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Use of preventive service and potentially preventable hospitalization among American adults with disability: Longitudinal analysis of Traditional Medicare and commercial insurance

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ABSTRACT

Objective: Examine the association between traditional Medicare (TM) vs. commercial insurance and the use of preventive care and potentially preventable hospitalization (PPH) among adults (18+) with disability [cerebral palsy/spina bifida (CP/SB); multiple sclerosis (MS); traumatic spinal cord injury (TSCI)] in the United States.
Methods: Using 2008–2016 Medicare and commercial claims data, we compared adults with the same disability enrolled in TM vs. commercial insurance [Medicare: n = 21,599 (CP/SB); n = 7,605 (MS); n = 4,802 (TSCI); commercial: n = 11,306 (CP/SB); n = 6,254 (MS); n = 5,265 (TSCI)]. We applied generalized estimating equations to address repeated measures, comparing cases with controls. All models were adjusted for age, sex, race/ethnicity, and comorbid conditions.
Results: Compared with commercial insurance, enrolling in TM reduced the odds of using preventive services. For example, adjusted odds ratios (OR) of annual wellness visits in TM vs. commercial insurance were 0.31 (95% confidence interval (CI): 0.28–0.34), 0.32 (95% CI: 0.28–0.37), and 0.19 (95% CI: 0.17–0.22) among adults with CP/SB, TSCI, and MS, respectively. Furthermore, PPH risks were higher in TM vs. commercial insurance. ORs of PPH in TM vs. commercial insurance were 1.50 (95% CI: 1.18–1.89), 1.83 (95% CI: 1.40–2.41), and 2.32 (95% CI: 1.66–3.22) among adults with CP/SB, TSCI, and MS, respectively. Moreover, dual-eligible adults had higher odds of PPH compared with non-dual-eligible adults [CP/SB: OR = 1.47 (95% CI: 1.25–1.72); TSCI: OR = 1.61 (95% CI: 1.35–1.92), and MS: OR = 1.80 (95% CI: 1.55–2.10)].
Conclusions: TM, relative to commercial insurance, was associated with lower receipt of preventive care and higher PPH risk among adults with disability.

1 Introduction

Health insurance is a salient enabling factor in timely access to quality care (Maddox et al., 2019; Andersen et al., 2007). As there is no universal health coverage in the U.S., health insurance may also serve as a proxy for healthcare purchasing power, representing how much a patient can afford or is willing to pay to be insured (Shavers, 2007; Kolenikov and Angeles, 2009; Lu et al., 2004; Ross and Mirowsky, 2000; Ganguli et al., 2018; Shavers, 2007). Thus, one's timely access to care may depend on the type and generosity of one's health insurance.

Abbreviations: AHRQ, Agency for Healthcare Research and Quality; AWV, Annual Wellness Visit; BMD, Bone Mineral Density; CI, Confidence Interval; CP/SB, Cerebral Palsy/Spinal Bifid; ICD-9-CM, Ninth Revisions, Clinical Modification; MA, Medicare Advantage; MBSF, Beneficiary Summary file; MedPAR, Medicare Provider and Analysis Review; MS, Multiple Sclerosis; OR, Odds Ratio; PPH, Potentially Preventable Hospitalization; PT/OT, Physical Therapy and Occupational Therapy; SD, Standard Deviation; SES, Socioeconomic Status; TM, Traditional Medicare; TSCI, Traumatic Spinal Cord Injury; U.S., United States.

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Potentially preventable hospitalizations (PPHs) are inpatient stays for treating ambulatory care-sensitive conditions that could be avoided if the patient had timely access to care (Jiang et al., 2006). PPHs are a commonly used metric of access to, quality, and efficiency of care (Jiang et al., 2006; Hodgson et al., 2019; Moy et al., 2013). Most often, PPHs have deleterious effects on the health and well-being of adults, particularly those with complex care needs (Jiang et al., 2006; Mahmoudi et al., 2020). PPHs also represent an essential target for healthcare cost reduction efforts. For example, in 2017, 3.5 million PPHs accounted for $33.7 billion in healthcare costs (HCUP, 2017). Research has shown that preventive and coordinated care may reduce the risk of PPH (Mahmoudi, 2021; Mahmoudi et al., 2020; Mahmoudi et al., 2022).

Individuals with complex care needs and those with fewer financial resources are at higher risk of PPH compared with people without complex needs and more resources (Toseef et al., 2019; Toseef et al., 2020; CMS, 2006). Adults with disabilities have more chronic conditions, lower income, and less access to resources than the general population (Brucker and Houtenville, 2015; Kinne et al., 2004; Mahmoudi et al., 2021; Erickson et al., 2011; Beatty et al., 2003; Loftus et al., 2021; Culler et al., 1998; Dicianno and Wilson, 2010); thus, they are more in need of coordinated care, especially preventive care (Mahmoudi et al., 2020; Mahmoudi et al., 2022; Figueroa and Jha, 2018; Whitney et al., 2019; Fortuna et al., 2016). Depending on the efficiency, associated costs, and care coordination mechanisms, health insurance may facilitate or hinder timely access to care (Dicianno and Wilson, 2010; Kroll and Neri, 2004). In this context, PPH is a quality metric and a proxy for measuring inequity in access to care. In the U.S., Medicare and Medicaid are the leading health insurance for people with disabilities (United States Government, 2022). Moreover, adults with disability who have low income and fewer resources may become qualified for both Medicare and Medicaid (duel-eligible) (United States Government, 2022). There are, however, many adults with disability who are covered by commercial insurance or Medicare Advantage (MA). MA runs by commercial insurers but is paid on a capitated payment system by Medicare (Agarwal et al., 2021). Research shows that among the general adult population, commercially insured people use preventive services at higher rates than publicly insured (Jiang et al., 2006; Bailes and Succop, 2012; Miller et al., 2014). Furthermore, older adults insured by MA have fewer PPH than their older counterparts covered by TM (Nicholas, 2013; Nicholas, 2013). There is, however, a paucity of evidence examining the association between health insurance and the use of preventive services and quality of care among high-need patients with disability.

To address this gap, we used Medicare and OptumInsight insurance claims data in the U.S. to compare TM with commercial insurance on the use of preventive services and PPH risk among adults with three different types of disability: (1) cerebral palsy or spina bifida (CP/SB) [congenital], (2) traumatic spinal cord injury (TSCI) [traumatic], and (3) multiple sclerosis (MS)[acquired]. These patient populations were selected to include broad disability conditions (congenital, traumatic, and acquired). We hypothesized that individuals with commercial insurance had lower PPH risk than TM, given their better access to care. We also performed two sensitivity analyses, examining the PPH risk comparing TM with MA (among older adults with a disability) and examining dual-eligible with non-dual-eligible adults with the same disability in TM. We anticipated that TM compared with MA, and dual eligible compared with non-dual eligible in TM had higher PPH risks. Our findings inform public health policies on the type of insurance that provides better access to preventive and quality care for patients with disability.

2. Methods

2.1. Data Source

We used 20% random sample of 2008–2016 TM administrative claims data and 100% of Clinformatics DataMart Database (OptumInsight, Eden Prairie, MN) as private insurance, which also includes MA enrollees (adults 65+). For TM claims, data were extracted from the Beneficiary Summary file (MBSF), Medicare Provider and Analysis Review (MedPAR) file, outpatient file, and Carrier file (office visits). Using the MBSF file, we extracted demographic information such as age, sex, race/ethnicity, and monthly indicator for a dual eligibility status for beneficiaries with both parts A and B, but not part C. Morbidity and healthcare encounters were defined using carrier, outpatient, and MedPAR files.

We also used 100% of 2008–2016 OptumInsightn (Optum) to abstract data for privately insured and MA enrollees (Mahmoudi et al., 2021; Peterson et al., 2019). OptumInsight includes data of over 80 million people from 52 states in the U.S. (including the District of Columbia and Puerto Rico) (Clinformatics Data Mart - Optum, 2021; User Guide Optum Clinformatics Data Mart Database, 2017). We used the same inclusion and exclusion criteria used in TM. Enrollment files were used to extract demographic information. We used the socioeconomic status (SES) view of the Optum, which enabled us to include race/ethnicity of the participants, trading off the geographic granularity of the zip code of their place of residence.

This study met the institution's and the data curator's guidelines for the protection of human subjects concerning safety and privacy. Both TM and Optum claims data are de-identified; hence the study was deemed exempt by our institutional review board.

2.2. Patient populations (cases and controls)

We used the International Classification of Diseases, Ninth Revisions, Clinical Modification (ICD-9-CM) codes to identify our patient cohorts of adults (18+) diagnosed with CP or SB, MS, or TSCI with 5 years of continuous enrollment (1 year lookback period and 4 years of follow-up). We pooled the Medicare and Optum data for each patient cohort together. Thus, people with the same disability diagnosis with commercial insurance served as controls for their counterparts covered by TM. Schematic flow diagrams of the samples for each patient population are presented in Appendix A.

People who died or switched to MA programs during the year were excluded from TM data because we did not have complete information on their use of services. The lookback period (365-day before the first disability diagnosis) is used to collect comorbidity history. All individuals with end-stage renal disease, pregnancy, or cancer diagnosis codes during the study period were excluded from both datasets to comply with the definition of PPH provided by the Agency for Healthcare Research and Quality (AHRQ)(Appendix A) (https://qualityindicators.ahrq.gov/Modules/pqi_resources.aspx#techspecs, 2021; https://qualityindicators.ahrq.gov/Modules/PQI_TechSpec_ICD10_v, 2021; Agency for Healthcare Research and Quality (AHRQ), 2021).

Our analytic file represented patient-year information. The sample size included 32,905 adults with CP or SB (11,306 in commercial; 21,599 in TM), 10,067 adults with TSCI (5,265 in commercial; 4,802 in TM), and 13,859 adults with MS (6,254 in commercial; 7,605 in TM).

2.3. Outcomes

We used the AHRQ's definition of prevention quality indicators to define our main outcome variable as a composite measure of any PPHs (Appendix A) (https://qualityindicators.ahrq.gov/Modules/pqi_resources.aspx#techspecs, 2021; https://qualityindicators.ahrq.gov/Modules/PQI_TechSpec_ICD10_v, 2021). Similar to our prior work, we used inpatient claims data and diagnosis codes defined for each PPH to define patient-year composite PPH as a binary variable based on evidence of any PPH occurring each year during a 4-year follow-up (Mahmoudi et al., 2022; Khan et al., 2022; Mahmoudi et al., 2022).

Furthermore, we defined any annual use of the following preventive services: (1) annual wellness visit (AWV); (2) bone mineral density (BMD); (3) cholesterol examination; (4) diabetes examination; and (5)

physical and occupational therapy (PT/OT). We chose these preventive care measures because individuals with physical disabilities are at greater risk for cardiometabolic conditions, low bone density, and fractures than the general population (Peterson et al., 2021; Peterson et al., 2020; Peterson et al., 2019; Peterson et al., 2021; Peterson et al., 2020; Peterson et al., 2022). The use of these services was identified using Current Procedural Terminology or Healthcare Common Procedure Coding System codes (Appendix A).

Each outcome was measured as a binary variable; it was set to 1 if we found any evidence of its occurrence during the patient-year; otherwise, it was set to 0.

2.4. Covariates

Using the one-year lookback period since the index diagnosis of each disability, we extracted the following information: age, sex, race/ethnicity, 9 United States (U.S.) Census divisions, Elixhauser comorbidity count, and diagnosis of any psychological, cardiovascular, and musculoskeletal conditions. In our regression models for PPH, we also included annual number of office visits and binary indicators of preventive services use.

Age was categorized to 18–44, 45–64, and 65+, with 18–44 being the reference group. This categorization enabled us to examine PPH among older adults with disability, comparing TM with MA. Using ICD-9 codes presented in Appendix A, diagnosis of any psychological, cardiovascular, and musculoskeletal illnesses during the lookback period was identified as a binary variable. Comorbidity burden was examined using the Elixhauser count, which consists of 31 conditions, each given equal weighting and summed together. A higher count has been associated with a greater risk of hospitalization and mortality (Mahmoudi et al., 2022). In TM, we used the Research Triangle Institute code to define race and ethnicity. In Optum (commercial data), only self-reported data on race/ethnicity was available. Race/ethnicity was categorized to White, Black, Hispanic, and other/unknown, with White being the reference category. We could not include any measures of socioeconomic status because we did not have access to the zip-code view for commercially insured patients for this project. Our exposure variable was health insurance: (1) TM vs. commercial insurance. TM was a dichotomous variable (1: TM; 0: commercial).

2.5. Statistical analysis

Bivariate analyses of the baseline demographics and characteristics between TM and commercially insured adults within each disability group were examined. For categorical variables, column percentages were compared between both groups using the Chi-square test. For continuous variables, means and standard deviations (SD) were presented, and a standard *t*-test was used to examine significant differences between cases and controls.

We applied a separate generalized estimating equation for each outcome variable to address repeated measures for patients. All models were adjusted for noted covariates. Since all our outcome variables were dichotomous, we applied a binomial distribution and log link function. A compound symmetry covariance structure was used because that minimized model fit statistics. In logistic models for any PPH, we interacted insurance with sex, race/ethnicity, and use of preventive services to examine the marginal effects of insurance. Adjusted predicted rates and adjusted marginal odds were post-estimated using least-square means (Appendix B–D).

All analyses were conducted in 2021–2022 using SAS 9.4 (SAS Institute, Cary, NC). Statistical testing was two-tailed, with a significance level of 0.05.

2.6. Sensitivity analysis

We conducted two sensitivity analyses by varying our exposure variable. First, informed by our prior work indicating a greater PPH risk for patients with lower income and fewer resources, we examined PPH risk for dual-eligible people (Mahmoudi et al., 2020). Since dual eligibility is only defined in Medicare and not in Optum (commercial data), to examine the risk of PPH for dual-eligible patients, we conducted the sensitivity analysis, using TM only. In this sensitivity analysis, our exposure variable was dual eligibility – defined as being eligible for Medicaid for at least one month during any calendar year. Using the same analytic model described above, we compared any PPH risk comparing the dual eligible with their non-dual eligible counterparts (TM only).

Furthermore, we assessed any PPH risk among older adults (65+), comparing people covered by TM vs. those covered by MA. We limited our patient cohorts to 65 and older to conduct this analysis. In that case, older adults with commercial coverage in Optum represent people covered by MA.

3. Results

Table 1 presents the characteristics of our patient populations of different disability diagnoses and insurance coverage. Among adults with CP/SB, there was a higher percentage of older people and females in commercial vs. Medicare. For example, 5.69% of Medicare beneficiaries vs. 15.88% of people with commercial insurance were 65+ ($p < 0.001$). A higher percentage of Black adults had TM than commercial insurance (14.53% vs. 10.28%; $p < 0.001$). No substantial differences in comorbidity were observed. Similarly, among people with TSCI, a higher percentage of people 65+ (48.21% vs. 26.63%; $p < 0.001$) and more females (56.73% vs. 46.71%; $p < 0.001$) had commercial insurance than TM. Also, a greater percentage of Black adults had TM than commercial insurance (15.64% vs. 7.27%; $p < 0.001$). People with TM had a higher Elixhauser comorbidity count (4.14 vs. 2.84; $p < 0.001$). Finally, for people with MS, the most notable differences between cases and controls included having a higher percentage of Black people (14.78% vs. 8.01%; $p < 0.001$) and having a larger Elixhauser comorbidity count (2.53% vs. 1.80%; $p < 0.001$) in TM vs. commercial insurance, respectively.

Table 2 presents the crude rates and adjusted predicted odds ratios for the use of preventive services. In all three subpopulations, adults with commercial insurance had higher rates of preventive service use than those with TM (except for diabetes screening among people with TSCI). Notably, there were large differences in wellness visits between TM and commercial insurance among all subpopulations. For example, 26.22% of adults with CP/SB with commercial insurance vs. 10.47% with TM had AWV. Our adjusted predicted values also show that in most cases (except for BDS in adults with CP/SB), the odds of receiving preventive care were lower in TM than in commercial insurance. For example, the odds ratios (OR) of AWV among adults with CP/SB, TSCI, and MS in TM vs. commercial insurance were OR = 0.31 (95% confidence interval (CI): 0.28–0.34), OR = 0.32(95% CI: 0.28–0.37), and OR = 0.19 (95% CI: 0.17–0.22), respectively. Moreover, our interaction terms reveal that the odds of receiving preventive services were lower among Black and Hispanic adults with TM compared with their Black and Hispanic counterparts with commercial insurance (Appendix B–D).

Table 3 shows unadjusted rates and adjusted odds of any PPH in TM vs. commercially insured adults. PPH risk was higher among adults with CP/SB, TSCI, and MS with TM than with commercial insurance by 1.50 (95% CI: 1.18–1.89), 1.83 (95% CI: 1.40–2.41), and 2.32 (1.66–3.22), respectively. Moreover, our interaction terms show that Black adults with TM compared with Black adults with commercial insurance were at higher PPH risk (OR = 1.41; 95% CI: 1.00–1.99) (Appendix B–D).

Regardless of insurance type, having an AWV reduces the odds of PPH by OR = 0.80 (95% CI: 0.70–0.91), OR = 0.74 (95% CI: 0.64–0.87), and OR = 0.60 (95% CI: 0.50–0.72) for adults with CP/SB, TSCI, and MS, respectively (Fig. 1).

Fig. 2 shows the crude rates and adjusted predicted odds of PPH for

Table 1
Descriptive Characteristics of Adults (18+) with a Disability in the United States by Insurance Coverage: 2008–2016.

Characteristics	Overall	Commercial Insurance	Traditional Medicare	P Value+
Adults with CP/SB	N = 32,905	N = 11,306	N = 21,599	
Age (# (%))				
18–44	17,209 (52.30)	5469 (48.37)	11,740 (54.35)	<0.001
45–64	12,671 (38.51)	4042 (35.75)	8629 (39.95)	<0.001
>=65	3025 (9.19)	1795 (15.88)	1230 (5.69)	<0.001
Female (# (%))	16181 (49.18)	6021(53.25)	10160(47.04)	<0.001
Race/Ethnicity (# (%))				
White	22559 (68.56)	6676(59.05)	15883(73.54)	<0.001
Black	4300 (13.07)	1162(10.28)	3138(14.53)	<0.001
Hispanic	2815 (8.55)	998(8.83)	1817(8.41)	<0.001
Other/Unknown	3231 (9.82)	2470(21.85)	761(3.52)	<0.001
Elixhauser Count (mean (SD))	1.99 (2.21)	1.99 (2.22)	2.00 (2.21)	0.614
Any Cardiometabolic (# (%))	13163 (40.00)	4620(40.86)	8543(39.55)	0.021
Any Psychological (# (%))	9909 (30.11)	3265(28.88)	6644(30.76)	<0.001
Any Musculoskeletal (# (%))	12415 (37.73)	4574(40.46)	7841(36.30)	<0.001
Adults with TSCI	N = 10,067	N = 5,265	N = 4,802	
Age (# (%))				
18–44	1967 (19.54)	1009(19.16)	958(19.95)	<0.001
45–64	4283 42.54)	1718(32.63)	2565(53.42)	<0.001
>=65	3817 (37.92)	2538(48.21)	1279(26.63)	<0.001
Female (# (%))	5228 (51.95)	2985(56.73)	2243(46.71)	<0.001
Race/Ethnicity (# (%))				
White	6659 (66.15)	3181(60.42)	3478(72.43)	<0.001
Black	1134 (11.26)	383(7.27)	751(15.64)	<0.001
Hispanic	880 (8.74)	463(8.79)	417(8.68)	<0.001
Other/Unknown	1394 (13.85)	1238(23.51)	156(3.25)	<0.001
Elixhauser Count (mean (SD))	3.45 (3.04)	2.84 (2.70)	4.14 (3.38)	<0.001
Any Cardiometabolic (# (%))	6793 (67.48)	3405(64.67)	3388(70.55)	<0.001
Any Psychological (# (%))	4967 (49.34)	2099(39.87)	2868(59.73)	<0.001
Any Musculoskeletal (# (%))	6635 (65.91)	3305(62.77)	3330(69.35)	<0.001
Adults with MS	N = 13,859	N = 6,254	N = 7,605	
Age (# (%))				
18–44	3525 (25.43)	2060(32.94)	1465(19.26)	<0.001
45–64	7780 (56.14)	3011(48.15)	4769(62.71)	<0.001
>=65	2554 (18.43)	1183(18.92)	1371(18.03)	<0.001
Female (# (%))	9670 (69.78)	4354(69.63)	5316(69.90)	0.730
Race/Ethnicity (# (%))				
White	9699 (69.98)	3860(61.72)	5839(76.78)	<0.001
Black	1625 (11.73)	501(8.01)	1124(14.78)	<0.001
Hispanic	895 (6.46)	448(7.16)	447(5.88)	<0.001
Other/Unknown	1640 (11.83)	1445(23.11)	195(2.56)	<0.001
Elixhauser Count (mean (SD))	2,20 (2.70)	1.80 (2.19)	2.53 (3.06)	<0.001
Any Cardiometabolic (# (%))	6397 (46.16)	2809(44.92)	3588(47.18)	0.078
Any Psychological (# (%))	4900 (35.36)	1893(30.27)	3007(39.54)	<0.001
Any Musculoskeletal (# (%))	6338 (45.73)	2980(47.65)	3358(44.16)	<0.001

Source:2008–2016 Medicare and Optum Claims data.
Notes: (1) ICD-9 codes for identifying CP or SB, TSCI, and MS are presented in Appendix A; (2) We identified the Elixhauser count, and cardiometabolic, psychological, and musculoskeletal illnesses based on a one-year lookback period; (3) The ICD-9 codes and description of the chronic conditions are presented in Appendix A.
Abbreviations: CP: Cerebral Palsy; SB: Spina Bifida; TSCI: Traumatic Spinal Cord Injury; MS: Multiple sclerosis.
+ To define the significant differences between commercial and Medicare insurance for categorical and continuous variables, Chi-Square and Student *t*-test were used, respectively.

(a) dual-eligible compared with non-dual-eligible adults and (b) Medicare Advantage enrollees compared with TM enrollees (based on our sensitivity analyses). PPH risks were higher for dual-eligible than non-dual-eligible by OR = 1.80 (95% CI: 1.55,2.10), OR = 1.61(95% CI: 1.35,1.92), and OR = 1.47 (95% CI: 1.25,1.72) among adults with MS, TSCI, and CP/SB, respectively (Fig. 2A). Moreover, among MS patients 65 years and older, PPH risk was higher for TM than MA by OR = 1.61 (95% CI: 1.20, 2.17) (Fig. 2B).

4. Discussion

In this study, we merged 2008–2016 TM and commercial claims data to examine the receipt of preventive care and PPH risks between adults with the same disability diagnosis (CP/SB, MS, or TSCI) but with different insurance. Across the three disability groups, three main findings emerged: (1) people with commercial insurance compared to those with TM had higher odds of receiving preventive care and were at lower risk for PPH; (2) older people with MA used more preventive services and were at lower risk of PPH than people with TM; and (3) in TM only, dual-eligible adults had lower use of preventive services and were at higher risk of PPH compared with non-dual eligible adults. Our results demonstrate the importance of insurance generosity and accessibility to preventive services in reducing PPH risk among adults with disability.

Our findings support prior research, showing lower rates of preventive care in TM than in commercial insurance (Jiang et al., 2006; Bailes and Succop, 2012; Miller et al., 2014; Chung et al., 2015). Since 2010, most preventive services, including AWV, have been covered without out-of-pocket costs. However, even among the general population, only 33% of TM beneficiaries vs. 43% of commercially insured have AWVs (Chung et al., 2015). Better insurance coverage would enable access to a more extensive network of qualified physicians, easier admission to high-quality primary care clinics with evening or weekend appointments, and more available labs and testing facilities (Lu et al., 2004; Ross and Mirowsky, 2000). The cost of obtaining better insurance

Table 2
Crude Rates and Adjusted Predicted Odds of Receiving Preventable Care Comparing Traditional Medicare with Commercial Insurance among Adults (18+) with a Disability in the United States: 2008–2016.

	Crude Rate+		Adjusted Odds Ratio
	Commercial Insurance (%)	Traditional Medicare (%)	OR (95% CI)
CP/SB			
Cholesterol Screening	42.73	39.95	0.84 (0.78, 0.89)*
Diabetes Screening	21.83	20.58	0.92 (0.85, 0.99)*
Annual Wellness Visit	26.22	10.47	0.31 (0.28, 0.34)*
Bone Density Screening	4.70	4.40	1.24 (1.07, 1.43)*
Physical/ Occupational Therapy	25.38	14.67	0.52 (0.48, 0.56)*
TSCI			
Cholesterol Screening	49.32	48.73	0.87 (0.79, 0.95)*
Diabetes Screening	29.14	34.39	1.02 (0.92, 1.14)
Annual Wellness Visit	23.13	8.05	0.32 (0.28, 0.37)*
Bone Density Screening	9.41	6.58	0.99 (0.86, 1.15)
Physical/ Occupational Therapy	35.24	26.50	0.58 (0.53, 0.63)*
MS			
Cholesterol Screening	48.56	37.86	0.56 (0.51, 0.61)*
Diabetes Screening	25.59	25.14	0.74 (0.67, 0.82)*
Annual Wellness Visit	34.56	7.34	0.19 (0.17, 0.22)*
Bone Density Screening	7.00	4.77	0.89 (0.72, 1.09)
Physical/ Occupational Therapy	24.58	17.84	0.63 (0.57, 0.70)*

Source:2008–2016 Medicare and Optum claims data.
Abbreviations: CP: Cerebral Palsy; SB: Spina Bifida; SCI: Spinal Cord Injury; MS: Multiple sclerosis.
+Crude rates are calculated based on the average use of preventive services during the study period.
Regression results are presented in Appendices B–D.

via the purchase of employer-sponsored coverage, self-pay, Medicare, or private supplemental coverage continues to grow (Frost et al., 2018). This may make it more challenging for adults with a disability to manage their complex medical conditions and prevent PPH.

Research shows an elevated PPH risk among adults with disability (Mahmoudi et al., 2022; Schüssler-Fiorenza Rose et al., 2017; Balogh et al., 2010). Our results revealed that among people with the same disability condition, PPH risk was higher in TM vs. commercial insurance (Balogh et al., 2013; Bocour and Tria, 2016). Commercial insurance is designed to operate more efficiently and often enables more accessible preventive care to reduce expensive events such as PPH (Park et al., 2020; Jung et al., 2020).

Our results show that dual-eligible compared with non-dual-eligible adults that have a disability have lower use of preventive care and are at higher odds of PPH. Prior work has shown that dual-eligible people and clinics with higher ratios of dual-eligible people have lower rates of AWV (Ganguli et al., 2018). Considering Medicaid's low reimbursement

Table 3
Crude Rates and Adjusted Predicted Odds of Having Any Potentially Preventable Hospitalization Comparing Traditional Medicare with Commercial Insurance among Adults (18+) with a Disability in the United States: 2008–2016.

	Crude Rate+		Adjusted Odds Ratio
Main Analysis	Commercial Insurance (%)	Traditional Medicare (%)	OR (95% CI)
CP/SB	1.77	2.62	1.50 (1.18–1.89)
TSCI	2.96	5.78	1.83 (1.40–2.41)
MS	1.27	3.98	2.32 (1.66–3.22)

Source:2008–2016 Medicare and Optum claims data.
Abbreviations: CP: Cerebral Palsy; SB: Spina Bifida; SCI: Spinal Cord Injury; MS: Multiple sclerosis.
+Crude rates are calculated based on the total number of potentially preventable hospitalizations during each year divided by the total number of participants in each disability group, averaged over the four-year follow-up period.
Regression results are presented in Appendices B–D.

fees, many physicians do not accept dual-eligible adults, limiting their access to quality primary care. In many cases, PPH and emergency visits are the only options for dual-eligible adults to get the care they need.

This study has critical ramifications for national health policy and clinical care for people with disability. Adults with disability are more likely than the general population to delay or forego necessary medical care due to poor care coordination, inaccessibility to preventive care, or financial difficulties (Reichard et al., 2017; Pezzin et al., 2018). Adults with disability are more likely to be publicly insured than the general population (Miller et al., 2014; Morley et al., 2020; Keisler-Starkey and Bunch, 2020). For example, 27% and 14% of people with a disability vs. 7% and 6% of people without a disability are insured by Medicare and Medicaid, respectively (Khavjou et al., 2020). Between 2003 and 2015, the percentage of people with a disability covered by Medicare increased by 42%, but the percentage of people with a disability with commercial insurance decreased by 47% (Khavjou et al., 2020).

5. Limitations

Our study had several noteworthy limitations. First, OptumInsight is not a nationally representative sample of commercially insured people in the U.S. We did not have access to all commercial insurance. There exists heterogeneity between and within commercial insurance that we could not assess in this analysis. Second, claims data lack information on socioeconomic status. Thus, we do not know the differential effect of socioeconomic status in TM compared with commercial insurance on their use of preventive services and PPH. We used dual eligibility as a proxy for SES in our sensitivity analysis. Perhaps the lower use of preventive care and higher PPH among dual-eligible compared with non-dual-eligible beneficiaries is a manifestation of what may partially be explained by their lower income and lack of other enabling factors such as housing, transportation, and health and insurance literacy than merely care accessibility or type of insurance. Furthermore, as the cost of obtaining insurance increases, the low provider reimbursement rates of Medicaid translate to lower access to primary and preventive care. Moreover, we did not examine the costs associated with obtaining health insurance (e.g., the premium). Often, the higher the cost of obtaining health insurance, the more generous the plan is in its coverage and access to care (Hoffman and Paradise, 2008; White, 2012). Third, Evidence suggests that regardless of insurance type, psychosocial, health literacy, and health insurance literacy are salient enabling factors associated with different patterns of healthcare use. It is plausible that some of our observed differences in the use of preventive services between those with TM vs. commercial insurance are associated with their differing characteristics and patterns of engagement with health services rather than insurance type (Kim et al., 2013; Levy and Janke, 2016). Finally, using claims data, we could not adjust for the severity of each disability

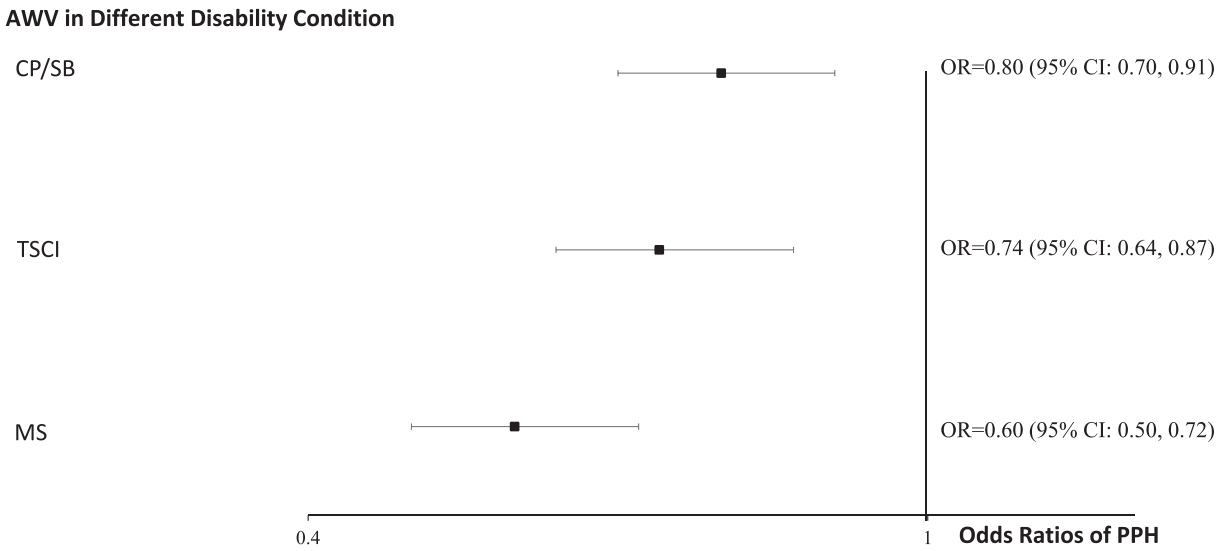

Fig. 1. Adjusted Predicted Odds of Potentially Preventable Hospitalization Associated with Annual Wellness Visits (AWV) among Adults (18+) with a Disability in the United States: 2008–2016. Source: 2008–2016 pooled Medicare and commercial claims data. Abbreviations: OR: odds ratio; CI: confidence interval; CP/SB: cerebral palsy/spina bifida; MS: multiple sclerosis; TSCI: traumatic spinal cord injury. X-axis: odds of annual wellness visits; Y-axis: disability conditions. Note: Regression results are presented in Appendices B-D.

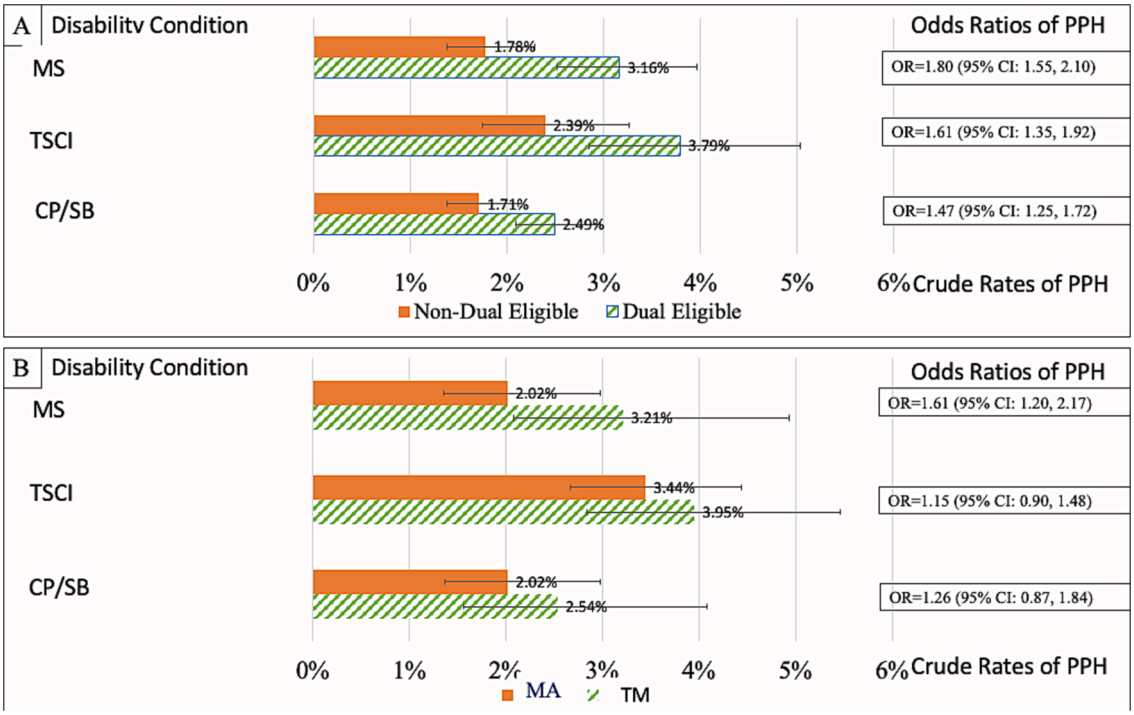

Fig. 2. Crude Rates and Adjusted Predicted Odds of Potentially Preventable Hospitalization Comparing Different Health Insurance among Adults (18+) with a Disability in the United States: 2008–2016. (A) dual-eligible vs non-dual eligible (Adults 18+); (B) Medicare Advantage vs Traditional Medicare (Adults 65+ Only). Source: 2008–2016 pooled Medicare and commercial claims data. Abbreviations: OR: odds ratio; CI: confidence interval; CP/SB: cerebral palsy/spina bifida; MS: multiple sclerosis; TSCI: traumatic spinal cord injury. X-axis: crude rates of PPH; Y-axis: disability conditions. Note: Regression results are presented in Appendices B-D.

condition. To address this shortcoming, we used diagnosis of chronic conditions and Elixhauser comorbidity count to adjust for the overall health of adults with disability.

6. Conclusion

In this longitudinal cohort study, we used TM and commercial claims data to examine the use of preventive care and PPH risk, comparing adults with the same diagnosed disability but different insurance. Our results indicate lower use of preventive care and higher PPH risk in TM vs. commercial insurance. Within TM, dual-eligible people had lower preventive care and higher PPH risk than their non-dual-eligible counterparts. Timely access to preventive care, particularly wellness visits, reduces the risk of PPH. Adverse health events may be reduced among high-need populations (such as those with disability) by improving access to preventive care via better health insurance.

Authors' contributions

All authors had read and approved the manuscript. Elham Mahmoudi conceptualized and designed the research strategy, drafted, and revised the manuscript, and supervised the research; Paul Lin performed the data analysis; all other authors drafted and revised the manuscript.

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Data availability

Administrative claims are proprietary data and are not publicly available. The authors do not have permission to share data.

CRediT authorship contribution statement

Elham Mahmoudi: Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Paul Lin:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Dana Rubenstein:** Writing – review & editing, Writing – original draft. **Timothy Guetterman:** Writing – review & editing, Writing – original draft. **Amanda Leggett:** Writing – review & editing, Writing – original draft, Conceptualization. **Katherine L. Possin:** Writing – review & editing, Writing – original draft, Conceptualization. **Neil Kamdar:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2024.102663.

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