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Medicare Part D Implementation and Associated Health Impact Among Older Adults in the United States

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Abstract

This study examined the effect of Medicare Part D implementation on health outcomes among U.S. older adults. Study participants were initially extracted from the 2004–2008 Health and Retirement Study (HRS). Data from respondents who further participated in the HRS 2005–2007 Prescription Drug Study were analyzed ($N = 746$). This was a retrospective pre-post design with a treatment and a control group. The difference-in-differences approach with panel ordered logistic regressions was used to examine the Part D effect on three patient health outcomes before and after the implementation, controlling for patient sociodemographic characteristics. People with continuous Part D enrollment from 2006–2008 were less likely to have a worse self-rated health than those who were not enrolled in Part D (odds ratio $[OR] = 0.48$; $p < .05$). A higher Charlson Comorbidity Index score was associated with a higher likelihood of having worse self-rated overall health, worse mental health, and worse activities of daily living impairment ($ORs = 1.12$, 1.17, and 1.36, respectively; all $ps < .001$). The Part D implementation appears to have a positive effect on older adults' overall health outcomes. A decrease in out-of-pocket cost for

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health care may encourage older adults to utilize more needed medications, which in turn helped maintain better health.

Keywords

medicare part D, health outcomes, prescription drugs, self-rated health

The Medicare Modernization Act (MMA) of 2003 provided prescription drug benefits for seniors and people with disabilities enrolled in the United States Medicare Part D program (Part D). This program offered a subsidized prescription drug benefit to Medicare eligible persons starting in 2006.

A number of studies have found that implementation of Part D was associated with reduced out-of-pocket expenses, increased medication use, and improved adherence to essential medications for older adults.[1–4] However, while prior studies have examined the effect of Part D on health care utilization or its monetary consequences, such as out-of-pocket costs and non-drug medical spending, few have examined the health outcomes associated with this health policy, and there has been a paucity of data that allowed such analyses.[3,5–7] This study used data on a nationally representative sample of older adults from the Health and Retirement Study (HRS), linked with Medicare data to investigate the health impacts associated with Part D.

We hypothesized that compared to persons without Part D coverage, those enrolled in Part D would show improvements in overall health and mental health status, as well as in the number of functional limitations.

Methods

Sample

We used data from the HRS, an ongoing, longitudinal survey study of respondents' health, income, health insurance, health care expenditure, and demographic information among middle-aged and older adults in the United States. The biennial survey uses a multi-stage stratified sampling design managed by the University of Michigan since 1992. We used the core survey data from 2004 to 2008 and linked the datasets to the 2005 and 2007 Prescription Drug Survey (PDS) that were HRS *off-year* (odd-numbered years) sub-studies that measured respondents' drug utilization pattern before and after the implementation of Part D. Moreover, the HRS-Medicare linked claims data were merged to allow investigation of the impact of disease burden and Part D enrollment status on the health outcomes. The study sample was the 2004–2008 HRS respondents who also participated in the 2005 and 2007 PDS, and who were aged 65 and older in 2006. In order to isolate the effects of Part D, we excluded respondents enrolled in other social welfare programs for their drug insurance during the study period, namely those with employer-sponsored drug insurance, Veteran Affairs health insurance coverage, Medicare and Medicaid dual eligibility, Medicare Part C coverage, and state or other government subsidies. Based on these criteria, our initial sample consisted of 1,257 beneficiaries. We dropped 230 participants who did not reach 65 years of age. Another 223 participants were dropped because they did not share their Medicare claims data, which would allow computation of morbidity status. Last, another 58 participants were excluded because data were missing on key study variables. The final study sample consisted of 746 Medicare beneficiaries.

Measures

We used an adapted Andersen model on health care utilization[8–10] as the conceptual framework to guide variable selection. The Andersen model includes predisposing, enabling, and need factors that lead to the use of health services and associated health outcomes.[9] Three dependent variables of health outcomes were modeled. The first was self-rated health change (SRHC). SRHC and self-rated health have been used as indices for overall health outcomes and predictors of mortality in various disciplines,[11] and researchers found evidence that SRHC is a stronger predictor of mortality for older women than self-rated health.[12] Moreover, longitudinal studies also showed that SRHC tends to produce less biased estimates of mortality and morbidity than self-rated health.[11] Thus, a five-level measure of SRHC (1 = much better, 2 = somewhat better, 3 = same, 4 = somewhat worse, 5 = much worse) rather than self-rated health was used for this study. To meet the adequate cell size assumption of analyses, these five categories were collapsed to three categories (1–2 = better, 3 = same, 4–5 = worse).

The second dependent variable was mental health status, measured by the 8-item Center for Epidemiologic Studies Depression (CES-D) Scale.[13–15] This variable was computed as the sum of six "negative" indicators (yes = 1, no = 0) and two "positive" indicators (yes = 0, no = 1), ranging from zero (no depressive symptom) to eight (maximum depressive symptoms). It was further collapsed into three categories (0 = no depressive symptom, 1–3 = depressive symptoms, and ≥ 4 = depressed) in this study.[16]

The third dependent variable was activities of daily living (ADL) impairment. The ADL impairment represents a measure of functional limitations. The five tasks of ADL included bathing, eating, dressing, walking across a room, and getting in or out of bed.[17] The participants were asked to categorize their functional limitation for each listed task as 1 (considered a limitation) and 0 (not considered a limitation). Every respondent's score on each task was added to determine overall ADL impairment score, ranging from zero to five. A higher score meant more functional limitations.

Three major categories of predictors from the Andersen model for our targeted health outcomes were predisposing factors, enabling factors, and need factors. The predisposing factors included age, sex, years of education, and race/ethnicity. Sex was coded as 0 (female) and 1 (male). Race/ethnicity was coded as 0 (non-Hispanic white), 1 (non-Hispanic black), 2 (Hispanic), and 3 (others). The enabling factors included marital status, income, and census region. Marital status was coded by a dichotomous variable (0 = single, divorced, widowed, or separated; 1 = married or living with a partner). Income was measured by the total household income of a respondent and his or her spouse. Census region was coded as 0 (Northeast), 1 (Midwest), 2 (South), and 3 (West). The need factors included body mass index (BMI) and Charlson Comorbidity Index (CCI). Height and weight were reported by the respondents and BMI was calculated as weight (lb)/(height [in])$^2 \times 703$. CCI was used to measure extent of comorbidities and was calculated via the International Classification of Diseases, 9th Revision (ICD-9) codes from the outpatient and inpatient records in the HRS-Medicare linked claims data. CCI represents a summary of overall disease burden of a person in which a weight of 1, 2, 3, or 6 is assigned to 17 major diseases depending on the risk of dying associated with each disease.[18] A higher score of CCI meant worse overall illness status. Other independent variables included Part D enrollment during 2006–2008 (yes = 1, no = 0) and the year when the health outcomes were measured (2004 = 0, 2008 = 1).

Study Design and Data Analysis

This study employed a retrospective quasi-experimental cohort design with control groups. Treatment and control groups were assigned based on the Part D enrollment status (yes/no). A difference-in-differences (DID) approach was used to analyze health outcomes by comparing a 2-year period before and after Part D implementation using the HRS data. Widely used to estimate the effect of a policy change,[19] the DID estimator represents the difference between the treatment and control groups in the within-subjects pre-post differences.[20] In other words, the DID model takes into account pre-existing differences between the treatment and control groups and general time trend. In the present study, people with a new and continuous enrollment of the Part D from 2006 to 2008 comprise the treatment group and people who were never enrolled in Part D during 2006–2008 comprise the control group.

We used a panel ordered logistic regression to estimate effects of Part D on SRHC, mental health, and functional limitations, controlling for predisposing factors, enabling factors, and need factors and sociodemographic characteristics. Given the categorical and ordinal nature of these three aforementioned dependent variables in a pre-post design, our analytical approach allowed us to capture the relevant relationships among the ordinal categories. Moreover, the interaction term between Part D enrollment and year when the health outcomes were measured was used to capture the difference-in-differences effect. All statistical analyses were conducted using STATA 13.0 (STATA Corporation, Texas).

Results

Table 1 and Table 2 outline descriptive statistics of the study sample. Table 1 shows the mean or frequencies of the three dependent variables. Of the 746 participants, there were 649 in the treatment group and 97 in the control group. In the treatment group, the mean of mental health (CES-D) increased from 1.56 ($SD = 1.98$) in 2004 to 1.68 ($SD = 2.05$) in 2008. The mean of ADL increased from 0.24 ($SD = 0.61$) in 2004 to 0.41 ($SD = 0.91$) in 2008. In the control group, the mean of mental health status (CES-D) increased from 1.05 ($SD = 1.48$) in 2004 to 1.41 ($SD = 1.82$) in 2008. The mean of ADL increased from 0.07 ($SD = 0.26$) in 2004 to 0.23 ($SD = 0.64$) in 2008. Table 2 shows the mean and frequencies of independent variables. For both groups, the majority of the participants were women and non-Hispanic whites. The mean age was 74.18 ($SD = 6.33$) for the treatment group and 77.32 ($SD = 7.24$) for the control group.

Table 3 shows results of the panel ordered logistic regression analyses. Model 1 (SRHC) shows that people who were never enrolled in Part D were associated with an increase in the odds of having worse health status (odds ratio [OR] = 2.24, 95% confidence interval [CI]: 1.21, 4.17) compared to the treatment group. In terms of the net effect of Part D enrollment (i.e., DID), people with Part D enrollment were associated with a decrease in the likelihood of having worse health status (OR = 0.48, 95% CI: 0.25, 0.93) compared to those who never enrolled in Part D. An increase in CCI score was associated with greater likelihood of having worse health status (OR = 1.12, 95% CI: 1.05, 1.19). An increase in BMI was also associated with a higher chance of having worse health status (OR = 1.03, 95% CI: 0.99, 1.60).

The net effect of Part D enrollment on mental health status (Model 2) was not significant. An increase in CCI score was associated with greater likelihood of having a worse mental health status (OR = 1.17, 95% CI: 1.07, 1.27). Living with a spouse or partner was protective against mental health problems (OR = 0.56, 95% CI: 0.37, 0.84). Moreover, the net effect of Part D enrollment on ADL impairment (Model 3) was not significant. Medicare beneficiaries were more likely to have more functional limitations as they get older (OR = 1.06, 95% CI: 1.01, 1.10) and as BMI increased (OR = 1.12, 95% CI: 1.07, 1.17).

Discussion

This study is one of the first longitudinal studies that investigated the effect of Part D enrollment on health outcomes of the Medicare beneficiaries. Our findings indicated continuous enrollment with Part D may have a positive association with healthy aging with sufficient drug insurance coverage, while people who were never enrolled in Part D were more likely to have worse health status in four years. One reason people were not enrolled in Part D could be due to the confusion and complexity, including numerous options and various packages

Table 1. Descriptive Statistics of Dependent Variables.

	2004 (Before Part D)			2008 (After Part D)		
	Treatment (n = 649)	Control (n = 97)		Treatment (n = 649)	Control (n = 97)	
	n (%)		*p*-value	*n* (%)		*p*-value
SRHC			.039^{*,a}			.674
Better	67 (10.32%)	15 (15.46%)		55 (8.47%)	6 (6.19%)	
Same	387 (59.63%)	64 (65.98%)		388 (59.78%)	62 (63.92%)	
Worse	195 (30.05%)	18 (18.56%)		206 (31.74%)	29 (29.90%)	
	Mean (*SD*)			Mean (*SD*)		
Mental health (CES-D)	1.56 (1.98)	1.05 (1.48)	.016*	1.68 (2.05)	1.41 (1.82)	.223
Activities of daily living impairment	0.24 (0.61)	0.07 (0.26)	.009**	0.41 (0.91)	0.23 (0.64)	.057

Note. *P*-values were derived from two-tailed *t*-tests for continuous variables and chi-square tests for categorical variables. SRHC: self-rated health change; CES-D: Center for Epidemiologic Studies Depression. [AQ3]

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 2. Descriptive Statistics of Independent Variables.

	2004 (Before part D)			2008 (After part D)		
	Treatment (n = 649)	Control (n = 97)		Treatment (n = 649)	Control (n = 97)	
	Mean (*SD*) or *n* (%)		*p*-value	Mean (*SD*) or *n* (%)		*p*-value
Predisposing factors:						
Sex:			.009**			.009**
Male	207 (31.90%)	44 (45.36%)		207 (31.90%)	44 (45.36%)	
Female	442 (68.10%)	53 (54.64%)		442 (68.10%)	53 (54.64%)	
Age	74.18 (6.33)	77.32 (7.24)	<.001***	78.18 (6.33)	81.32 (7.25)	<.001***
Race/ethnicity:			.223			.223
Non-Hispanic white	516 (79.51%)	84 (86.60%)		516 (79.51%)	84 (86.60%)	
Non-Hispanic black	79 (12.17%)	6 (6.19%)		79 (12.17%)	6 (6.19%)	
Hispanic	47 (7.24%)	5 (5.15%)		47 (7.24%)	5 (5.15%)	
Other	7 (1.08%)	2 (2.06%)		7 (1.08%)	2 (2.06%)	
Enabling factors:						
Years of education	11.88 (3.33)	12.42 (2.98)	.130	11.88 (3.33)	12.42 (2.98)	.130
Marital status:			.112			.200
Married/partnered	373 (57.47%)	54 (55.67%)		333 (51.31%)	43 (44.33%)	
Not married/partnered	276 (42.53%)	43 (44.33%)		316 (48.69%)	54 (55.67%)	
Household income:			.001***			.096
<$15,000	184 (28.35%)	18 (18.56%)		181 (27.89%)	20 (20.62%)	
$15,000–$25,000	130 (20.03%)	36 (37.11%)		131 (20.18%)	23 (23.71%)	

(continued)

Table 2. (continued)

	2004 (Before part D)			2008 (After part D)		
	Treatment (n = 649)	Control (n = 97)		Treatment (n = 649)	Control (n = 97)	
	Mean (*SD*) or *n* (%)		*p*-value	Mean (*SD*) or *n* (%)		*p*-value
$25,000–$45,000	154 (23.73%)	28 (28.87%)		167 (25.73%)	35 (36.08%)	
> $45,000	181 (27.89%)	15 (15.46%)		170 (26.19%)	19 (19.59%)	
Census region:			.646			.806
Northeast	69 (10.63%)	13 (13.40%)		70 (10.79%)	13 (13.40%)	
Midwest	198 (30.51%)	24 (24.74%)		192 (29.58%)	25 (25.77%)	
South	287 (44.22%)	45 (46.39%)		292 (44.99%)	45 (46.39%)	
West	95 (14.64%)	15 (15.46%)		95 (14.64%)	14 (14.43%)	
Need factors:						
CCI	1.99 (2.35)	1.67 (2.14)	.211	1.99 (2.35)	1.67 (2.14)	.211
BMI	27.47 (5.21)	26.33 (4.12)	.040*	27.74 (5.64)	26.26 (4.47)	.014*

Note. CCI = Charlson Comorbidity Index; BMI = Body Mass Index; *P*-values derived from two-tailed *t*-tests for continuous variables and chi-squared tests for categorical variables.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 3. Panel Ordered Logistic Regression Analysis of Self-rated Health Change, Mental Health and Activities of Daily Living Impairment (N = 746).

	Model 1: Self-rated health change (better, same, worse)		Model 2: Mental health (CES-D)		Model 3: Activities of daily living impairment	
	OR	95% CI	OR	95% CI	OR	95% CI
Predisposing factors:						
Age in 2006	1.02	[0.99, 1.04]	1.00	[0.97, 1.03]	1.06*	[1.01, 1.10]
Male	0.90	[0.65, 1.25]	0.79	[0.52, 1.19]	0.69	[0.37, 1.29]
Race/ethnicity:						
Non-Hispanic White	–	–	–	–	–	–
Non-Hispanic Black	0.69	[0.42, 1.14]	1.07	[0.57, 2.00]	1.19	[0.50, 2.80]
Hispanic	0.67	[0.35, 1.28]	0.73	[0.33, 1.65]	1.06	[0.35, 3.23]
Others	0.74	[0.19, 2.81]	3.44	[0.64, 18.53]	2.47	[0.28, 22.06]
Enabling factors:						
Years of education	0.99	[0.94, 1.04]	0.88***	[0.82, 0.94]	0.96	[0.87, 1.05]
Married/Partnered: yes	1.03	[0.73, 1.44]	0.56**	[0.37, 0.84]	0.80	[0.43, 1.48]
Household income:						
<$15,000	–	–	–	–	–	–
$15,000–$25,000	0.79	[0.52, 1.20]	0.87	[0.54, 1.40]	0.90	[0.46, 1.77]
$25,000–$45,000	0.68	[0.44, 1.07]	0.60*	[0.36, 1.00]	0.64	[0.30, 1.34]
>$45,000	0.53*	[0.32, 0.87]	0.49*	[0.28, 0.88]	0.43*	[0.18, 1.00]
Census region:						
Northeast	–	–	–	–	–	–

(continued)

Table 3. (continued)

	Model 1: Self-rated health change (better, same, worse)		Model 2: Mental health (CES-D)		Model 3: Activities of daily living impairment	
	OR	95% CI	OR	95% CI	OR	95% CI
Midwest	0.65	[0.39, 1.07]	0.61	[0.32, 1.16]	0.43	[0.17, 1.10]
South	0.83	[0.51, 1.34]	0.86	[0.47, 1.57]	0.75	[0.32, 1.79]
West	0.65	[0.37, 1.16]	1.35	[0.66, 2.74]	1.40	[0.52, 3.75]
Need factors:						
Body mass index	1.03*	[1.00, 1.06]	1.01	[0.98, 1.05]	1.12***	[1.07, 1.17]
Charlson comorbidity index	1.12***	[1.05, 1.19]	1.17***	[1.07, 1.27]	1.36***	[1.21, 1.52]
Part D variables:						
Year: 2008 (vs 2004)	2.24**	[1.21, 4.17]	1.47	[0.77, 2.81]	3.34*	[1.05, 11.26]
Part D enrollment: yes	2.04**	[1.19, 3.53]	1.61	[0.84, 3.09]	3.95*	[1.16, 13.46]
Year × Part D enrollment	0.48*	[0.25, 0.93]	0.78	[0.39, 1.54]	0.55	[0.16, 1.88]

Note. OR: odds ratio; CI: confidence interval; CES-D: Center for Epidemiologic Studies Depression.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

during the first few years.[21] Another reason for nonparticipation might be that Part D plans do not provide comprehensive coverage; thus, it may not save out-of-pocket costs for some beneficiaries.[21]

The results of the present study suggested that the Part D implementation was not associated with a better mental health status. From the reported CES-D scores, we found that our study sample generally had minor mental health problems. Evidence has shown that the effectiveness of pharmacological and non-pharmacological treatments for minor mental disorders is comparable.[22] Thus, the coverage of Part D might not benefit people who did not use medications to treat mental health problems.[22]

Furthermore, our findings revealed that the implementation of Part D was not associated with a decrease in functional limitations. This is consistent with studies that examined impacts of drug insurance coverage on functional disabilities of older adults because insurance coverage had only a small effect on drug use for the general elderly population.[23] ADL impairment is often derived from various chronic conditions such as cerebrovascular diseases and diabetes.[24,25] However, a recent study showed that Part D beneficiaries with chronic diseases might skip or drop medications due to affordability concerns, which may lead to little improvement of functional limitations.[26] Therefore, people with Part D coverage may still suffer from unaffordability for medications to control chronic conditions, which may lead to little improvement of functional limitations.

Our findings also indicated that sociodemographic characteristics such as age and income had different effects on health outcomes of the elderly population. Age was the only significant predictor among predisposing factors that was associated with an increased chance of more functional limitations, which is consistent with the findings in the previous literature.[27] Among the enabling factors, income was the strongest predictor across the three examined models in this study. This indicates that income plays a critical role in the elderly's health outcomes because it affects their ability to receive quality medications and therapies. Policy makers might pay more attention to health disparities among poor elderly populations. A Low-Income Subsidy (LIS) exists to address income inequality on health care utilization and Part D participation, but needs more intervention efforts involving federal, state agencies, and nonprofit organizations to better educate the low-income elderly about the LIS applications and Part D coverage details. These interventions could be particularly helpful because the current Part D LIS program is overly complicated and does not automatically enroll eligible beneficiaries.[26] In terms of the need factors, CCI, which measures the overall disease burden, was the strongest predictor of health outcomes among the three examined models. Older adults with higher overall disease burden have intense needs of prescription drugs and reduced out-of-pocket costs to improve their health outcomes.[28]

Our study findings should be interpreted in light of the following limitations. First, selection bias might exist between the treatment and control groups (i.e., enrolled in Part D or not). To detect possible selection bias, an additional logistic regression analysis (available from authors) was conducted to estimate the likelihood of enrollment in Part D on the sociodemographic variables. The results of the analysis, however, did not reveal any significant association between the enrollments in Part D and sociodemographic variables, indicating no significant selection bias between the treatment group and control group at the baseline regarding their sociodemographic characteristics. Second, because the HRS is a self-reported survey, the responses might not reflect the true outcomes due to interview bias, recall bias, or respondent bias. Finally, our study excluded the subjects who were enrolled in employer-sponsored drug insurance, Veteran Affairs health insurance, Medicare and Medicaid dual eligibility, Medicare Advantage plans, and state or other government subsidies. Therefore, our study findings may not be generalizable to these particular populations. However, we do not believe that these limitations are large enough to negate the findings and contribution of this study.

Conclusions

The findings of this study suggest that Part D implementation may lead to health benefits for enrolled beneficiaries in addition to cost savings and increased drug adherence. Moreover, the findings indicate that older adults with low incomes and higher burdens of chronic diseases are particularly vulnerable to experiencing adverse health conditions. Therefore, it is suggested that the federal government should continuously seek to enhance the Part D program by improving its operations and drug coverage, boosting enrollment, and increasing funding/education for programs such as the LIS, which could further provide more affordable medications for all Medicare beneficiaries.

Declaration of Conflicting Interests

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