Consumer-directed health plans (CDHPs) are high-deductible health plans (HDHPs) coupled with a health savings account (HSA) or a health reimbursement arrangement (HRA). The proportion of covered workers with employer-sponsored insurance enrolled in a CDHP increased from 4% in 2006 to 29% in 2016. In 2016, 56% of covered workers were employed by a firm that offered a CDHP and, among the 41% of covered workers who were offered only 1 type of plan, nearly one-third were offered only a CDHP.

CDHPs are designed to make patients more cost-conscious and to encourage value-based decision making. Although previous work has consistently demonstrated that CDHPs reduce healthcare spending and utilization, they may also increase financial burden when patients utilize healthcare. Previous research has shown that CDHP enrollees are more likely to have difficulty accessing necessary healthcare and to incur high medical bills and medical debt, particularly among lower-income individuals and those with chronic conditions.

However, many existing studies are based on findings from cross-sectional surveys and thus might be subject to potential selection bias. We therefore investigated the impact of CDHP enrollment on the financial burden of healthcare utilization at the point of service, using longitudinal private insurance claims data from January 1, 2011, to December 31, 2013. We estimated the effects of CDHP enrollment on out-of-pocket (OOP) costs both at the mean and across the distribution of healthcare spending. Additionally, we analyzed the effect of CDHP enrollment on the probability of an enrollee having excessive financial burden, defined as whether an enrollee spent 3% or more of household income on OOP spending. Additionally, we assessed these outcomes for 2 subgroups: those with lower household income and those with chronic conditions.

Within the first year of CDHP enrollment, CDHP enrollees experienced a mean marginal increase in OOP spending of $285 (41% increase; 95% CI, $271-$299; P <.001) relative to traditional plan enrollees. The lower-income and chronic conditions subgroups experienced mean marginal increases in OOP costs of $306 (44% increase; 95% CI, $257-$353; P <.001) and $387 (56% increase; 95% CI, $339-$435; P <.001), respectively. The probability of an enrollee having excessive financial burden increased by 4.3 percentage points (95% CI, 4.0-4.6; P <.001) for the full CDHP sample. These effects were about 3 times larger for the lower-income subgroup (12.3 percentage points; 95% CI, 10.7-13.8; P <.001) and 2 times larger for the chronic conditions subgroup (8.0 percentage points; 95% CI, 6.9-9.1; P <.001).

CDHP enrollment led to a significant increase in financial burden associated with healthcare utilization, especially for those with lower incomes and those with chronic conditions.
Consumer-directed health plan (CDHP) enrollment increases the financial burden associated with healthcare utilization, especially for those with lower incomes, those with chronic conditions, and those at the higher end of the healthcare spending distribution.

- Due to the unpredictable nature of healthcare utilization, it is unclear in advance who will end up with high healthcare utilization and significant financial burden in a given year.
- More effort is needed to make individuals aware of the potentially significant out-of-pocket spending and financial burden that could be incurred after enrollment in a CDHP.

### METHODS

#### Data and Sample

We used claims data from the OptumInsight (a subsidiary of UnitedHealth Group) Clininformatics Data Mart from 2011 to 2013 to analyze a 25% random sample of the insurer’s commercially insured subscribers and dependents who were continuously enrolled over the full 3-year period in both employer-sponsored and nongroup plans. These claims data also include measures of socioeconomic status, including categorical household income, predicted by a demographic-based analytical model using Census block group–level data where the unit population size (~600-3000) is smaller than that of a Census tract (~1200-8000) or a zip code tabulation area. The data also include measures of education level, predicted by the median level of education attained by individuals 25 years or older at the Census block level, and race/ethnicity code, derived from a combination of sources including public records, self-reported surveys, and a proprietary ethnic code algorithm.

We included 2 groups of enrollees. The CDHP group included enrollees who were in a traditional plan in 2011 and in a CDHP in 2012 and 2013 (switch date: January 1, 2012) and enrollees who were in a traditional plan in 2011 and 2012 and in a CDHP in 2013 (switch date: January 1, 2013); switching was split relatively evenly across the 2 years in the study sample (Appendix Table [eAppendix available at ajmc.com]). The traditional plan control group included enrollees who were in a traditional plan throughout all 3 years. We excluded enrollees who were 65 years or older (5.7% of the sample) and enrollees with negative OOP costs (0.009% of the sample). The lower-income subgroup included enrollees with an estimated annual household income of less than $40,000 (the lowest category defined in the data). The chronic conditions subgroup was defined as enrollees with at least 1 chronic condition in the baseline year, defined by the Charlson Comorbidity Index (CCI). The data were deidentified, and this study was approved by the University of Southern California University Park Institutional Review Board.

#### Outcomes

We analyzed OOP spending and a binary indicator of excessive financial burden, defined by OOP spending being greater than or equal to 3% of household income, based on prior research. We also used alternative thresholds (5% and 10%) to examine the sensitivity of our findings to this definition. In all cases, OOP spending refers only to spending incurred at the point of care and represents the sum of co-payments, deductibles, and coinsurance paid by an enrollee for all healthcare services utilized in the given year. Because estimated household income was a categorical variable in our data, we calculated the excessive financial burden indicator using the midpoint of each income interval, capped at $100,000 (the highest category defined in the data).

#### Statistical Analysis

We used the χ² test and the t test to compare baseline characteristics between the CDHP group and the traditional plan group. We then performed descriptive analyses of the trends in mean OOP spending and the percentage of enrollees having excessive financial burden before and after CDHP enrollment. We used difference-in-differences (DID) regression analysis to compare changes in the outcomes for individuals who switched to CDHPs (CDHP group) with those for individuals who remained in traditional plans (traditional plan group). Compared with a standard DID model in which the participants in the treatment group usually experience a 1-time shift, we analyzed enrollees who switched to a CDHP at 2 different time points to enable estimation of both short-term (1-year) and medium-term (2-year) effects of CDHP enrollment. In all models, the analysis was at the enrollee-year level, and the primary independent variables were the indicators for the first and second year (where applicable) of CDHP enrollment, adjusted for group fixed effects, year fixed effects, age, gender, race, education, Census division, and CCI score.

For each population, we first estimated the impact of CDHP enrollment on mean OOP spending. Because OOP spending was highly skewed, we used a generalized linear model (GLM) with log link function and gamma distribution. We calculated the average marginal effects (incremental effects) of first- and second-year CDHP enrollment. Standard errors were clustered at the enrollee level. We also investigated the impact of CDHP enrollment on the distribution of differences in OOP spending (relative to traditional plan enrollees) using the linear quantile DID (QDID) model, which outputs the treatment effects of CDHP enrollment at each decile of OOP spending. We used the QDID regression coefficients to predict traditional plan enrollees’ adjusted OOP spending distribution in 2013 and the traditional plan group’s counterfactual OOP spending distribution (ie, what the OOP spending distribution of the traditional plan group would have been had they enrolled in a CDHP). Based on the adjusted and counterfactual OOP cost distribution, we examined the change in the percentage of enrollees who would have very high OOP spending (eg, higher than $2000) due to CDHP.
enrollment. Finally, we analyzed the impact of CDHP enrollment on the indicator of whether an enrollee had excessive financial burden (OOP spending to household income ratio ≥3%, 5%, or 10%) in a given year using GLM with logit link function and Bernoulli distribution. Standard errors were clustered at the enrollee level. Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc; Cary, North Carolina) and Stata version 14 (StataCorp; College Station, Texas). We used a significance level of $P \leq .05$ and all statistical tests were 2-sided.

**RESULTS**

**Baseline Enrollee Characteristics**

There were a total of 689,542 enrollees in our sample, consisting of 36,387 enrollees in the CDHP group and 653,155 enrollees in the traditional plan group. The baseline characteristics of each group are shown in **Table 1**. The $\chi^2$ test indicates that CDHP enrollees differed from traditional plan enrollees in terms of age, education, gender, health status, region, and race and ethnicity. There were no statistically significant differences in predicted annual household income between the 2 groups.

**Trends in OOP Spending and Financial Burden**

Both the levels and trends in our key outcome variables were similar for the CDHP and the traditional plan group during the pre-CDHP enrollment period of up to 2 years (eAppendix Figures 1 and 2). Within the first year of CDHP enrollment, the percentage of CDHP enrollees having excessive financial burden rose from 9.7% (95% CI, 9.4%-10.0%) to 16.0% (95% CI, 15.7%-16.4%) for the full sample, compared with a slight increase from 9.0% (95% CI, 8.9%-9.1%) to 9.8% (95% CI, 9.7%-9.9%) among traditional plan enrollees (eAppendix Figure 2).

The impact of CDHP enrollment on financial burden was more pronounced among the lower-income and chronic conditions subgroups: The percentage of CDHP enrollees having excessive financial burden among these subgroups rose from 32.9% (95% CI, 31.4%-34.5%) to 47.7% (95% CI, 46.1%-49.4%) and from 25.3% (95% CI, 24.1%-26.5%) to 33.9% (95% CI, 32.7%-35.2%), respectively (eAppendix Figure 2). The effects of CDHP enrollment persisted for 2 years; OOP spending increased among CDHP enrollees while OOP spending for traditional plan enrollees remained stable (eAppendix Figure 1).

**Regression Results**

The effects of CDHP enrollment on mean OOP spending are shown in **Table 2**. In the first year of CDHP enrollment, the mean marginal increase in OOP spending was $285 (41% increase; 95% CI, $271-$299; $P < .001$). CDHP enrollment resulted in larger marginal increases in OOP spending for the lower-income ($306; 44% increase; 95% CI, $257-$354; $P < .001$) and chronic conditions ($387; 56% increase; 95% CI, $339-$435; $P < .001$) subgroups. By the second year of CDHP enrollment, mean marginal OOP spending increased by $306 among the full sample (44% increase; 95% CI, $286-$325; $P < .001$), $364 (53% increase; 95% CI, $300-$429; $P < .001$) among the lower-income subgroup, and $428 (62% increase; 95% CI, $364-$492; $P < .001$) among the chronic conditions subgroup. The larger increases in OOP spending in the second year of CDHP enrollment are consistent

### Table 1. Baseline Enrollee Characteristics (2011)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Traditional Plan Group</th>
<th>CDHP Group</th>
<th>$P$</th>
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<tbody>
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<td>Age, years, %</td>
<td></td>
<td></td>
<td>.001</td>
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<tr>
<td>&lt;17</td>
<td>24.3</td>
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<td>18-24</td>
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CDHP indicates consumer-directed health plan.
with prior work which has found that utilization increases in the second year of CDHP enrollment.8,9

Table 3 presents the QDID estimates of the impact of CDHP enrollment at each decile across the distribution of OOP spending. Generally, the marginal effect of CDHP enrollment increased with higher levels of OOP spending. For example, among the full sample, CDHP enrollment led to a $162 (95% CI, $150-$173; $P <.001) marginal increase in OOP spending at the median in the first year compared with a $726 (95% CI, $678-$773; $P <.001) marginal increase in OOP spending at the 90th percentile. That is, the marginal impact of CDHP enrollment on OOP spending (compared with traditional plan enrollees) was greater for those at the higher end of the OOP spending distribution.
spending distribution. For the lower-income and chronic conditions subgroups, the marginal increases at the median were $241 (95% CI, $200-$282; \( P < .001 \)) and $480 (95% CI, $425-$535; \( P < .001 \)), respectively, and the marginal increases at the 90th percentile were $715 (95% CI, $558-$871; \( P < .001 \)) and $647 (95% CI, $495-$799; \( P < .001 \)), respectively.

The adjusted and counterfactual OOP spending distributions for the traditional plan group are shown in the Figure. As expected, the counterfactual OOP spending distributions fall above the predicted OOP spending distribution, suggesting that traditional plan enrollees would have had higher OOP spending if they had switched to a CDHP (Figure). As a sensitivity analysis, we also separately estimated the magnitude of these counterfactual spending estimates if the traditional plan group switched to CDHP/HRAs compared with CDHP/HSAs (based on separate underlying QDID regressions for the CDHP/HRA and CDHP/SHA populations). We found that increased OOP spending after enrollment in a CDHP tended to be larger for enrollees in CDHP/HRAs versus CDHP/HSAs across nearly all of the OOP spending distributions (eAppendix Figure 3). This is consistent with prior work, which has found that enrollees in CDHP/HSAs had significantly greater reductions in utilization than did enrollees in CDHP/HRAs, potentially because employees with HSAs have a stronger incentive to save money because HSA account balances are owned by the employee whereas HRA account balances are owned by the employer.23

CDHP enrollment also increased the probability of having very high OOP spending. For example, the percentage of enrollees spending more than $2000 increased by nearly 10 percentage points for the full sample and for the lower-income subgroup and by about 15 percentage points for the chronic conditions subgroup (Figure). These findings regarding the impact of CDHPs on the probability of having very high OOP spending are supported by the results of the impact of CDHP enrollment on the probability of having excessive financial burden (Table 2b). For the entire sample, enrollment in a CDHP increased the probability of an enrollee being exposed to excessive financial burden (defined as OOP spending being ≥3% of household income) by 4.3 percentage points (95% CI, 4.0-4.6; \( P < .001 \); baseline, 9.7%). The effects were about 3 times larger for the lower-income subgroup (12.3 percentage points; 95% CI, 10.7-13.8; \( P < .001 \); baseline, 32.9%) and 2 times larger for the chronic conditions subgroup (8.0 percentage points; 95% CI, 6.9-9.1; \( P < .001 \); baseline, 25.3%). These effects persisted in the second year of CDHP enrollment and were robust to alternative definitions of excessive financial burden (Table 2b).

**DISCUSSION**

We estimated the impact of CDHP enrollment on financial burden due to cost sharing incurred at the point of service when utilizing care. We found that CDHP enrollment led to a significant increase in

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**FIGURE. Impact of CDHP Enrollment on OOP Spending, Across the OOP Spending Distribution**

A. Full Sample

B. Lower-Income Subgroup

C. Chronic Conditions Subgroup

CDHP indicates consumer-directed health plan; DID, difference-in-differences; OOP, out-of-pocket.

*The predicted OOP cost distribution shows the OOP cost distribution for traditional plan enrollees in 2013 adjusted using quantile DID estimates. The counterfactual OOP cost distribution shows the OOP cost distribution for traditional plan enrollees in 2013 had they switched to a CDHP in 2012 (ie, OOP cost distribution 2 years after CDHP enrollment). The counterfactual OOP cost distribution in 2012 (1 year after CDHP enrollment) is similar.
OOP spending and that this higher financial burden was particularly pronounced for the lower-income and chronic conditions subgroups. For example, more than half of the lower-income subgroup and more than one-third of the chronic conditions subgroup faced excessive financial burden from OOP spending after enrollment in a CDHP. Moreover, we found that CDHP enrollment increased the probability of having very high OOP spending.

**Limitations**

Our sample was subject to potential selection concerns because we were unable to evaluate whether CDHP enrollees actively chose a CDHP among a menu of plan options or whether it was the only option made available to them by their employer, although the fact that the level and trend of the key outcome variables were similar between the CDHP and traditional plan groups in the baseline period reduces these concerns (eAppendix Figures 1 and 2). Additionally, the household income data were based on a prediction model and thus may be subject to measurement error, although the predictions were based on very local geography. We were also unable to link dependents to subscribers, so we could not assess financial burden due to OOP spending at the household level; however, because the income levels represent household (rather than individual) income whereas we assessed individual-level OOP spending, our estimates may thus represent a lower bound of financial burden on OOP spending pooled across all household members. Finally, our data did not include additional detail, such as plan premiums or whether and how much the employer contributed to the individual’s HSA or HRA, so we could not directly evaluate the impact of CDHP enrollment on overall spending.

**Implications**

Our findings, and in particular, the variation in the impact of CDHP enrollment on OOP spending across the distribution, should be considered in the broader context of overall healthcare spending, including premiums and potential HSA/HRA contributions. Nationally representative data on employer-sponsored health benefits indicate that, in 2013, the average annual worker contribution to premiums for single coverage was $1058 for CDHPs with an HRA, $726 for CDHPs with an HSA, and $1027 for non-CDHP plans. This suggests that enrollees in CDHPs with an HSA saved $301 ($1027 minus $726) in employee-paid premium contributions compared with those enrolled in non-CDHPs, on average. Additionally, 34% of covered workers in CDHPs with an HSA worked for an employer that did not make an HSA contribution but, among those that did, the average annual HSA contribution for a single employee was $950. 24

At the lower end of the distribution, we found very modest increases in OOP spending at the point of care among CDHP enrollees compared with traditional plan enrollees. Thus, it is likely that these individuals may actually be financially better off by enrolling in CDHPs, as the savings in employee-paid premium contributions and/or the benefits of employer contributions to a tax-advantaged savings account likely more than offset the increased OOP spending at the point of care. However, at the high end of the distribution, the increased OOP spending would still heavily outweigh the reduced spending on employee contributions to premiums, particularly if the individual was among the one-third of covered workers who did not receive an HSA contribution from their employer. Moreover, even if those individuals at the lower end of the actual spending distribution may have lower total expenditures on premiums plus OOP spending at the point of care in a given year, due to the unpredictable nature of catastrophic health events, they still face the potential risk of having very large OOP spending under a high deductible, which may be particularly problematic for lower-income individuals with limited assets.

The potential consequences of CDHP enrollees experiencing high financial burden are significant. Previous work suggests that high financial burden may cause CDHP enrollees to delay or skip routine healthcare visits.10,11,26 Additionally, individuals who face financial burden often have to change their employment or lifestyle, or make other sacrifices, to make ends meet.26 We do not know the extent to which individuals considered potential downstream OOP costs when enrolling in CDHPs. However, prior research suggests that many individuals make poor health plan choices and frequently choose worse plans when alternative choices that have both lower financial risk of OOP spending and lower premiums are available.27,28 A possible explanation for these poor choices is that many individuals do not understand the basics of benefit design, such as the meaning of deductibles and co-payments.29,30 Moreover, this problem of poor health insurance literacy is more acute among the low-income population,30 suggesting that these individuals may not understand the potential financial burden associated with enrollment in CDHPs. Although prior work suggests that providing information on OOP costs can improve health plan choice,26,31 more work is needed to design effective interventions for improving plan choice. Additionally, further research on the impact of financial burden associated with CDHP enrollment on the use of appropriate care, unmet medical need, and other health outcomes is warranted.

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**Authorship Information:** Concept and design (XZ, ET, NS); acquisition of data (NS); analysis and interpretation of data (XZ, ET, NS); drafting of the manuscript (XZ, NS); critical revision of the manuscript for important intellectual content (XZ, ET); statistical analysis (XZ); administrative, technical, or logistic support (ET); and supervision (NS).

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REFERENCES


Full text and PDF at www.ajmc.com

CDHPs and Financial Burden
**eAppendix Table.** Enrollment by Plan Type and Year

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Sample (n = 689,542)</th>
<th>Lower-Income Subgroup (n = 66,709)</th>
<th>Chronic Condition Subgroup (n = 117,360)</th>
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CDHP indicates consumer-directed health plan.
eAppendix Figure 1. Trends in Out-of-Pocket Spending, by Plan Type

CDHP indicates consumer-directed health plan.

The graphs show the mean out-of-pocket spending with 95% CIs in the years before and after
CDHP enrollment for the full sample (panel A), the lower-income subgroup (panel B) and the subgroup with chronic conditions (panel C).
**eAppendix Figure 2.** Trends in the Percentage of Enrollees Having Excessive Financial Burden, by Plan Type

A. Entire Population

B. Lower-Income Population

C. Population with Chronic Conditions

CDHP indicates consumer-directed health plan.
The graphs show the percentage of enrollees having excessive financial burden with 95% CIs in the years before and after CDHP enrollment for the full sample (panel A), the lower-income subgroup (panel B) and the subgroup with chronic conditions (panel C).
eAppendix Figure 3. Impact of CDHP Enrollment on Out-of-Pocket Spending, Across the Out-of-Pocket Spending Distribution, by CDHP/HSA Enrollees vs. CDHP/HRA Enrollees

CDHP/HSA vs. Traditional Plan Enrollees

CDHP/HRA vs. Traditional Plan Enrollees

CDHP indicates consumer-directed health plan; HRA, health reimbursement account; HSA, health savings account; OOP, out-of-pocket.

The predicted OOP cost distribution shows the OOP cost distribution for traditional plan
enrollees in 2013 adjusted using quantile DID estimates. The counterfactual OOP cost distribution shows the OOP cost distribution for traditional plan enrollees in 2013 had the traditional plan enrollees switched to a CDHP with either an HSA or HRA in 2012 (i.e. OOP cost distribution 2 years after CDHP enrollment). The counterfactual OOP cost distribution in 2012 (1 year after CDHP enrollment) is similar.