programs</u> .	January 2011
Access	
Provide payments totaling \$400 million in fiscal years 2011 and 2012 to qualifying hospitals in counties with the lowest quartile Medicare spending.	January 2011
Provide a 10% bonus payment to primary care physicians in Medicare from 2011 through 2015.	January 2011
Reduce <u>Medicare Disproportionate Share Hospital</u> (DSH) payments initially by 75% and increase payments.	October 2014
<u>Eliminate cost-sharing</u> for Medicare covered preventive services and waive the Medicare deductible for <u>colorectal cancer screening tests</u> .	January 2011
Authorize Medicare coverage of annual <u>personalized prevention plan services</u> .	January 2011
Cost	
Increase the Medicare Part A (hospital insurance) tax rate on wages by 0.9% (from 1.45% to 2.35%) on earnings over \$200,000 for individual taxpayers and \$250,000 for married couples.	January 2013
Restructure payments to Medicare Advantage (MA) plans by setting payments to different percentages of Medicare fee-for-service (FFS) rates.	January 2011
Establish an Independent Payment Advisory Board to submit legislative proposals containing recommendations to reduce the per capita rate of growth in Medicare spending.	April 2013
Cost & Quality (Alternative Payment Models)	
Allow providers organized as <u>accountable care organizations (ACOs)</u> that voluntarily meet quality thresholds to share in the cost savings they achieve for the Medicare program.	January 2012
Establish a hospital <u>value-based purchasing</u> program in Medicare to pay hospitals based on performance on quality measures.	October 2012
Establish a national Medicare pilot program to develop and evaluate paying a <u>bundled payment</u> .	January 2013
[Promote] patient-centered medical home models for high-need applicable individuals.	January 2011

Table 2. Sample Characteristics Before and After the Affordable Care Act (ACA), MEPS 2006-2015

	<i>Pre-ACA</i> (2006-2010)	<i>ACA (2011-2013)</i>	<i>Post-ACA</i> (2014-2015)	Overall
Sample Size	15,548	10,313	7,058	32,919
Population Represented	16,723,986	11,515,758	8,256,622	36,496,366
Outcomes				
<i>Any ED Visits</i>	18.1	18.2	21.0	18.8
Number of ED Visits (if 1+), Mean (SD)	1.4 (0.9)	1.4 (0.8)	1.6 (1.1)	1.4 (0.9)
<i>Any Inpatient Visits</i>	17.1	15.2	15.6	16.2
Number of Inpatient Visits (if 1+), Mean (SD)	1.4 (0.8)	1.4 (0.8)	1.5 (1.0)	1.4 (0.9)
Total Inpatient Nights (if 1+), Mean (SD)	7.6 (10.9)	7.4 (13.8)	7.8 (11.6)	7.6 (12.0)
Average Number of Nights/Inpatient Visit (if 1+), Mean (SD)	5.1 (6.5)	5.0 (7.5)	4.9 (6.2)	5.0 (6.8)
Demographics				
Age, Mean (SD)	74.1 (6.3)	73.7 (6.4)	73.5 (6.3)	73.9 (6.3)
Female (%)	57.4	55.7	55.9	56.5
<i>Race/Ethnicity (%)</i>				
White (Non-Hispanic)	80.8	79.5	77.4	79.6
Black (Non-Hispanic)	7.9	8.3	8.6	8.2
Other (Non-Hispanic)	4.5	5.1	6.3	5.1
Hispanic	6.8	7	7.7	7.1
<i>Poverty Level (%)</i>				
Poor/Negative-Income (<100%FPL)	9.3	9.1	9.2	9.2
Near-Poor (100-125%FPL)	7.4	6.2	6.1	6.7
Low-Income (125-200%FPL)	18	18	16.3	17.6
Middle-Income (200-400%FPL)	29.9	29.3	27.2	29.1
High-Income (≥400%FPL)	35.4	37.4	41.3	37.4
<i>Education (%)</i>				
Less than High School	23.7	18.4	16.6	20.5
High School Diploma	35.3	32.4	30.5	33.3
Some College	18.6	22.9	24.4	21.3
Bachelor's Degree or Higher	22.3	26.3	28.6	25.0
<i>Census Region (%)</i>				
Northeast	19.9	18.7	18.7	19.2
Midwest	22.1	22.8	22.3	22.4
South	37.0	36.8	37.2	37.0
West	21.0	21.7	21.8	21.4
<i>Marital Status (%)</i>				
Single/Never Married	3.5	4.2	4.2	3.9
Widowed/Divorced/Separated	42.3	41.4	40	41.5
Married/Cohabiting	54.2	54.5	55.8	54.6
<i>Interview Not In English (%)</i>	3.3	4.2	4.6	3.9
Health Status (%)				
<i>General Health Status (Self-Rated)</i>				
Excellent	14.9	17.1	17.6	16.2
Very Good	29.9	30.5	31.1	30.4
Good	32.8	32.5	31.4	32.4
Fair	16.2	15.0	14.6	15.5

Poor	6.2	4.9	5.3	5.6
<i>Mental Health Status (Self-Rated)</i>				
Excellent	27.8	29.5	30.2	28.9
Very Good	30.9	30.4	29.1	30.3
Good	30.8	30.1	29.8	30.3
Fair	8.2	7.9	8.5	8.1
Poor	2.4	2.3	2.5	2.4
<i>Any Physical or Cognitive Limitations (Self-Reported)</i>				
Chronic Conditions (%)				
<i>Number of Chronic Conditions</i>				
0	7.4	7.2	8.2	7.5
1	12.6	11.1	11.4	11.8
2	16.7	16.4	16.4	16.5
3	16.5	16.9	16.7	16.7
4	14.7	15.2	15.8	15.1
5+	32.2	33.2	31.6	32.4
High Blood Pressure	67.8	69.5	68.2	68.4
Coronary Heart Disease	19.3	19.9	18.9	19.4
Angina	9.0	7.7	7.1	8.2
Myocardial Infarction	12.3	11.8	12.4	12.2
Other Heart Disease	25.0	27.1	29.3	26.6
Stroke	12.2	12.2	11.6	12.0
Diabetes	20.6	21.4	23.2	21.4
Emphysema	6.5	6.5	6.2	6.4
Asthma	8.8	8.7	9.0	8.8
Arthritis	58.1	59.4	60.2	59.0
Insurance and Access to Care (%)				
Had Any Private Insurance	52.3	52.7	54.6	53.0
Had Any Public Insurance	47.7	47.3	45.4	47.0
Had Medicaid (Ever)	9.7	10.3	10.0	10.0
Have a Usual Source of Care	93.9	93.9	94.0	93.9
Cannot Get Needed Medical Care	0.9	1.1	1.6	1.1
Cannot Get Needed Prescription Drugs	1.4	1.7	2.2	1.7

Figures

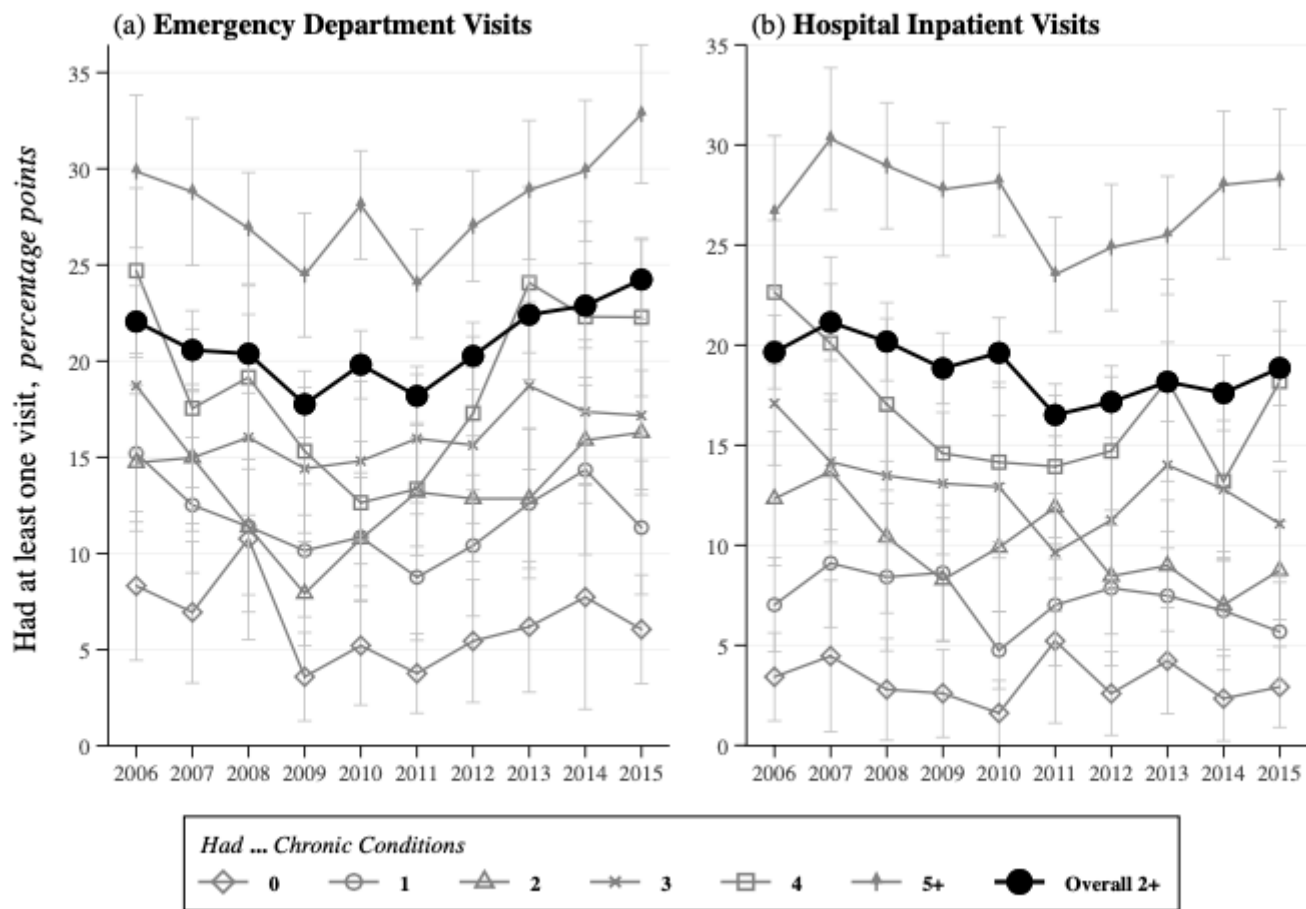


Figure 1

Observed Trends in Emergency Department and Inpatient Visits by Multiple Chronic Condition Levels

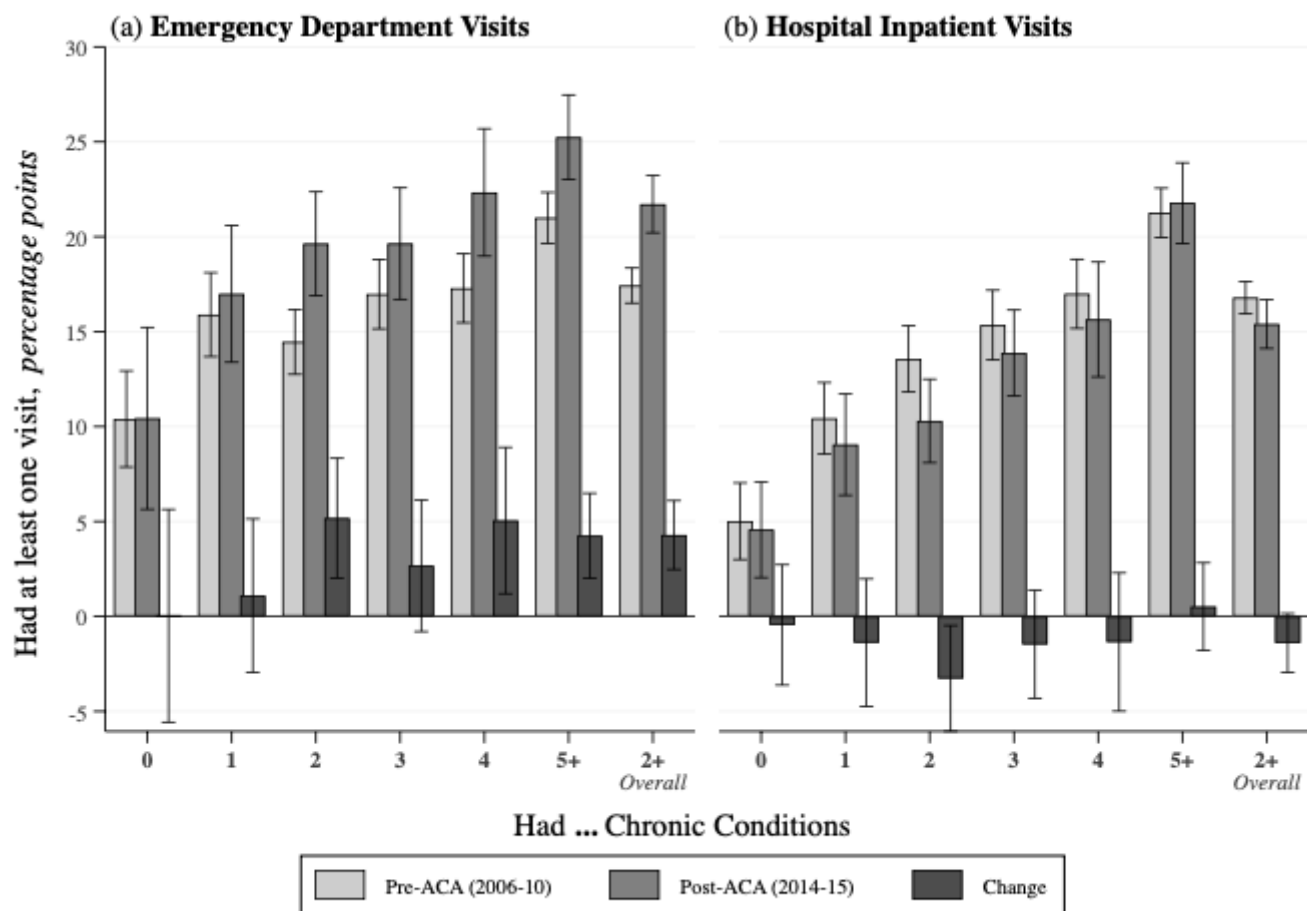


Figure 2

Adjusted estimates for ED and Inpatient probability by Multiple Chronic Condition Levels

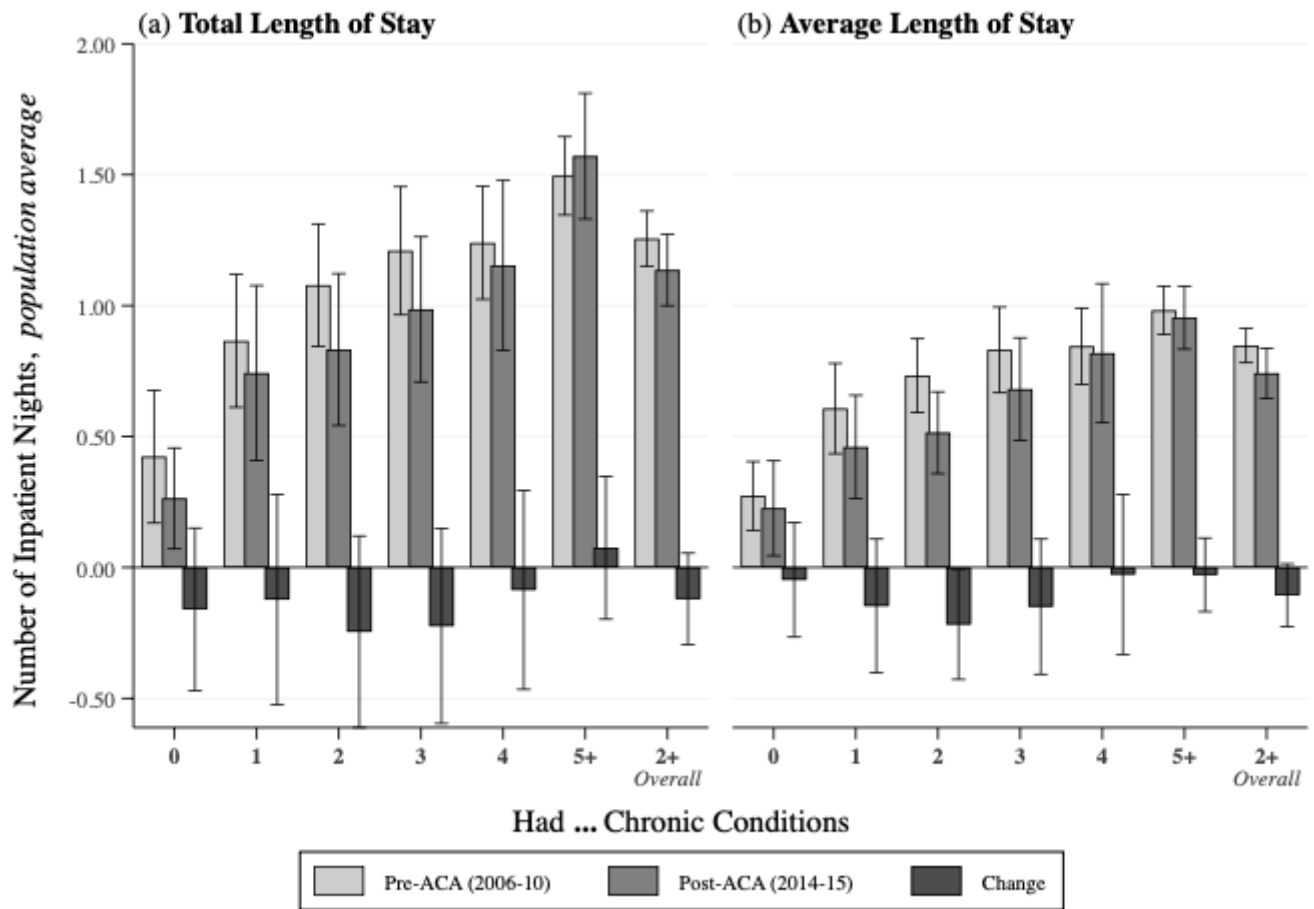


Figure 3

Adjusted estimates for Length of Stay by Multiple Chronic Condition Levels

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [supplement1.docx](#)