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RESEARCH TOPIC

Race/ethnicity-related discrepancies in access to medication and service utilization amongst Medicare beneficiaries: a comparison between 2013 and 2020 MCBS Publicly available data
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Master Thesis

ACCESS TO MEDICATION AND SERVICE UTILIZATION AMONGST MEDICARE BENEFICIARIES

Race/ethnicity-related discrepancies, a comparison between 2013 and 2020

MCBS Publicly available data

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RESEARCH PAPER

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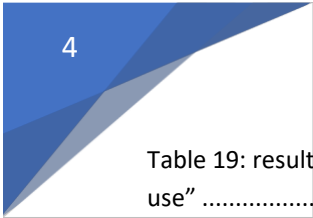


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I RESEARCH QUESTION AND PROBLEM STATEMENT

Topic:

Race/ethnicity-related discrepancies in access to medication and service utilization amongst Medicare beneficiaries: a comparison between 2013 and 2020 MCBS Publicly available data

Problem Statement:

The Medicare insurance program is the United-States most extensive public-run insurance system and is available to all Americans above 65 or with specific chronic conditions. Though it underwent several reforms and contributed positively to Medicare-aged Americans' overall health insurance coverage rate, it is still under criticism due to persisting inequalities amongst beneficiaries. As Covid-19 hit the United States, ethnicity and socio-economic conditions proved to be major drivers of inequalities in terms of healthcare service utilization and access to medication. Therefore, the main object of this study is to assess the relations of association between these metrics and ethnicity at the beginning of the pandemic and to compare them with older data to see the evolution. Furthermore, it attempts to analyze the potential interaction effects between ethnicity-related variables and relevant covariates for the year 2020.

II ABSTRACT

Background: The Covid-19 pandemic has reignited existing concerns about health inequalities amongst Medicare-aged Americans. This is especially true with access to medication and service utilization which have a significant influence on senior's health outcomes.

Objective: To look into race-related discrepancies in access to medication and service utilization for the year 2013 and 2020, and compare results to see what has changed before the beginning of the pandemic

Methods: This study uses the Medicare Current Beneficiary Survey(MCBS) Public Use Files(PUF) for 2013 and 2020 and investigates differences using chi-square test and multiple variable logistic regressions, adjusting for age, gender, education, starting health status (including chronic conditions) and type of health insurance coverage

Results: Before and after adjustment, The levels of satisfaction of Hispanic beneficiaries have dropped significantly regardless of the variable involved when it comes to access to medication. Non-Hispanic blacks, however, tend to fare slightly better, though they are still falling behind their non-black counterparts for most metrics used. Investigations into possible interaction effects linked to race show that ethnicity also plays a significant moderating effect on the impact of certain chronic conditions such as cancer. When looking at service utilization, significant discrepancies linked to race continue to exist between White beneficiaries and other ethnic groups. Lastly, beneficiaries' starting health status remains the most important contributing factor across all metrics studied, with some chronic conditions having more importance than before.

Conclusion: facilitating access to information on drug plans, and more broadly on health insurance coverage plans, might help with solving this issue. The current situation also requires that greater attention be given to the health of patients regardless of their ethnic background and that current biases, around race or gender, that exist in the medical world be addressed.

III ACKNOWLEDGMENTS

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IV LITERATURE REVIEW

As the Covid 19 pandemic hit the United-States in 2020, the issue of protecting the health of older people and of those suffering from chronic conditions soon became a national priority. Recent data from the U.S. Census Bureau have shown that, though the U.S. population is still growing, the share of Americans that are now 65 and older rose by nearly a third between 2010 and 2020 [1]. While age does not necessarily have a significant influence on health outcomes following a COVID-19 infection, comorbidities associated with it tend to have a strong influence on disease severity [2]. Therefore, the need for older Americans to benefit from proper health insurance coverage is now more important than ever.

The U.S. government attempted to tackle this issue as early as 1965 with the implementation of the Medicare program, their largest public Health program, which helped nearly all Americans that are 65 and older get basic health coverage by the 1970s [3]. However, this program has been at the center of many a controversy over its nearly 60 years of existence despite several reforms.

A recurrent issue that has been brought to the fore once again during the pandemic is that of significant discrepancies in access to care and service utilization between Medicare beneficiaries, especially in relation to race. In terms of access to care, studies have found that factors such as race or income level had a significant effect on factors such as hospital discharges or visits to physicians [4]. Access to medication more specifically has been the focus of several studies which showed that one's race, income or starting health status have a major impact on a given beneficiary's likelihood of engaging in cost-coping behaviors or his satisfaction with his drug plan [5][6]. This question of prescription drugs is a vital component of access to care as it has been proven that those that suffer from chronic conditions who had access to medications benefitted from a significantly longer lifespan [7], notably for diseases like diabetes [8]. Even though programs such as Medicare Part D or Medicaid helped increase the likelihood of Americans having drug coverage [9], this did not suffice to bridge inequalities in access to drugs between the neediest individuals [10]. All of this makes medication access a major health issue for seniors during and outside the pandemic.

In the current context, the question of service utilization has also gained momentum, especially due to Covid as ethnic minorities and beneficiaries with chronic conditions have been found to experience significantly higher rates of Covid-related hospitalization [11]. Similarly, racial and ethnic disparities in the level and nature of Covid outpatient treatments have also been highlighted in recent reports from the U.S. Center for Disease Control and Prevention [12]. However, as was observed with access to medication, these differences are not limited to Covid19 and are the reflection of preexisting inequalities. Ethnicity-based discrepancies in healthcare utilization amongst Medicare enrollees are indeed well documented [13][14] and tend to be amplified by other forms of socio-economic inequalities such as gender [15], income [16] or age [17]. For instance, an individual's net worth contributes significantly to his chances of rating his health status as poor or fair within each ethnic group [18], though factors such as education tend to have a mitigating effect on the strength of this association. In general, service utilization levels are strongly associated with health outcomes, notably when looking at changes in the probability of death [19] and provide important information on health inequalities in addition to access to care [20].

Lastly, many recent studies have pointed out the issue of the diversification of types of health insurance coverage for Medicare beneficiaries. Indeed, the standard Medicare formula, also called Medicare Fee For Service, has been flagged multiple times for its high level of copayments and out-of-pocket costs which still reached around 3024\$ per year and per beneficiary in 2017 [21]. To mitigate these costs, many Medicare beneficiaries have turned to alternative solutions such as Medicare Advantage [22] or, to a lesser extent, to supplemental private insurance plans such as Medigap plans [23]. Nonetheless, this multiplication/diversification of Medicare-associated health care plans has also been linked to several new issues for Medicare beneficiaries. In the case of Medigap, studies have pointed out that enrollees in this type of program are subject to noteworthy levels of moral hazard and adverse selection [24][25][26] due to greater plan generosity, which may have a substantial effect on important components of service utilization such as the level of inpatient stay [27]. Therefore, though this question is not at the center of this study, the effect of the type of plan cannot be neglected when considering service utilization and is thus considered.

These discrepancies regarding service utilization, access to care, and plan generosity have concrete implications in terms of public policy and call for an actualization of our

understanding of them using post-Covid data. Therefore, this study aims at providing an actualized overview of racial/ethnic discrepancies in terms of access to care and service utilization amongst Medicare Beneficiaries at the beginning of the Covid pandemic in 2020. This includes critically reviewing previous results obtained in 2013 and comparing them to 2020 data. In accordance with prior studies, this study adjusts for socio-economic factors (income, gender, education level), health factors (chronic conditions, health status), and type of health insurance coverage. This last covariate is essential to correct for the effect of adverse selection and moral hazard on service utilization observed in more recent studies as mentioned above. Besides, this study investigates existing interaction effects between covariates in order to look for potential mediating effects of ethnicity on other preexisting discrepancies, which is a problem very few studies have tackled before.

V METHODOLOGY

The database used for the purpose of this study is the 2020 Medicare Current Beneficiary Survey Public Use File (PUF). This is a “multipurpose survey of a nationally representative sample of the Medicare population” [28] which is carried out by the Office of Enterprise Data and Analytics of the Centers for Medicare & Medicaid Services (CMS). This survey provides extensive data about a given respondent’s socio-economic situation (income, education, marital status, living arrangement), starting health situation (self-assessed health status and chronic conditions such as Diabetes, Alzheimer, COPD...) or type of insurance coverage (Medicare Advantage, employer-sponsored, private insurance, Medicaid dual enrollment). Besides, it includes a variety of indicators for access to medication (satisfaction with a current drug plan, presence of cost-coping behaviors) as well as for healthcare utilization (inpatient, outpatient, skilled nursing facilities user rate).

The total number of respondents is 13,916, however, since this study focuses on age-eligible Medicare beneficiaries, the population is restricted to individuals who are 65 years old and above ($n = 11,587$). In the case of variables linked to medication access, this study focuses on individuals belonging to the MCBS summer subsection ($n = 8,394$) and excludes Medicare beneficiaries with no drug coverage for some dependent variables (“satisfaction with finding pharmacy” and “satisfaction with drug list”).

This study uses race/ethnicity as the main independent variable to categorize individuals between non-Hispanic whites ($n = 10,266$), non-Hispanic blacks (1,393), Hispanics (1,418). This is mostly due to the fact that information regarding socioeconomic status (SES) variables used to be much harder to access, which lead several of the early studies conducted in this field to consider this variable as a proxy for SES variables [29]. Nonetheless, the wide majority of recent studies have demonstrated that SES and ethnicity variables have separate effects on healthcare and now also include these variables as controlling variables. This is the approach chosen for this study. The main SES variables used in this study are education level and income level. Other controlling variables are Age, Gender, Chronic conditions (such as Diabetes, Cancer, Depression, and High blood pressure), and Health status. The latter is self-assessed by the respondent. Lastly, this study controls for the type of insurance coverage of beneficiaries in two separate ways: For access to care, which is centered on access to prescription drugs, it separates individuals based on whether they receive prescription drug coverage from 1) a private insurance plan, 2) a Medicare Advantage plan, 3) Medicare Part D, or from 4) Medicaid. Beneficiaries with no prescription drug coverage plan are grouped under the “No Coverage” category. For service utilization, it relies on a different decomposition which differentiates between individuals getting their health coverage from 1) a private supplemental insurance plan (Medigap or Employer-sponsored), 2) Medicaid, 3) Medicare Advantage or 4) Medicare Fee For Service (Medicare FFS, which is the traditional Medicare formula). The second definition employed for Medicare Advantage and Private insurance is broader than the one used for access to medication variables, since it comprises individuals who receive their health insurance from these plans but do not necessarily benefit from prescription drug coverage.

Regarding dependent variable: this study relies on two main constructs which regroup several dependent variables. The first construct is “access to care” and focuses on access to medication. The dependent variables associated with this construct are 1) the satisfaction of a beneficiary with the amount he or she pays for prescription drugs, 2) his or her satisfaction with the list of drugs covered by his or her drug plan, 3) his or her satisfaction with the ease of finding a pharmacy that accepts his or her drug plan, 4) the likelihood of a beneficiary resorting to cost-coping behaviors. The latter is split into two separate variables 1) one’s likelihood to forgo filling a prescription, and 2) one’s likelihood of skipping doses or taking

smaller doses than recommended to save on costs. This decomposition is mostly based on two studies realized in 2019 and 2017 respectively (Pollack, 2019 and Deborah A.Taira, 2017). The latter used the MCBS PUF 2013 access to care file and was critically replicated to ensure the relevance of this study. The second and last construct is “service utilization” and comprises three distinct variables, which are 1) outpatient service utilization, 2) inpatient service utilization, 3) skilled nurse facility utilization.

The statistical analysis performed in this study is divided into two main steps. Firstly, Chi-Square tests are used to get more information on demographic characteristics, access to care, and service utilization variables in relation to ethnic categories. This first part aims at providing a solid overview of the 2013 and 2020 databases and looks at the evolution of the characteristics of respondents in each ethnic category.

The second method used, which is at the core of this study, consists in several multiple variable logistic regressions to look at 1) the nature and strength of associations between independent variables and each of the dependent variables, and observe 2) their evolution through comparing 2013 and 2020 data.

Both the Chi-Square tests and the multiple variable logistic regressions are carried out using STATA V.17. Results are adjusted for sampling variability through balanced repeated replication (BRR) using the sets of sampling weights provided by the MCBS PUF. It is worth noting, for the 2020 dataset, that the set of sampling weights used in the case of access to medication variables is the “summer weights” set, whereas the one used for service utilization variable is the “fall weights” set. While results focus primarily on direct links of association as interpreting interaction terms can be arduous in the case of logistic regressions [30][31]... this study also looks into interaction terms in relation to ethnicity in order to identify potential moderating effects of this variable on the impact of covariates. Lastly, it is worth noting that the data used in this survey is de-identified and some variables have been excluded from this study due to limited access under the MCBS’s new privacy policy.

VI RESULTS OBTAINED

VI.1 POPULATION CHARACTERISTICS IN RELATION TO ETHNICITY

VI.1.1 SOCIO-ECONOMIC INDICATORS

Comparing MCBS data from year 2013 (see Table 1) and 2020 (see Table 2), no significant evolution in differences between ethnic groups can be observed for gender, age, income and education variables. For both years, non-Hispanic whites are more likely to be above 75 than their non-white and Hispanic counterparts **[45.5% against 42% and 43.1% for 2013, and 41.1% against 37.7% and 35.7% for 2020, P-val <0.001]**. A similar observation can be made regarding income given that the share of non-Hispanic white beneficiaries with revenues below 25000\$ is significantly lower than for beneficiaries from other ethnic groups **[30.8% against 59.6% and 68.5% for 2013, and 18.3% against 50.8% and 58.6% for 2020, P-val <0.001]**. It is worth noting that while the overall proportion of beneficiaries having revenues lower than 25000\$ annually has dropped for all categories, this fall has been uneven across ethnicities **[-12.5 percentage points for non-Hispanic whites against -8.8 and -9.9]**. Lastly, education appears as another major point of difference, with non-Hispanic black and Hispanic beneficiaries exhibiting lower rates of post-secondary education compared to non-Hispanic white beneficiaries **[32.9% and 26.1% against 50.4% for 2013, and 41.5% and 34.8% against 34.8% for 2020, P-val <0.001]**. As with income discrepancies, an overall positive evolution is witnessed across all racial categories, however the rise in higher education rates appears to be higher for non-Hispanic white beneficiaries, adding to the divide witnessed for the year 2013.

Table 1: results from the chi-square tests based on data from the MCBS ATC 2013 file for socio-economic variables

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Gender	male	0.447	0.408	0.437	0.0669
	female	0.553	0.592	0.563	
Age	Age 65-74	0.545	0.58	0.569	<0.001
	Age 75+	0.455	0.42	0.431	
Income	income <25000\$	0.308	0.596	0.685	<0.001
Education	Less than high school	0.131	0.343	0.501	<0.001
	High school graduate	0.364	0.328	0.238	
	More than high school	0.504	0.329	0.261	

Table 2: results from the chi-square tests based on data from the MCBS 2020 PUF (summer weights) for socio-economic variables

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Gender	male	0.449	0.426	0.404	0.1002
	female	0.551	0.574	0.596	
Age	Age 65-74	0.589	0.623	0.643	<0.001
	Age 75+	0.411	0.377	0.357	
Income	income <25000\$	0.183	0.508	0.586	<0.001
Education	Less than high school	0.06	0.238	0.457	<0.001
	High school graduate	0.288	0.348	0.195	
	More than high school	0.652	0.415	0.348	

VI.1.2 HEALTH INDICATORS: CHRONIC CONDITIONS AND SELF-ASSESSED HEALTH STATUS

Regarding chronic conditions, some notable changes can be seen between 2013 (see Table 3) and 2020 (see Table 4). The differences observed in 2013 between ethnic groups regarding the proportion of beneficiaries with cancer or depression appear to be significantly less marked for 2020 [**P-val <0.001 for both cancer and depression in 2013, and P-val of 0.1688 and 0.007 respectively in 2020**]. For cancer, this narrowing of the gap between ethnicities is driven mainly by an increase in observed cancer rates for minority groups and a decrease for non-Hispanic whites [**-1.5 percentage points for the latter, against +0.012 and 0.02 for non-Hispanic blacks and Hispanics respectively**]. Other chronic condition does not show a major) evolution in differences between races, with non-Hispanic whites remaining significantly less likely than others to suffer from high blood pressure [**66.1% against 83.3% and 70.3% in 2013, and 61.3% against 80.1% and 63.2% in 2020, P-val <0.001**] or from diabetes [**25.6% against 39.4% and 35.6% in 2013, and 25.8% against 43% and 45.8% in 2020, P-val <0.001**]. In addition, while there remain limited discrepancies between ethnic groups regarding the proportion of people with high cholesterol, a growing gap in favor of non-Hispanic whites can be observed for the year 2020 [**P-val of 0.9998 for 2013 against 0.0012 for 2020**], along with a general rise across all ethnic groups.

Lastly, the rate of beneficiaries deeming their health status to be good or above is markedly higher in 2020. Nonetheless, the divide between non-Hispanic white beneficiaries and other beneficiaries persists in 2020.

Table 3: results from the chi-square tests based on data from the MCBS ATC 2013 file for health-related variables

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Chronic conditions	High blood pressure	0.661	0.833	0.703	<0.001
	high cholesterol	0.587	0.587	0.587	0.9998
	diabetes	0.256	0.394	0.356	<0.001
	heart disease	0.112	0.096	0.085	0.0219
	COPD/asthma/emphysema	0.183	0.158	0.165	0.1462
	heart failure	0.069	0.081	0.062	0.2818
	depression	0.218	0.158	0.261	<0.001
	cancer	0.209	0.166	0.14	<0.001
Health status (self-assessed)	excellent	0.209	0.129	0.145	<0.001
	very good	0.351	0.245	0.203	
	good	0.279	0.347	0.334	
	fair	0.118	0.229	0.246	
	poor	0.042	0.05	0.072	

Table 4: results from the chi-square tests based on data from the MCBS 2020 PUF (summer weights) for health-related variables

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Chronic conditions	High blood pressure	0.613	0.801	0.632	<0.001
	high cholesterol	0.628	0.691	0.705	0.0012
	diabetes	0.258	0.43	0.458	<0.001
	heart disease	0.086	0.084	0.071	0.4959
	COPD/asthma/emphysema	0.17	0.165	0.139	0.2647
	heart failure	0.051	0.077	0.034	0.0042
	depression	0.221	0.166	0.252	0.007
	cancer	0.194	0.178	0.16	0.1668
Health status (self-assessed)	excellent	0.213	0.092	0.146	<0.001
	very good	0.41	0.294	0.245	
	good	0.257	0.384	0.32	
	fair	0.1	0.183	0.238	
	poor	0.021	0.047	0.05	

VI.1.3 TYPE OF HEALTH INSURANCE PLAN IN ADDITION TO OR IN PLACE OF MEDICARE FFS

VI.1.3.1 FOR PRESCRIPTION DRUG COVERAGE

The main significant gap between 2013 (see Table 5) and 2020 (see Table 6) is observed for beneficiaries receiving prescription coverage through a private insurance plan (either self-sponsored or employer-sponsored). Indeed, the proportion of Hispanic beneficiaries in this situation has risen sharply while it remained stable for others, dwindling the discrepancy observed between this racial category and others for 2013 [**12.4% against 25.6% and 22.4% in 2013 with P-val<0.001, and 17.3% against 25.2 and 20.9 in 2020 for P-val of 0.0084**]. Nonetheless, non-Hispanic whites are still significantly more likely to receive drug coverage from a Medicare Part D plan [**25.6% against 14.5% and 11.3% in 2013, and 26.7% against 9% and 7.7% in 2020, P-val<0.001**] and significantly less likely to receive it via a Medicare advantage plan [**29.2% against 33.2% and 48.5% in 2013, 36.9% against 57.5% and 59.4% in**

2020, P-val <0.001]. It is worth noting that the proportion of beneficiaries getting prescription drug coverage through a Medicare Advantage plan has seen a major increase regardless of the ethnic group [**+7.7 percentage points, +24.3 percentage points, and +10.9 percentage points**]. In addition, in accordance with recent studies on the level of prescription drug coverage, the proportion of beneficiaries without drug coverage has dropped for every racial category between 2013 and 2020. Lastly, Non-Hispanic blacks and Hispanics are even more likely to benefit from Medicaid dual coverage than non-Hispanic whites when comparing 2013 and 2020 data [**26.6% and 28% against 7% in 2013, 29.4% and 40% against 5.5% in 2020, P-val<0.001**].

Table 5: results from the chi-square tests based on data from the MCBS ATC 2013 file regarding type of health insurance coverage for prescription drugs

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Type of Medicare coverage	Medicare Part D	0.256	0.145	0.113	<0.001
	Private	0.256	0.224	0.124	<0.001
	Medicare advantage	0.292	0.332	0.485	<0.001
	Medicaid coverage	0.07	0.266	0.28	<0.001
	No drug coverage	0.155	0.14	0.11	0.006

Table 6: results from the chi-square tests based on data from the MCBS 2020 PUF (summer weights) regarding type of health insurance coverage for prescription drugs

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Type of Medicare coverage	Medicare Part D	0.267	0.09	0.077	<0.001
	Private	0.252	0.209	0.173	0.0084
	Medicare advantage	0.369	0.575	0.594	<0.001
	Medicaid coverage	0.055	0.294	0.407	<0.001
	No drug coverage	0.115	0.086	0.068	0.0124

VI.1.3.2 FOR OVERALL HEALTH INSURANCE COVERAGE

As coverage of Inpatient, outpatient, and skilled nursing facility services is not dependent on prescription drug coverage, individuals are also compared based on their type of health insurance coverage irrespective of whether their insurance plan covers prescription drugs or not. A few minor discrepancies can be observed between 2013 (see Table 7) and 2020 (see Table 8): The proportion of beneficiaries enrolled in a Medicare Advantage plan has increased, irrespective of the ethnic group [**+7 percentage points, +19 and + 7.9 percentage points**]. Conversely, the proportion of beneficiaries with only the traditional Medicare FFS has dropped slightly across all ethnic groups. Lastly, while the proportion of non-Hispanic white

beneficiaries with Medicaid dropped slightly, for Hispanics it rose by over 10 percentage points.

Table 7: results from the chi-square tests based on data from the MCBS ATC 2013 file regarding type of health insurance coverage

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Type of medicare coverage	Private	0.58	0.372	0.256	<0.001
	Medicare advantage	0.311	0.371	0.508	<0.001
	Medicaid coverage	0.07	0.266	0.28	<0.001
	Medicare FFS	0.134	0.164	0.139	0.0715

Table 8: results from the chi-square tests based on data from the MCBS 2020 PUF (fall weights) regarding type of health insurance coverage

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
Type of medicare coverage	Private	0.596	0.327	0.277	<0.001
	Medicare advantage	0.381	0.561	0.587	<0.001
	Medicaid coverage	0.061	0.289	0.381	<0.001
	Medicare FFS	0.096	0.104	0.089	0.7133

VI.2 ACCESS TO MEDICATION VARIABLES IN RELATION TO ETHNICITY: UNADJUSTED RESULTS

Levels of satisfactions have risen noticeably between 2013 (see Table 9) and 2020 (see Table 10) for non-Hispanic whites and non-Hispanic blacks when it comes to amount paid **[+13.3 percentage points and +12.8 percentage points]**, drug list covered by their health insurance plan **[+7.4 percentage points and +9.3 percentage points]** and finding a pharmacy that accepts their drug plan **[+5.2 percentage points and +10.5 percentage points]**. Hispanic beneficiaries, however, show slumping satisfaction levels for drug lists **[-8 percentage points]** and for capacity to find a pharmacy **[-12.7 percentage points]**. Overall, non-Hispanic whites exhibit higher levels of satisfaction than others regardless of the variable observed **[Pval<0.001]**, though the divide between them and non-Hispanic blacks shrunk while the one between non-Hispanic whites and Hispanics widened.

Lastly, while all ethnic groups are less likely to engage in cost-coping behaviors that involve taking a smaller dose or skipping a dose to save on medication costs, there is a growing number of individuals who choose not to fill a prescription due to costs.

Table 9: results from the chi-square tests based on data from the MCBS ATC 2013 file regarding variables linked to access to medications

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
satisfaction with amount paid	very satisfied	0.291	0.206	0.276	<0.001
	satisfied	0.552	0.623	0.525	
	dissatisfied	0.127	0.135	0.161	
	very dissatisfied	0.03	0.035	0.039	
satisfaction with drug list	very satisfied	0.297	0.209	0.299	<0.001
	satisfied	0.626	0.738	0.614	
	dissatisfied	0.065	0.045	0.077	
	very dissatisfied	0.012	0.008	0.009	
satisfaction with finding pharmacy	very satisfied	0.515	0.327	0.414	<0.001
	satisfied	0.475	0.664	0.574	
	dissatisfied	0.007	0.008	0.011	
	very dissatisfied	0.002	0.001	0.001	
did not fill a prescription due to costs	often	0.005	0.007	0.005	0.8651
	sometimes	0.028	0.033	0.028	
	never	0.967	0.96	0.967	
took a smaller dose due to costs	often	0.007	0.01	0.008	0.8279
	sometimes	0.038	0.032	0.036	
	never	0.955	0.958	0.956	
skipped a dose due to costs	often	0.009	0.015	0.005	0.1078
	sometimes	0.058	0.064	0.074	
	never	0.934	0.921	0.92	

Table 10: results from the chi-square tests based on data from the MCBS 2020 PUF (summer weights) regarding variables linked to access to medications

	Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
satisfaction with amount paid	very satisfied	0.424	0.334	0.31	<0.001
	satisfied	0.472	0.577	0.595	
	dissatisfied	0.079	0.066	0.076	
	very dissatisfied	0.026	0.023	0.019	
satisfaction with drug list	very satisfied	0.371	0.302	0.219	<0.001
	satisfied	0.575	0.661	0.739	
	dissatisfied	0.044	0.03	0.039	
	very dissatisfied	0.01	0.006	0.004	
satisfaction with finding pharmacy	very satisfied	0.567	0.432	0.287	<0.001
	satisfied	0.423	0.556	0.704	
	dissatisfied	0.008	0.008	0.007	
	very dissatisfied	0.002	0.004	0.002	
did not fill a prescription due to costs	often	0.007	0.017	0.006	0.23
	sometimes	0.064	0.066	0.074	
	never	0.928	0.917	0.92	
took a smaller dose due to costs	often	0.01	0.004	0.003	0.043
	sometimes	0.023	0.047	0.03	
	never	0.967	0.947	0.967	
skipped a dose due to costs	often	0.004	0.002	0.008	0.0171
	sometimes	0.02	0.043	0.026	
	never	0.976	0.955	0.967	

VI.3 SERVICE UTILIZATION VARIABLES IN RELATION TO ETHNICITY: UNADJUSTED RESULTS

Levels of service utilization have increased across all variables between 2013 (see Table 11) and 2020 (see Table 12). Non-Hispanic whites remain significantly more likely to have at least one outpatient visit throughout the year than their counterparts from another ethnic category [**40.1% against 25.7% and 24.8% in 2013, 48.2% against 41% and 30.3% in 2020, P-val<0.001**]. Nevertheless, the proportion of beneficiaries having outpatient visits rose faster for non-Hispanic blacks compared to others [**+15.3 percentage points against +8.2 and +5.5 percentage points**].

Table 11: results from the chi-square tests based on data from the MCBS ATC 2013 file regarding variables linked to service utilization

Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
at least 1 stay in a skilled nursing facility	0.013	0.011	0.007	0.4191
at least 1 inpatient visit	0.069	0.064	0.046	0.0679
at least 1 outpatient visit	0.401	0.257	0.248	<0.001

Table 12: results from the chi-square tests based on data from the MCBS 2020 PUF (fall weights) regarding variables linked to service utilization

Variable	Non Hispanic White	Non Hispanic Black	Hispanic	P-value
at least 1 stay in a skilled nursing facility	0.029	0.021	0.021	0.2622
at least 1 inpatient visit	0.11	0.102	0.073	0.0049
at least 1 outpatient visit	0.482	0.41	0.303	<0.001

VI.4 ACCESS TO MEDICATION VARIABLES: ADJUSTED RESULTS

Table 13: results from the multiple variable logistic regression for the dependent variable “satisfaction amount”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	1.01	0.91	1.12	0.892	0.85	0.75	0.96	0.010
Gender	0.94	0.85	1.04	0.196	1.01	0.89	1.15	0.850
Hispanic	1.02	0.85	1.23	0.820	0.53	0.42	0.68	0.000
Non Hispanic Black	0.67	0.53	0.84	0.001	0.61	0.48	0.78	0.000
Income	0.90	0.80	1.01	0.064	0.93	0.79	1.10	0.400
Highschool	0.83	0.72	0.95	0.008	1.02	0.89	1.18	0.753
Less than highschool	0.66	0.56	0.78	0.000	0.73	0.56	0.95	0.022
HBP	1.11	0.98	1.26	0.099	0.94	0.82	1.08	0.353
High cholesterol	1.14	1.02	1.27	0.021	1.20	1.03	1.41	0.020
Diabetes	0.91	0.81	1.02	0.088	1.01	0.85	1.20	0.893
Heart disease	1.30	1.11	1.52	0.001	0.93	0.75	1.15	0.514
COPD	0.92	0.81	1.04	0.179	0.84	0.71	1.00	0.047
Heart failure	1.01	0.82	1.24	0.936	0.95	0.68	1.34	0.786
Depression	0.96	0.84	1.09	0.506	0.90	0.78	1.05	0.177
Cancer	1.10	0.97	1.25	0.126	1.08	0.95	1.22	0.262
Very good	0.64	0.54	0.75	0.000	0.69	0.57	0.83	0.000
Good	0.44	0.38	0.52	0.000	0.50	0.42	0.60	0.000
Fair	0.36	0.30	0.44	0.000	0.48	0.38	0.61	0.000
Poor	0.42	0.32	0.56	0.000	0.59	0.36	0.98	0.042
Private	0.70	0.59	0.83	0.000	0.69	0.54	0.87	0.002
Medicare Advantage	0.78	0.68	0.90	0.001	0.88	0.72	1.07	0.185
Part D	0.51	0.43	0.59	0.000	0.42	0.33	0.52	0.000
Medicaid	1.72	1.40	2.12	0.000	1.63	1.21	2.19	0.001
constant	0.96	0.79	1.16	0.648	1.68	1.29	2.18	0.000

Table 14: results from the multiple variable logistic regression for the dependent variable “drug list satisfaction”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	0.96	0.84	1.10	0.551	0.91	0.80	1.02	0.116
Gender	1.03	0.91	1.16	0.664	1.05	0.93	1.18	0.426
Hispanic	1.38	1.13	1.67	0.002	0.50	0.38	0.66	0.000
Non Hispanic Black	0.62	0.50	0.78	0.000	0.81	0.66	1.01	0.056
Income	0.84	0.71	1.00	0.052	0.83	0.70	0.99	0.037
Highschool	0.86	0.73	1.02	0.078	0.90	0.78	1.04	0.152
Less than highschool	0.64	0.53	0.78	0.000	0.65	0.50	0.85	0.002
HBP	1.13	0.96	1.31	0.131	1.04	0.88	1.24	0.650
High cholesterol	1.07	0.95	1.20	0.274	1.17	1.00	1.37	0.049
Diabetes	0.94	0.80	1.10	0.446	0.99	0.84	1.17	0.921
Heart disease	1.37	1.14	1.66	0.001	1.05	0.85	1.31	0.633
COPD	1.01	0.84	1.21	0.941	0.93	0.79	1.10	0.395
Heart failure	1.19	0.97	1.46	0.098	1.00	0.76	1.32	0.982
Depression	0.77	0.65	0.91	0.003	0.91	0.78	1.07	0.245
Cancer	1.25	1.07	1.46	0.006	1.18	1.03	1.36	0.019
Very good	0.68	0.57	0.80	0.000	0.69	0.58	0.81	0.000
Good	0.49	0.40	0.59	0.000	0.48	0.41	0.57	0.000
Fair	0.39	0.31	0.49	0.000	0.47	0.38	0.59	0.000
Poor	0.47	0.35	0.65	0.000	0.43	0.26	0.69	0.001
Private	1.39	1.11	1.74	0.005	1.11	0.91	1.35	0.292
Medicare Advantage	1.22	1.00	1.48	0.050	1.24	1.09	1.42	0.002
Medicaid	2.05	1.63	2.58	0.000	1.62	1.25	2.10	0.000
constant	0.53	0.39	0.70	0.000	0.75	0.61	0.93	0.009

Table 15: results from the multiple variable logistic regression for the dependent variable “pharmacy satisfaction”

	2013				2020			
	Odds ratio	Confidence interval(95%)	P-val		Odds ratio	Confidence interval(95%)	P-val	
Age	0.91	0.81	1.02	0.109	0.95	0.84	1.07	0.402
Gender	1.18	1.06	1.32	0.004	1.15	1.01	1.32	0.039
Hispanic	0.98	0.81	1.17	0.811	0.38	0.30	0.49	0.000
Non Hispanic Black	0.54	0.43	0.67	0.000	0.71	0.58	0.87	0.001
Income	0.78	0.68	0.91	0.001	0.67	0.57	0.79	0.000
Highschool	0.78	0.69	0.89	0.000	0.77	0.67	0.90	0.001
Less than highschool	0.52	0.44	0.63	0.000	0.52	0.40	0.69	0.000
HBP	1.09	0.95	1.24	0.205	1.16	0.99	1.36	0.067
High cholesterol	1.08	0.97	1.22	0.171	1.09	0.94	1.26	0.235
Diabetes	0.99	0.88	1.12	0.907	1.08	0.92	1.27	0.356
Heart disease	1.08	0.91	1.28	0.371	1.00	0.80	1.25	0.988
COPD	1.13	0.97	1.32	0.128	1.01	0.85	1.21	0.892
Heart failure	1.26	1.00	1.58	0.049	1.01	0.76	1.36	0.919
Depression	0.97	0.84	1.12	0.689	1.01	0.88	1.16	0.876
Cancer	1.12	0.97	1.29	0.112	1.07	0.93	1.24	0.362
Very good	0.70	0.59	0.83	0.000	0.74	0.62	0.88	0.001
Good	0.47	0.39	0.56	0.000	0.53	0.44	0.63	0.000
Fair	0.41	0.34	0.50	0.000	0.54	0.43	0.68	0.000
Poor	0.42	0.31	0.56	0.000	0.40	0.25	0.62	0.000
Private	1.29	1.06	1.57	0.012	1.08	0.90	1.29	0.408
Medicare Advantage	1.24	1.03	1.50	0.026	1.16	1.01	1.32	0.030
Medicaid	1.57	1.27	1.94	0.000	1.54	1.15	2.06	0.004
constant	1.36	1.04	1.78	0.023	1.60	1.27	2.03	0.000

Table 16: results from the multiple variable logistic regression for the dependent variable “no fill”

	2013				2020			
	Odds ratio	Confidence interval(95%)	P-val		Odds ratio	Confidence interval(95%)	P-val	
Age	0.44	0.36	0.52	0.000	0.61	0.49	0.76	0.000
Gender	1.25	1.02	1.53	0.032	1.39	1.12	1.73	0.004
Hispanic	0.90	0.65	1.24	0.524	1.05	0.65	1.69	0.850
Non Hispanic Black	1.04	0.73	1.47	0.839	1.09	0.68	1.75	0.704
Income	1.72	1.42	2.08	0.000	1.53	1.14	2.05	0.005
Highschool	1.13	0.93	1.37	0.217	1.02	0.79	1.30	0.897
Less than highschool	1.14	0.84	1.55	0.389	1.18	0.78	1.80	0.426
HBP	0.94	0.73	1.21	0.630	1.10	0.84	1.44	0.473
High cholesterol	1.24	1.02	1.51	0.032	1.13	0.86	1.47	0.375
Diabetes	1.19	0.95	1.49	0.136	1.35	1.07	1.71	0.013
Heart disease	0.99	0.73	1.33	0.924	1.15	0.78	1.70	0.472
COPD	1.34	1.06	1.70	0.016	1.74	1.33	2.28	0.000
Heart failure	1.08	0.79	1.48	0.626	1.75	1.15	2.66	0.009
Depression	1.63	1.31	2.03	0.000	1.54	1.16	2.04	0.004
Cancer	0.97	0.77	1.21	0.760	1.42	1.09	1.85	0.011
Very good	1.09	0.75	1.58	0.654	1.53	1.00	2.32	0.049
Good	1.62	1.18	2.22	0.003	2.26	1.40	3.63	0.001
Fair	2.45	1.76	3.41	0.000	2.62	1.66	4.12	0.000
Poor	2.54	1.69	3.84	0.000	2.63	1.30	5.34	0.008
Private	0.59	0.43	0.81	0.001	0.78	0.48	1.26	0.300
Medicare Advantage	0.88	0.66	1.19	0.414	1.10	0.74	1.64	0.631
Part D	0.99	0.73	1.36	0.967	1.69	1.09	2.61	0.019
Medicaid	0.45	0.31	0.64	0.000	0.42	0.26	0.66	0.000
constant	0.04	0.03	0.06	0.000	0.02	0.01	0.03	0.000

Table 17: results from the multiple variable logistic regression for the dependent variable “other cost-coping behaviors”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	0.63	0.52	0.77	0.000	0.64	0.49	0.84	0.002
Gender	1.01	0.84	1.21	0.947	1.16	0.82	1.66	0.396
Hispanic	0.80	0.52	1.23	0.305	0.87	0.51	1.49	0.607
Non Hispanic Black	1.07	0.75	1.54	0.700	1.42	0.83	2.43	0.203
Income	1.65	1.26	2.17	0.000	2.08	1.39	3.12	0.000
Highschool	0.86	0.70	1.06	0.164	0.84	0.63	1.12	0.242
Less than highschool	0.81	0.58	1.13	0.219	0.89	0.47	1.68	0.720
HBP	0.62	0.48	0.80	0.000	0.84	0.58	1.23	0.374
High cholesterol	1.17	0.92	1.51	0.202	1.13	0.83	1.55	0.441
Diabetes	1.26	0.98	1.61	0.071	1.61	1.17	2.22	0.004
Heart disease	1.06	0.77	1.46	0.710	2.32	1.48	3.62	0.000
COPD	1.76	1.35	2.30	0.000	1.35	0.92	1.97	0.122
Heart failure	0.96	0.71	1.30	0.793	1.31	0.75	2.28	0.342
Depression	2.11	1.63	2.72	0.000	1.48	1.07	2.05	0.020
Cancer	0.91	0.74	1.14	0.416	1.41	0.99	2.00	0.057
Very good	1.21	0.83	1.76	0.307	1.26	0.73	2.16	0.409
Good	1.65	1.19	2.30	0.003	1.66	0.98	2.81	0.061
Fair	3.07	2.08	4.55	0.000	1.69	0.87	3.27	0.120
Poor	2.66	1.70	4.18	0.000	1.68	0.72	3.91	0.227
Private	0.85	0.62	1.17	0.322	0.81	0.47	1.40	0.450
Medicare Advantage	1.02	0.75	1.39	0.883	1.08	0.69	1.71	0.730
Part D	1.39	1.04	1.86	0.026	1.04	0.58	1.85	0.906
Medicaid	0.56	0.38	0.84	0.005	0.53	0.32	0.87	0.013
constant	0.03	0.02	0.05	0.000	0.02	0.01	0.04	0.000

VI.4.1 CONTRIBUTION OF SOCIO-ECONOMIC INDICATORS

After adjustment, several notable evolutions can be observed regarding differences in medication access between ethnic groups. Hispanics have experienced the sharpest decline in satisfaction relative to other ethnic groups, as being Hispanic has a significant negative impact on the chance of one being satisfied for all three satisfaction variables in 2020, which was not the case in 2013. When it comes to satisfaction with the amount paid for prescription drugs, Hispanics are now significantly less likely to be satisfied than non-Hispanic whites [**OR = 0.53, 95%CI(0.42,0.68)**], contrary to conclusions drawn for 2013 [**OR = 1.02, 95%CI(0.85,1.23)**]. Besides, while Hispanics were significantly more likely to be satisfied with the drug list comprised in their drug plan in 2013 [**OR = 1.38, 95%CI(1.13,1.67)**], the opposite can be observed with the year 2020 [**OR = 0.50, 95%CI(0.38,0.66)**]. They are also less likely to be satisfied with finding a pharmacy accepting their drug plan in 2020 [**OR = 0.38, 95%CI(0.30,0.49)**], even though this was not the case in 2013 [**OR = 0.98, 95%CI(0.81,1.17)**]. Regarding cost-coping behaviors, however, there remains no significant difference between Hispanics and Non-Hispanic whites. Non-Hispanic blacks, however, have seen an improvement in their satisfaction level compared to that of non-Hispanic whites. Indeed,

though being black is still associated with lower levels of satisfaction for the variable linked to amount satisfaction [**OR = 0.61, 95%CI(0.48,0.78)**] and pharmacy satisfaction [**OR = 0.71, 95%CI(0.58,0.87)**] in comparison to being white, this difference is no longer significant when it comes to satisfaction with their list of drugs [**OR = 0.81, 95%CI(0.66,1.01)**]. Besides, similarly to Hispanics, there are still no significant differences between them and non-Hispanic whites as regards cost-coping behaviors.

The impact of other socio-economic variables, such as age, gender, and education level, has remained constant overall when comparing 2013 to 2020, apart from a few notable changes. Beneficiaries aged 75 and above are now significantly less likely to be satisfied with the amount they pay for prescription drugs [**OR = 0.85, 95%CI(0.75,0.96)**] compared to 2013[**OR = 1.01, 95%CI(1.12)**]. Besides that, the contradictory relation between age, satisfaction with pharmacy, and likeliness to engage in cost-coping behaviors that were pointed out in a previous study on the subject has maintained itself and is still visible with 2020 data. Similarly, no substantial evolution is observed regarding gender differences. Women are more likely to be satisfied with finding a pharmacy accepting their drug plan [**OR = 1.15, 95%CI(1.01,1.32)**] and more likely to neglect to fill a prescription in order to cut on costs [**OR = 1.39, 95%CI(1.12,1.73)**]. People with income inferior to 25000\$ annually were also more likely to engage in cost-coping behaviors and more likely to be dissatisfied with their drug plans (except in terms of the amount paid). Lastly, it is interesting to note that education remains a variable that contributes significantly to access to medication variables, with people having a post-secondary education faring significantly better than their less educated peers across nearly all dependent variables. One minor change can be mentioned regarding levels of satisfaction for the amount paid for prescription drugs where being a high school graduate no longer puts one at a significant disadvantage.

VI.4.2 CONTRIBUTION OF HEALTH-RELATED INDICATORS

As was observed in 2013, health status remains the most significant contributing variable across all dependent variables for medication access. Medicare beneficiaries who assess their health to be below excellent are significantly less likely to be dissatisfied with their drug plan in terms of cost, access to pharmacy, or drug list comprehensiveness. For cost satisfaction for instance, this association is observable even for those who still rate their

health status as very good [**OR = 0.69, 95%CI(0.57, 0.83)**] and is stronger for those in fair condition [**OR = 0.48, 95%CI(0.38,0.61)**]. Conversely, they are more likely to avoid filling prescriptions to save on costs. Nonetheless, while individuals with a subpar health condition were also significantly more likely to engage in other forms of cost-coping behaviors in 2013, especially those rating their condition as fair [**OR = 3.07, 95%CI(2.08,4.55)**], this was not the case in 2020 [**OR = 1.69, 95%CI(0.87,3.27)**]. This suggests that health status is no longer associated as strongly with this type of behavior as it was in 2013.

A similar observation can be made regarding those who suffer from COPD: while beneficiaries with this condition were previously more likely to try and find ways to cut costs [**OR = 1.76, 95%CI(1.35,2.30)**], this difference is no longer significant [**OR = 1.35, 95%CI(0.92,1.97)**], save for the odd of not filling a prescription. The same can be observed for those with high blood pressure. Other chronic conditions, however, now have a significant impact on a beneficiary's likelihood to put their health at risks for financial motives. This is notably the case with diabetes [**OR = 1.61, 95%CI(1.17,2.22)**] and heart diseases [**OR = 2.32, 95%CI(1.48, 3.62)**]. Therefore, these appear to have partly replaced health status as predictor of cost-coping behaviors. Though, in the case of heart disease, the likelihood of a beneficiary having this condition being discontent with his drug plan no longer differs significantly from that of others.

VI.4.3 CONTRIBUTION OF THE TYPE OF DRUG COVERAGE PLAN

The type of coverage that has seen the most significant changes is private coverage. Contrary to 2013, beneficiaries who get their drug coverage from one or several private health insurance plans are no longer significantly less likely to be dissatisfied with the amount paid for their drug plan [**OR = 0.72, 95%CI(0.72,1.07)**], the drug list covered by said plan [**OR = 1.11, 95%CI(0.91,1.35)**] or with finding a pharmacy that accepts it [**OR = 1.08, 95%CI(0.90,1.29)**]. Similarly, receiving prescription drug coverage through a Medicare Advantage plan no longer impacts noticeably a beneficiaries likelihood to be less satisfied with their drug plan [**OR = 0.88, 95%CI(0.72,1.07)**]. On the contrary, being a Medicaid dual enrollee still contributes highly positively to a beneficiary's odds of being satisfied across all variables. It also keeps contributing negatively to one's likelihood of engaging in any manner of cost-coping behavior. Lastly, Part D enrollees show an interesting evolution as they are no longer

significantly more likely to take a smaller dose or skip one to save on costs but are now, paradoxically, significantly more likely to refuse to fill a prescription for this same reason.

VI.5 SERVICE UTILIZATION VARIABLES: ADJUSTED RESULTS

Table 18: results from the multiple variable logistic regression for the dependent variable “inpatient service use”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	1.54	1.31	1.80	0.000	1.77	1.47	2.13	0.000
Gender	1.02	0.88	1.19	0.784	1.00	0.81	1.25	0.965
Hispanic	0.61	0.44	0.84	0.003	0.72	0.47	1.10	0.124
Non Hispanic Black	0.74	0.56	0.97	0.032	1.02	0.72	1.46	0.905
Income	1.04	0.88	1.23	0.665	1.14	0.84	1.54	0.398
Highschool	1.00	0.84	1.19	0.964	1.23	0.98	1.53	0.074
Less than highschool	1.10	0.87	1.37	0.429	1.11	0.83	1.49	0.466
HBP	1.09	0.92	1.28	0.314	1.20	0.97	1.49	0.088
High cholesterol	0.91	0.78	1.06	0.233	0.81	0.66	1.00	0.052
Diabetes	1.14	0.97	1.33	0.114	1.16	0.97	1.40	0.110
Heart disease	1.15	0.92	1.43	0.230	1.22	0.88	1.67	0.225
COPD	1.28	1.09	1.51	0.004	1.20	0.95	1.53	0.125
Heart failure	2.39	1.86	3.07	0.000	1.84	1.32	2.55	0.000
Depression	1.27	1.08	1.48	0.003	1.15	0.93	1.43	0.193
Cancer	1.23	1.05	1.43	0.010	1.24	1.00	1.54	0.046
Very good	1.66	1.22	2.26	0.002	2.12	1.53	2.94	0.000
Good	3.06	2.32	4.03	0.000	3.23	2.23	4.68	0.000
Fair	4.22	3.11	5.72	0.000	4.93	3.41	7.13	0.000
Poor	5.65	3.81	8.36	0.000	7.98	4.51	14.10	0.000
Private	1.04	0.86	1.26	0.686	1.34	1.05	1.70	0.017
Medicare Advantage	0.09	0.06	0.13	0.000	0.02	0.01	0.04	0.000
Medicaid	1.38	1.05	1.81	0.020	1.54	1.00	2.36	0.051
constant	0.04	0.03	0.06	0.000	0.02	0.01	0.03	0.000

Table 19: results from the multiple variable logistic regression for the dependent variable “outpatient service use”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	1.43	1.27	1.60	0.000	1.51	1.33	1.72	0.000
Gender	1.54	1.37	1.74	0.000	1.53	1.37	1.72	0.000
Hispanic	0.58	0.46	0.74	0.000	0.63	0.47	0.85	0.002
Non Hispanic Black	0.70	0.56	0.87	0.002	0.62	0.46	0.83	0.001
Income	0.99	0.84	1.15	0.851	0.99	0.84	1.16	0.871
Highschool	1.04	0.91	1.19	0.581	1.14	1.00	1.31	0.053
Less than highschool	1.07	0.89	1.29	0.480	1.38	1.05	1.81	0.020
HBP	1.14	1.00	1.31	0.053	1.13	0.99	1.29	0.069
High cholesterol	1.19	1.05	1.34	0.008	1.26	1.11	1.44	0.001
Diabetes	0.97	0.86	1.10	0.651	0.99	0.83	1.17	0.888
Heart disease	1.18	0.99	1.41	0.070	1.63	1.28	2.08	0.000
COPD	1.35	1.15	1.58	0.000	1.15	0.98	1.35	0.095
Heart failure	1.53	1.21	1.94	0.000	1.86	1.45	2.39	0.000
Depression	1.12	0.96	1.31	0.137	1.01	0.85	1.19	0.948
Cancer	1.50	1.26	1.78	0.000	1.34	1.15	1.56	0.000
Very good	1.39	1.18	1.63	0.000	1.28	1.06	1.56	0.011
Good	1.74	1.44	2.10	0.000	1.75	1.44	2.11	0.000
Fair	2.11	1.72	2.60	0.000	1.75	1.31	2.33	0.000
Poor	2.53	1.82	3.51	0.000	1.84	1.23	2.76	0.003
Private	1.53	1.31	1.77	0.000	1.63	1.38	1.93	0.000
Medicare Advantage	0.03	0.02	0.04	0.000	0.02	0.01	0.03	0.000
Medicaid	2.07	1.61	2.65	0.000	1.99	1.41	2.81	0.000
constant	0.45	0.38	0.54	0.000	0.36	0.28	0.47	0.000

Table 20: results from the multiple variable logistic regression for the dependent variable “skilled nursing facility use”

	2013				2020			
	Odds ratio	Confidence interval(95%)		P-val	Odds ratio	Confidence interval(95%)		P-val
Age	2.60	1.83	3.70	0.000	4.14	2.31	7.40	0.000
Gender	1.61	1.23	2.13	0.001	1.09	0.73	1.63	0.665
Hispanic	0.55	0.30	1.04	0.064	0.32	0.12	0.91	0.032
Non Hispanic Black	0.51	0.30	0.84	0.010	0.69	0.26	1.84	0.451
Income	0.98	0.72	1.34	0.909	1.94	1.21	3.11	0.006
Highschool	0.69	0.51	0.95	0.021	0.77	0.48	1.23	0.276
Less than highschool	0.87	0.62	1.22	0.425	0.56	0.23	1.35	0.196
HBP	1.32	0.92	1.89	0.135	1.43	0.90	2.29	0.132
High cholesterol	0.83	0.65	1.06	0.137	0.68	0.43	1.09	0.106
Diabetes	1.09	0.79	1.50	0.614	1.20	0.75	1.91	0.448
Heart disease	1.00	0.70	1.44	0.994	0.84	0.46	1.55	0.576
COPD	1.38	1.06	1.78	0.016	0.77	0.44	1.35	0.358
Heart failure	2.40	1.58	3.65	0.000	0.88	0.40	1.92	0.741
Depression	1.32	1.02	1.69	0.033	1.27	0.76	2.13	0.363
Cancer	1.14	0.84	1.56	0.387	1.02	0.62	1.70	0.924
Very good	2.14	1.10	4.17	0.025	7.77	1.73	34.86	0.008
Good	4.76	2.64	8.59	0.000	9.81	2.25	42.78	0.003
Fair	5.49	2.77	10.87	0.000	25.47	6.18	104.88	0.000
Poor	9.81	4.54	21.17	0.000	47.12	9.59	231.56	0.000
Private	1.16	0.83	1.62	0.382	1.10	0.61	1.98	0.748
Medicare Advantage	0.34	0.23	0.52	0.000	0.05	0.01	0.20	0.000
Medicaid	1.55	1.01	2.36	0.044	2.33	1.00	5.41	0.049
constant	0.00	0.00	0.01	0.000	0.00	0.00	0.00	0.000

VI.5.1 CONTRIBUTION OF SOCIO-ECONOMIC INDICATORS

While a beneficiary’s ethnic background contributed significantly to his or her likelihood to use inpatient services or stay at a skilled nurse facility in 2013, this is no longer the case in 2020. For instance, looking at inpatient service use, Hispanics were significantly less likely than others to spend at least a night at the hospital in 2013 [**OR = 0.74, 95%CI(0.56,0.97)**] but not in 2020 [**OR = 1.02, 95%CI(0.72,1.46)**]. This trend, however, did not extend to outpatient service use, with Non-Hispanic Blacks and Hispanics remaining less likely than their white counterparts to receive ambulatory care.

Regarding skilled nursing facility use, gender differences are no longer statistically relevant: Though women were more likely than men to rely on this type of service in 2013 [**OR = 1.61, 95%CI(1.23,2.13)**] the same cannot be said for 2020 [**OR = 1.09, 95%CI(0.73,1.63)**].

VI.5.2 CONTRIBUTION OF HEALTH-RELATED INDICATORS

As was observed with variables pertaining to medication access, health-status remains the most significant contributor for service utilization variables. Unsurprisingly, the worse a beneficiary considers his health to be, the higher his or her odds to go to a healthcare facility. This phenomenon is less pronounced for outpatient care but remains important.

Looking at chronic conditions, COPD is not a significant contributing factor anymore, regardless of the service utilization variable involved. Conversely, heart related diseases now have a noticeable positive impact on outpatient service use [**OR = 1.63, 95%CI(1.28,2.08)**].

VI.5.3 CONTRIBUTION OF THE TYPE OF DRUG COVERAGE PLAN

No significant differences are observed between the year 2013 and the year 2020 as regards the impact of a given beneficiary's type of health coverage on his odds of using any of the healthcare services considered in this study. Those with a Medicare advantage plan remain significantly less likely to use the aforementioned services, whereas those with Medicaid coverage or with a supplemental private insurance plan (Medigap) are still significantly more likely to do so.

VI.6 INTERACTION EFFECTS IN RELATION TO ETHNICITY (ADJUSTED)

Table 21: significant interaction terms observed

dependent variable	interaction term	ratio of odds ratio	p-value	inverted ratio
satisfaction with finding pharmacy	HBP x Hispanic	0.59	0.025	1.69
	HBP x NonHispanicBlack	2.25	0.035	0.44
	Age x Hispanic	0.58	0.034	1.72
	Cancer x Hispanic	0.61	0.05	1.64
	MA x Hispanic	1.61	0.02	0.62
cost-coping behaviors	Depression x Hispanic	5.32	0.007	0.19
inpatient service use	Diabetes x NonHispanicBlack	2.77	0.019	0.36
	HBP x NonHispanicBlack	0.34	0.05	2.94
outpatient service use	HBP x Hispanic	0.54	0.019	1.85
	MAOU x Hispanic	0.39	<0.001	2.56

VI.6.1 FOR VARIABLES RELATED TO ACCESS TO MEDICATION

As can be seen in the Table 21, most significant ethnicity-related interaction effects pertaining to a beneficiary's satisfaction with finding a pharmacy that accepts his drug plan involve a chronic condition. For instance, being Hispanic implies a **41% lower** odds ratio for high-blood pressure than the one observed for Non-Hispanic Whites. Therefore, having high blood pressure has a significantly more negative impact on the aforementioned dependent variable for Hispanic beneficiaries compared to non-Hispanic white beneficiaries. The opposite can be said for non-Hispanic Blacks.

Nonetheless, the odds ratio associated with Medicare Advantage is **61% higher** for Hispanic beneficiaries compared to their Non-Hispanic White counterparts. This means

Hispanic beneficiaries with Medicare Advantage tend to display higher satisfaction levels than those with the same plan but who belong to the latter category.

When looking at cost-coping behaviors, this study shows a significant interaction effect linking Hispanics and Depression. The odds ratio of Depression is indeed **5.32 times higher** for Hispanics, pointing to a significant mediating power of ethnicity, for Hispanics, on the effect of depression on the likelihood of engaging in cost-coping behaviors.

VI.6.2 FOR VARIABLES RELATED TO SERVICE UTILIZATION

As with access to medication variables, the independent variables that show the most significant interaction effects when considering ethnicity are those related to chronic conditions. Regarding inpatient service use, the odds ratio for diabetes is significantly superior for Non-Hispanic Black beneficiaries compared to Non-Hispanic White beneficiaries. Conversely, the odds ratio for Non-Hispanic Blacks with a high blood pressure condition is significantly lower compared to Non-Hispanic Whites suffering from the same condition.

Lastly, contrary to what was observed with the dependent variable pertaining to pharmacy satisfaction, being Hispanic or not has a strongly negative moderating effect on the impact of receiving health insurance via a Medicare Advantage plan on outpatient service.

VII DISCUSSION

This study shows that there were noticeable evolutions in terms of differences in access to medication and service utilization in relation to race between 2013 and 2020. Looking at access to medication (ATM), overall levels of satisfaction have risen for Non-Hispanic Whites and Non-Hispanic blacks, whereas they have dropped significantly for their Hispanic counterparts. This remains true when considering adjusted results, along with the fact that non-Hispanic white beneficiaries tend to fare better than others regardless of the ATM variable involved. The latter is also true for outpatient service utilization, which is still much higher for non-Hispanic whites, even though other ethnic groups are slowly catching up.

Regarding access to medication, these results speak to a well-documented truth that there linger significant ethnicity-related disparities in terms of drug plans, and more specifically in terms of access to information on available quality drug plans [32]. This can explain some of

the persisting differences that have been observed after the implementation of Part D plans in 2013, despite these plans having a measurable positive effect on levels of health coverage [33].

For service utilization, the discrepancies shown in this study are most statistically significant for outpatient service use. This is a well-known issue [34] and raises the question of inequality in access to forms of preventive care which may then have an impact on hospital readmission rates. Besides, a recent report from the Kaiser Family Foundation [35] points out the broader concern of differentiated access to care and service utilization based on race due to cost barriers.

On this note, this study highlights the major influence of SES variables on access to medication variables, notably income with beneficiaries earning less than 25000\$ being significantly more likely to put their health at risk to save money. Such inequalities were already touched upon in the late 1990s [36] and in 2013 and appear to have maintained themselves in 2020.

Similarly, chronic conditions and self-assessed health status remain the most important contributing factor when evaluating satisfaction with access to medication and service utilization. Nonetheless, the role of the latter has somewhat dwindled when predicting medication cost-related non-adherence, to the benefit of some chronic conditions such as cancer. The type of Medicare coverage is also of importance, notably when looking at Medicaid and Medicare Advantage plans as can be seen in this study and in recent scientific literature [37]. This is all the truer when looking at service utilization variables where the influence of moral hazard and adverse selection can be clearly seen.

In addition, this study shows that ethnicity can have a strong moderating effect on the impact of both variables related to some chronic conditions, such as High blood pressure, as well as variables related to health insurance coverage plans. The fact is that preexisting racial biases in the US can have an impact on the incidence rates of some chronic conditions [38] which can lead to real health complications.

These issues are part of a larger context of major healthcare inequalities in the US, that ought to be addressed through better information, stronger healthcare subsidies program, better-designed higher-quality health plans, and through spreading awareness of racial biases in the

medical field. Fixing these inequalities linked to medication access is vital to ease the stress that is then put on the rest of the healthcare system [39].

There are, nonetheless, limitations to this study. While chronic conditions are an important predictor, they also tend to be underdiagnosed for minorities which might have an influence on the conclusion drawn in this study. The question of ethnic misclassification is also one that has emerged [40] in recent literature regarding CMS-produced databases, including the MCBS, and calls for caution in addition to preexisting self-reporting biases when it comes to race. Lastly, this study only looks at two separate and fairly remote years to make its comparisons instead of looking at the year-to-year evolution. This, in addition to the fact that this study focuses on association rather than causation, makes additional studies necessary to fully understand what changes took place between 2014 and 2020 and how.

More detailed research should also be conducted to take into account other minorities, notably Asian Americans, as well as differences within a single ethnic group. This has been identified as a major problem for broad and ill-defined ethnic groups such as Hispanics [41]. Looking at location-based inequalities is also important when considering the discrepancies in experience faced by different ethnic groups [42] and raises the broader question of existing interaction effects between ethnicity factors and other factors, which should also be further investigated.

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I CRITICAL ANALYSIS AND REPLICATION OF THE 2013 STUDY

I.1 INTRODUCTION

To verify the model used in this study and perform a comparison between the year 2020 and older data, a replication of a former study [1] on a related subject was carried out. The study replicated focused on results from the 2013 MCBS data and analyzed associations in the access to medications for Medicare enrollees. It relied on chi-square tests and multiple variable logistic regressions to capture a comprehensive picture of the Medicare beneficiaries' population in terms of access to prescription drugs. The population studied was restricted to individuals for whom data on prescription drugs were available, who were above 65 years old, and whose race was clearly defined in the base survey. Individuals whose race was listed as others were therefore removed from the study. Furthermore, for some dependent variables, individuals with no drug coverage were excluded as well, leading to a population comprised between 10,515 and 8,901 depending on the outcome variable. Lastly, all proportions obtained were adjusted for the sampling weights provided by the MCBS, which account for survey non-response, clustering, and stratification.

I.1.1 CHI-SQUARE TESTS AND VARIABLE DESCRIPTION: COMPARISON WITH TABLES 1-3 OF THE STUDY PAPER

Since the original paper did not mention the way the variables it used were coded, the first part of the replication consisted in finding this information through experimentation while looking at the proportions and p-values given by the chi-square tests. These experiments, carried out on STATA V17 (compared to STATA V13 for the study replicated), gave the results displayed in

Table 1 for the chi-square test.

Table 1: Comparison between results shown in table 2-3 of the original paper and those obtained in this study

	Variables	p-value	p-value from the study	same proportions observed	significant difference in p-value
Socio-economic indicators	Gender	0.07	0.07	Yes	No
	Age	<0.001	<0.001	Yes	No
	Education	<0.001	<0.001	Yes	No
Health indicators	Income	<0.001	<0.001	Yes	No
	High Blood Pressure	<0.001	<0.001	Yes	No
	High Cholesterol	0.1	0.4	Yes	No
	Diabetes	<0.001	<0.001	Yes	No
	Heart disease	0.02	0.1	Yes	No
	COPD	0.15	0.73	Yes	No
	Heart failure	0.28	0.01	Yes	No
	Depression	<0.001	<0.001	Yes	No
	Cancer	<0.001	<0.001	Yes	No
	Health Status	<0.001	<0.001	Yes	No
Coverage type	Part D	<0.001	<0.001	Yes	No
	Private	<0.001	<0.001	Yes	No
	Medicaid	<0.001	<0.001	Yes	No
	Medicare Advantage	<0.001	<0.001	Yes	No
	No Coverage	<0.001	<0.001	Yes	No
Dependent variables	Satisfaction with amount paid	<0.001	<0.001	Yes	No
	Satisfaction with drug list	<0.001	<0.001	Yes	No
	Satisfaction with finding pharmacy	<0.001	<0.001	Yes	No
	No fill	0.1	<0.001	Yes	Yes
	Took smaller dose	0.8	0.08	Yes	No
	Skipped dose	0.9	<0.001	Yes	Yes

As can be seen in the

Table 1, all variables related to health status, insurance coverage, and socio-economic conditions showed the same proportions as the ones described in the study replicated. Besides, while some slight differences may be observed when looking at p-values for these variables, they are still in line with the conclusions made in the source paper. The only variables which exhibit a great difference in terms of p-value are the variables related to “individuals not filling a prescription” (↔no fill variable) and “individuals skipping doses of medication to save money” (↔skipped dose variable). However, as shown in the **Table 2** for “no fill variable” and in **Table 3** for “skipped dose variable”, there is no difference in terms of proportion, and the results obtained appear to be more consistent with these proportions than the one described in the study paper.

Table 2: proportions obtained for the “No Fill” variable

No fill\Ethnicity	Non-Hispanic white	Non-Hispanic black	Hispanic
often	0.90%	1.50%	0.50%
sometimes	5.80%	6.40%	7.40%
never	93.40%	92.10%	92.00%

Table 3: proportions obtained for the “Skipped dose” variable

Skipped dose\Ethnicity	Non-Hispanic white	Non-Hispanic black	Hispanic
often	0.50%	0.70%	0.50%
sometimes	2.80%	3.30%	2.80%
never	96.70%	96.00%	96.70%

As can be seen in the above tables, the proportion of individuals who have often, sometimes, or never neglected to fill a prescription because of costs does not vary significantly across ethnic categories. The same observation can be made for the “Skipped dose” variable. Therefore, p-values above 0.001 are likely to be more sensible, which goes in favor of the results obtained in this study.

Based on the results obtained so far regarding proportions and p-values, it is safe to infer that the variables used in this study are reliable proxies for the ones the source paper relied upon. The labels for these variables, based on the MCBS documentation, are thus listed in the **Table 4**.

Table 4: definition of the variables used in this study with their corresponding labels in the MCBS 2013 codebook

	Variables used	Label in the MCBS PUF 2013
Socio-economic indicators	Age	iv_age
	Gender	iv_sex
	Ethnicity	iv_race
	Income	d_icode
	Education	d_edu
Health indicators	Health status	hlt_genhelth
	High blood pressure	hlt_ochbp
	Heart disease	hlt_occhd
	Heart failure	hlt_occfail
	Cancer	hlt_occancer
	Diabetes	hlt_ocbetes
	Depression	hlt_ocdeprss
	COPD	hlt_ocemphys
	High Cholesterol	hlt_occholes
Type of coverage	Medicare Advantage	ins_mhmx
	Private	ins_privrx
	Medicaid	ins_d_mcaid
	Part D	ins_part_d
	no coverage	regroups all individuals who do not belong to previous categories
Access to medication variables	Satisfaction Amount	acc_mcamtpay
	Satisfaction Drug list	acc_mcdrglst
	Satisfaction finding pharmacy	acc_mcfndpcy
	No fill	acc_nofillrx
	Took a smaller dose	acc_skiprx
	Skipped a dose	acc_mcfndpcy
	Cost-Coping behavior	union of the previous two variables

I.1.2 MULTIVARIABLE LOGISTIC REGRESSIONS: COMPARISON WITH TABLE 4 OF THE STUDY PAPER

The second part of the study replicated took the form of 5 separate multivariable logistic regressions, to look at the association between medication access and ethnicity while adjusting for other parameters such as age, gender, education, or health status. The results of these regressions are listed in table 4 of the paper.

While the replication carried out on Stata proved to be faithful to the source paper in many regards (see **Table 5**), there remain some discrepancies. Discrepancies observed for each of the 5 outcome variables are listed below along with the corresponding result tables.

Table 5: result table comparing the results obtained with Stata with those presented in the study for the dependent variable “Satisfaction with amount paid”

independent variables	Replication			Study paper		
	Odds ratio	Confidence interval(95%)		Odds ratio	Confidence interval(95%)	
age	1.00	0.90	1.11	1	0.90	1.11
Female	0.90	0.81	1.00	0.9	0.81	0.99
Hispanic	0.99	0.83	1.19	0.99	0.82	1.19
NonHispanicBlack	0.69	0.55	0.86	0.69	0.55	0.86
income	0.91	0.81	1.03	1.07	0.96	1.19
HighSchool	0.83	0.72	0.95	0.83	0.73	0.95
LessThanHighSchool	0.67	0.57	0.79	0.67	0.57	0.79
HighBloodPressure	1.12	0.99	1.27	1.12	0.99	1.27
HighCholesterol	1.13	1.01	1.26	1.13	1.00	1.26
Diabetes	0.90	0.81	1.01	0.9	0.81	1.01
HeartDisease	1.26	1.09	1.47	1.26	1.09	1.47
COPD	0.93	0.82	1.04	0.93	0.82	1.04
Heart Failure	1.02	0.83	1.25	1.02	0.83	1.25
Depression	0.96	0.84	1.09	0.96	0.84	1.09
Cancer	1.10	0.97	1.25	1.1	0.97	1.25
VeryGood	0.63	0.53	0.74	0.63	0.53	0.74
Good	0.44	0.38	0.52	0.44	0.38	0.52
Fair	0.36	0.30	0.43	0.36	0.30	0.43
Poor	0.42	0.32	0.55	0.42	0.32	0.55
private	0.98	0.85	1.14	0.98	0.85	1.14
MA	1.05	0.93	1.19	1.05	0.93	1.19
PartD	0.82	0.67	1.00	0.82	0.67	1.00
medicaid	2.32	1.91	2.82	2.32	1.91	2.82

Note: Subpopulation size for the replication = 9952 / Subpopulation size in the study = 9951

For the dependent variable “Satisfaction with amount paid”, no significant discrepancies between Stata and previous results (see **Table 6**) are observed apart from the income variable. Nonetheless, the proportions observed for this variable tend to be more in line with the results obtained using Stata. Besides, the confidence interval for the income variable

comprises 1.00 in both tables, thus this variable does not have a significant effect on the dependent variable.

Table 6: result table comparing the results obtained with Stata with those presented in the study for the dependent variable “Satisfaction with drug list”

independent variables	Replication			Study paper		
	Odds ratio	Confidence interval(95%)		Odds ratio	Confidence interval(95%)	
age	0.95	0.83	1.09	0.94	0.85	1.04
Female	1.03	0.92	1.17	1.01	0.91	1.13
Hispanic	1.30	1.07	1.57	1.25	1.05	1.50
NonHispanicBlack	0.62	0.50	0.78	0.69	0.56	0.85
income	0.84	0.71	1.00	0.81	0.71	0.94
HighSchool	0.86	0.72	1.01	0.9	0.79	1.03
LessThanHighSchool	0.64	0.52	0.77	0.64	0.54	0.76
HighBloodPressure	1.13	0.97	1.31	1.11	0.96	1.27
HighCholesterol	1.07	0.95	1.20	1.09	0.98	1.20
Diabetes	0.94	0.80	1.10	0.88	0.78	0.99
HeartDisease	1.37	1.13	1.66	1.26	1.06	1.48
COPD	1.01	0.84	1.21	0.94	0.82	1.09
Heart Failure	1.20	0.98	1.48	1.19	0.98	1.44
Depression	0.77	0.65	0.92	0.83	0.72	0.96
Cancer	1.25	1.06	1.46	1.17	1.03	1.33
VeryGood	0.68	0.57	0.80	0.68	0.59	0.77
Good	0.49	0.40	0.60	0.49	0.42	0.58
Fair	0.39	0.31	0.48	0.41	0.34	0.50
Poor	0.47	0.35	0.65	0.47	0.35	0.62
private	1.38	1.10	1.73	1.18	1.02	1.36
MA	1.21	0.99	1.47	1.04	0.90	1.21
medicaid	2.00	1.61	2.48	1.96	1.61	2.38

Note: Subpopulation size for the replication = 6461 / Subpopulation size in the study = 8901

Differences in significance are observed for the income and diabetes variables, which are both significant in the source study but not in the replication (see **Table 7**). This is likely to be due to a major gap in subpopulation size between the original study and the replication. A gap which may stem from the fact that individuals with no prescription drug coverage are excluded from the population for this variable, however, chi-square tests and observed proportions seem to indicate that the no-coverage variable is defined in the same way in both studies. Thus, it is possible that the study replicated omitted to remove some individuals that were otherwise excluded for all outcome variables.

Table 7: result table comparing the results obtained with Stata with those presented in the study for the dependent variable “Satisfaction with finding pharmacy”

independent variables	Replication			Study paper		
	Odds ratio	Confidence interval(95%)		Odds ratio	Confidence interval(95%)	
age	0.91	0.81	1.02	0.91	0.83	0.99
Female	1.19	1.06	1.33	1.19	1.09	1.30
Hispanic	0.95	0.79	1.15	0.94	0.79	1.13
NonHispanicBlack	0.54	0.44	0.68	0.59	0.48	0.72
income	0.80	0.69	0.92	0.76	0.67	0.86
HighSchool	0.78	0.68	0.89	0.78	0.71	0.87
LessThanHighSchool	0.53	0.44	0.63	0.5	0.43	0.59
HighBloodPressure	1.09	0.96	1.24	1.04	0.94	1.16
HighCholesterol	1.08	0.97	1.22	1.17	1.07	1.28
Diabetes	0.99	0.88	1.12	0.96	0.86	1.06
HeartDisease	1.08	0.91	1.28	1.13	0.97	1.31
COPD	1.13	0.97	1.32	1.09	0.96	1.24
Heart Failure	1.27	1.01	1.59	1.24	1.00	1.54
Depression	0.97	0.85	1.12	1.04	0.93	1.17
Cancer	1.12	0.97	1.28	1.11	0.99	1.25
VeryGood	0.70	0.60	0.83	0.69	0.61	0.78
Good	0.47	0.39	0.56	0.46	0.40	0.53
Fair	0.41	0.34	0.50	0.42	0.35	0.49
Poor	0.42	0.31	0.56	0.41	0.31	0.55
private	1.25	1.03	1.52	1.02	0.89	1.16
MA	1.21	1.00	1.46	1	0.88	1.15
medicaid	1.43	1.17	1.74	1.38	1.14	1.67

Note : Subpopulation size for the replication = 6568 / Subpopulation size in the study = 9057

As with the previous outcome variable, significant discrepancies are observed between Stata and previous results (see **Table 8**) for the Income and diabetes variables. This is most likely for the same reason as the ones mentioned above since these variables do not exhibit any discrepancies in terms of significance for other outcome variables.

Table 8: result table comparing the results obtained with Stata with those presented in the study for the dependent variable “No Fill”

independent variables	Replication			Study paper		
	Odds ratio	Confidence interval(95%)		Odds ratio	Confidence interval(95%)	
age	0.44	0.37	0.52	0.44	0.37	0.52
Female	1.25	1.01	1.54	1.25	1.00	1.54
Hispanic	0.97	0.70	1.34	0.97	0.70	1.34
NonHispanicBlack	1.04	0.73	1.46	1.04	0.73	1.46
income	1.71	1.41	2.08	1.71	1.41	2.08
HighSchool	1.13	0.93	1.38	1.13	0.93	1.38
LessThanHighSchool	1.15	0.85	1.56	1.15	0.85	1.56
HighBloodPressure	0.94	0.73	1.20	0.94	0.73	1.20
HighCholesterol	1.24	1.02	1.51	1.24	1.02	1.51
Diabetes	1.19	0.94	1.49	1.19	0.94	1.49
HeartDisease	0.99	0.73	1.33	0.99	0.73	1.33
COPD	1.35	1.06	1.71	1.35	1.06	1.71
Heart Failure	1.07	0.78	1.47	1.07	0.78	1.47
Depression	1.64	1.32	2.03	1.64	1.32	2.03
Cancer	0.97	0.77	1.21	0.97	0.77	1.21
VeryGood	1.09	0.75	1.58	1.09	0.75	1.58
Good	1.61	1.18	2.21	1.61	1.18	2.21
Fair	2.46	1.76	3.43	2.46	1.76	3.43
Poor	2.54	1.68	3.84	2.54	1.68	3.84
private	0.59	0.46	0.76	0.59	0.46	0.76
MA	0.89	0.72	1.11	0.89	0.72	1.11
PartD	0.99	0.69	1.40	0.99	0.69	1.40
medicaid	0.46	0.34	0.63	0.46	0.34	0.63

Note : Subpopulation size for the replication = 10508 / Subpopulation size in the study = 10510

Table 9: result table comparing the results obtained with Stata with those presented in the study for the dependent variable “Skipped dose/Took smaller dose” (⇔ Cost-Coping behaviors)

independent variables	Replication			Study paper		
	Odds ratio	Confidence interval(95%)		Odds ratio	Confidence interval(95%)	
age	0.63	0.52	0.77	0.63	0.52	0.77
Female	1.03	0.86	1.24	1.03	0.86	1.24
Hispanic	0.83	0.54	1.30	0.83	0.54	1.30
NonHispanicBlack	1.04	0.73	1.49	1.04	0.73	1.49
income	1.60	1.22	2.11	1.60	1.22	2.11
HighSchool	0.86	0.70	1.06	0.86	0.70	1.06
LessThanHighSchool	0.81	0.58	1.13	0.81	0.58	1.13
HighBloodPressure	0.61	0.47	0.80	0.61	0.47	0.80
HighCholesterol	1.18	0.92	1.52	1.18	0.96	1.37
Diabetes	1.26	0.98	1.61	1.12	0.92	1.52
HeartDisease	1.07	0.78	1.47	1.07	0.78	1.47
COPD	1.75	1.34	2.28	1.75	1.34	2.28
Heart Failure	0.96	0.71	1.30	0.96	0.71	1.84
Depression	2.09	1.62	2.70	2.09	1.62	2.70
Cancer	0.92	0.74	1.14	0.92	0.74	1.14
VeryGood	1.22	0.84	1.78	1.22	0.84	1.78
Good	1.66	1.20	2.31	1.66	1.20	2.31
Fair	3.10	2.11	4.57	3.10	2.11	4.57
Poor	2.67	1.70	4.19	2.67	1.70	4.19
private	0.72	0.56	0.93	0.72	0.56	0.93
MA	0.89	0.69	1.13	0.89	0.69	1.13
PartD	1.16	0.73	1.84	1.16	0.73	1.84
medicaid	0.52	0.35	0.76	0.52	0.35	0.76

Note : Subpopulation size for the replication = 10515 / Subpopulation size in the study = 10512

As can be seen in **Table 9** for Stata and for previous study results, no significant differences are observed for the last two outcome variables. This supports the idea that the definitions provided for the income and diabetes variables are in line with the ones used in the replicated study.

I.1.3 DIFFERENCES WITH NEW MODEL USED IN THIS STUDY

Due to differences in reporting method in the MCBS between 2013 and 2020, this study uses a revised encoding method for variables related to the type of prescription drug coverage. From **Table 10** to **Table 14**, the differences observed between this new model and the one used to replicate the 2013 study are listed.

Table 10: comparison between the replication model and the new model tailored for comparison for the year 2013, with “satisfaction amount” as the dependent variable

Variables	odds ratio replication	95%CI replication	odds ratio new model	95%CI new model	difference in significance ?		
Age	1	0.9	1.11	0.85	0.91	1.12	No
Gender	0.9	0.81	1	1.01	0.85	1.04	No
Hispanic	0.99	0.83	1.19	0.53	0.85	1.23	No
Non Hispanic Black	0.69	0.55	0.86	0.61	0.53	0.84	No
Income	0.91	0.81	1.03	0.93	0.80	1.01	No
Highschool	0.83	0.72	0.95	1.02	0.72	0.95	No
Less than highschool	0.67	0.57	0.79	0.73	0.56	0.78	No
HBP	1.11	0.99	1.27	0.94	0.98	1.26	No
High cholesterol	1.13	1.01	1.26	1.20	1.02	1.27	No
Diabetes	0.9	0.81	1.01	1.01	0.81	1.02	No
Heart disease	1.26	1.09	1.47	0.93	1.11	1.52	No
COPD	0.93	0.82	1.04	0.84	0.81	1.04	No
Heart failure	1.02	0.83	1.25	0.95	0.82	1.24	No
Depression	0.96	0.84	1.09	0.90	0.84	1.09	No
Cancer	1.1	0.97	1.25	1.08	0.97	1.25	No
Very good	0.63	0.53	0.74	0.69	0.54	0.75	No
Good	0.44	0.38	0.51	0.50	0.38	0.52	No
Fair	0.36	0.3	0.43	0.48	0.30	0.44	No
Poor	0.42	0.32	0.44	0.59	0.32	0.56	No
Private	0.98	0.85	1.14	0.69	0.59	0.83	Yes
Medicare Advantage	1.05	0.93	1.19	0.88	0.68	0.90	Yes
Part D	0.82	0.67	1	0.42	0.43	0.59	Yes
Medicaid	2.32	1.91	2.82	1.63	1.40	2.12	No

Table 11: comparison between the replication model and the new model tailored for comparison for the year 2013, with “drug list satisfaction” as the dependent variable

Variables	odds ratio replication	95%CI replication	odds ratio new model	95%CI new model	difference in significance ?
Age	0.95	0.83 1.09	0.91	0.84 1.10	No
Gender	1.03	0.92 1.17	1.05	0.91 1.16	No
Hispanic	1.3	1.07 1.57	0.50	1.13 1.67	No
Non Hispanic Black	0.62	0.5 0.78	0.81	0.50 0.78	No
Income	0.84	0.71 1	0.83	0.71 1.00	No
Highschool	0.86	0.72 1.01	0.90	0.73 1.02	No
Less than highschool	0.64	0.52 0.77	0.65	0.53 0.78	No
HBP	1.13	0.97 1.31	1.04	0.96 1.31	No
High cholesterol	1.07	0.95 1.2	1.17	0.95 1.20	No
Diabetes	0.94	0.8 1.1	0.99	0.80 1.10	No
Heart disease	1.37	1.13 1.66	1.05	1.14 1.66	No
COPD	1.01	0.84 1.21	0.93	0.84 1.21	No
Heart failure	1.2	0.98 1.48	1.00	0.97 1.46	No
Depression	0.77	0.65 0.92	0.91	0.65 0.91	No
Cancer	1.25	1.06 1.46	1.18	1.07 1.46	No
Very good	0.68	0.57 0.8	0.69	0.57 0.80	No
Good	0.49	0.4 0.6	0.48	0.40 0.59	No
Fair	0.39	0.31 0.48	0.47	0.31 0.49	No
Poor	0.47	0.35 0.65	0.43	0.35 0.65	No
Private	1.38	1.1 1.73	1.11	1.11 1.74	No
Medicare Advantage	1.21	0.99 1.47	1.24	1.00 1.48	Yes
Medicaid	2	1.61 2.48	1.62	1.63 2.58	No

Table 12: comparison between the replication model and the new model tailored for comparison for the year 2013, with “pharmacy satisfaction” as the dependent variable

Variables	odds ratio replication	95%CI replication	odds ratio new model	95%CI new model	difference in significance ?
Age	0.91	0.81 1.02	0.95	0.81 1.02	No
Gender	1.19	1.06 1.33	1.15	1.06 1.32	No
Hispanic	0.95	0.79 1.15	0.38	0.81 1.17	No
Non Hispanic Black	0.54	0.44 0.68	0.71	0.43 0.67	No
Income	0.8	0.69 0.92	0.67	0.68 0.91	No
Highschool	0.78	0.68 0.89	0.77	0.69 0.89	No
Less than highschool	0.53	0.44 0.63	0.52	0.44 0.63	No
HBP	1.09	0.96 1.24	1.16	0.95 1.24	No
High cholesterol	1.08	0.97 1.22	1.09	0.97 1.22	No
Diabetes	0.99	0.88 1.12	1.08	0.88 1.12	No
Heart disease	1.08	0.91 1.28	1.00	0.91 1.28	No
COPD	1.13	0.97 1.32	1.01	0.97 1.32	No
Heart failure	1.27	1.01 1.59	1.01	1.00 1.58	No
Depression	0.97	0.85 1.12	1.01	0.84 1.12	No
Cancer	1.12	0.97 1.28	1.07	0.97 1.29	No
Very good	0.7	0.6 0.83	0.74	0.59 0.83	No
Good	0.47	0.39 0.56	0.53	0.39 0.56	No
Fair	0.41	0.34 0.5	0.54	0.34 0.50	No
Poor	0.42	0.31 0.56	0.40	0.31 0.56	No
Private	1.25	1.03 1.52	1.08	1.06 1.57	No
Medicare Advantage	1.21	1 1.46	1.16	1.03 1.50	Yes
Medicaid	1.43	1.17 1.74	1.54	1.27 1.94	No

Table 13: comparison between the replication model and the new model tailored for comparison for the year 2013, with “no fill” as the dependent variable

Variables	odds ratio replication	95%CI replication	odds ratio new model	95%CI new model	difference in significance ?
Age	0.44	0.37 0.52	0.61	0.36 0.52	No
Gender	1.25	1.01 1.54	1.39	1.02 1.53	No
Hispanic	0.97	0.7 1.34	1.05	0.65 1.24	No
Non Hispanic Black	1.04	0.73 1.46	1.09	0.73 1.47	No
Income	1.71	1.41 2.08	1.53	1.42 2.08	No
Highschool	1.13	0.93 1.38	1.02	0.93 1.37	No
Less than highschool	1.15	0.84 1.56	1.18	0.84 1.55	No
HBP	0.94	0.73 1.2	1.10	0.73 1.21	No
High cholesterol	1.24	1.02 1.51	1.13	1.02 1.51	No
Diabetes	1.19	0.94 1.49	1.35	0.95 1.49	No
Heart disease	0.99	0.73 1.33	1.15	0.73 1.33	No
COPD	1.25	1.06 1.71	1.74	1.06 1.70	No
Heart failure	1.07	0.78 1.47	1.75	0.79 1.48	No
Depression	1.64	1.32 2.03	1.54	1.31 2.03	No
Cancer	0.97	0.77 1.21	1.42	0.77 1.21	No
Very good	1.09	0.75 1.58	1.53	0.75 1.58	No
Good	1.61	1.18 2.21	2.26	1.18 2.22	No
Fair	2.46	1.76 3.43	2.62	1.76 3.41	No
Poor	2.54	1.68 3.84	2.63	1.69 3.84	No
Private	0.59	0.46 0.76	0.78	0.43 0.81	No
Medicare Advantage	0.89	0.72 1.11	1.10	0.66 1.19	No
Part D	0.99	0.69 1.4	1.69	0.73 1.36	No
Medicaid	0.46	0.34 0.63	0.42	0.31 0.64	No

Table 14: comparison between the replication model and the new model tailored for comparison for the year 2013, with “other cost-coping behaviors” as the dependent variable

Variables	odds ratio replication	95%CI replication	odds ratio new model	95%CI new model	difference in significance ?
Age	0.63	0.52 0.77	0.64	0.52 0.77	No
Gender	1.03	0.86 1.24	1.16	0.84 1.21	No
Hispanic	0.83	0.54 1.3	0.87	0.52 1.23	No
Non Hispanic Black	1.04	0.73 1.49	1.42	0.75 1.54	No
Income	1.6	1.22 2.11	2.08	1.26 2.17	No
Highschool	0.86	0.7 1.06	0.84	0.70 1.06	No
Less than highschool	0.81	0.58 1.13	0.89	0.58 1.13	No
HBP	0.61	0.47 0.8	0.84	0.48 0.80	No
High cholesterol	1.18	0.92 1.52	1.13	0.92 1.51	No
Diabetes	1.26	0.98 1.61	1.61	0.98 1.61	No
Heart disease	1.07	0.78 1.47	2.32	0.77 1.46	No
COPD	1.75	1.34 2.28	1.35	1.35 2.30	No
Heart failure	0.96	0.71 1.3	1.31	0.71 1.30	No
Depression	2.09	1.62 2.7	1.48	1.63 2.72	No
Cancer	0.92	0.74 1.14	1.41	0.74 1.14	No
Very good	1.22	0.84 1.78	1.26	0.83 1.76	No
Good	1.66	1.2 2.31	1.66	1.19 2.30	No
Fair	3.1	2.11 4.57	1.69	2.08 4.55	No
Poor	2.67	1.7 4.19	1.68	1.70 4.18	No
Private	0.72	0.56 0.93	0.81	0.62 1.17	Yes
Medicare Advantage	0.89	0.69 1.13	1.08	0.75 1.39	No
Part D	1.16	0.73 1.84	1.04	1.04 1.86	Yes
Medicaid	0.52	0.35 0.76	0.53	0.38 0.84	No

No significant differences are observed between those models for all ethnicity, SES and health variables. However, there are some variations in terms of health insurance coverage plans' significance. This can be explained by the fact that the new model adopts a broader definition of what constitutes a Part D enrollee which is closer to the definition adopted in other related papers [42] and which has an operational definition that can be faithfully replicated for the year 2020. Details regarding the new encoding method can be found under the section “operational definitions of variables used” §1.2.

I.2 OPERATIONAL DEFINITIONS OF VARIABLES USED

I.2.1 ETHNICITY AND S.E.S. VARIABLES

While names can be different, all these variables are structured in the same way. The same questions and answer options were presented to the respondents.

Variables	definition in the MCBS database for 2013	definition in the MCBS database for 2020
Age	iv_age	dem_age
Gender	iv_sex	dem_sex
Ethnicity	iv_race	dem_race
Income	d_income	dem_income
Education	d_edu	dem_edu

I.2.2 HEALTH AND CHRONIC CONDITIONS VARIABLES

Variables	definition in the MCBS database for 2013	definition in the MCBS database for 2020
Health status	hlt_genhelth	hlt_genhelth
High blood pressure	hlt_ochbp	hlt_ochbp
Heart disease	hlt_occhd	hlt_occhd
Heart failure	hlt_occfail	hlt_occfail
Cancer	hlt_occancer	hlt_occancer
Diabetes	hlt_ocbetes	hlt_ocbetes
Depression	hlt_ocdeprss	hlt_ocdeprss
COPD	hlt_ocemphys	hlt_ocemphys
High Cholesterol	hlt_occholes	hlt_occholes

I.2.3 HEALTH INSURANCE PLAN VARIABLES

VARIABLES USED FOR THE REPLICATION

Variables	definition in the MCBS database for 2013
Medicare Advantage	ins_mhmx
Private	ins_privx
Medicaid	ins_d_mcaid
Part D	ins_part_d
no coverage	regroups all individuals who do not belong to previous categories

VARIABLES USED FOR THE COMPARISON BETWEEN 2013 AND 2020: ACCESS TO MEDICATION

Variables	definition in the MCBS database for 2013	definition in the MCBS database for 2020
Medicare Advantage	ins_mhmx	ins_madvrxht
Private	ins_privrx	ins_privrx
Medicaid	adm_op_mdcd	adm_op_mdcd
Part D	adm_partd (excluding individuals who have medicaid, a private insurance plan or a medicare advantage plan)	adm_partd (excluding individuals who have medicaid, a private insurance plan or a medicare advantage plan)
no coverage	regroups all individuals who do not belong to previous categories	regroups all individuals who do not belong to previous categories

The new definition for Part D is based on a recent report on the demographic profile of Medicare Part D beneficiaries [43] and has been adapted to reflect the need of this study as best as possible.

I.2.4 VARIABLES USED FOR THE COMPARISON BETWEEN 2013 AND 2020: SERVICE UTILIZATION

Variables	definition in the MCBS database for 2013	definition in the MCBS database for 2020
Skilled nursing facility use	adm_h_snfsty	adm_h_snfsty
Inpatient service use	adm_h_inpsty	adm_h_inpsty
Outpatient service use	adm_h_outsw	adm_h_outsw

I.2.5 DEPENDENT VARIABLES: ACCESS TO MEDICATION

Variables	definition in the MCBS database for 2013	definition in the MCBS database for 2020
Satisfaction Amount	acc_mcamtpay	rxs_mcamtpay
Satisfaction Drug list	acc_mcdrglst	rxs_mcdrglst
Satisfaction finding pharmacy	acc_mcfndpcy	rxs_mcfndpcy
No fill	acc_nofillrx	rxs_nofillrx
Took a smaller dose	acc_skiprx	rxs_skiprx
Skipped a dose	acc_mcfndpcy	rxs_mcfndpcy
Cost-Coping behavior	union of the previous two variables	union of the previous two variables

In the logistic regression model, satisfaction variables are simplified to take the form of binary variables where only individuals who declare themselves to be “very satisfied” are given the value of one. This can be considered a limitation compared to more advanced multinomial logistic regression models, but this process was the one applied in the 2013 study replicated and was necessary to obtain clearer insights.

The same process is applied to variables linked to other dependent variables: individuals with the value “often” or “sometimes” are considered ones and all others are considered zeros.