Does the Diabetes Health Plan Have a Differential Impact on Medication Adherence Among Beneficiaries with Fewer Financial Resources?

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Abstract

Background: The Diabetes Health Plan (DHP), a value-based insurance plan that reduces cost sharing, was previously shown to modestly increase employer-level medication adherence. However, it is unclear whether the DHP has a larger impact on individual-level medication adherence among lower- or higher-income beneficiaries.

Methods: An employer-level propensity score match was done to identify suitable control employers, followed by individual-level propensity score weighting. These weights were applied to difference-in-difference (DID) models examining 1) the effect of the DHP and 2) the effect of income on changes in adherence to metformin, statins, and ACE/ARBs. The weights were then applied to a differences-in-differences-in-differences (DDD) model to estimate the differential impact of DHP status on changes in adherence by income group. This is a retrospective, quasi-experimental study.

Results: There were no significant differences in changes to adherence for any medications between beneficiaries enrolled in the DHP versus standard plans. However, changes in adherence were higher for all medications among those in the highest income strata (>$75,000) versus those in the lowest income strata (<$50,000; $p < 0.01$). Finally, the DDD term examining the impact of income on the DHP effect was not significant for any comparisons.

Conclusion: We did not find significant associations between the DHP and changes in individual-level medication adherence, even for low-income beneficiaries. New strategies to improve consumer engagement may be needed in order to translate value-based insurance designs into changes in patient behavior.

Background

The relationship between socioeconomic status and health outcomes is well-documented (1–4). Considerable research has shown that individuals with higher incomes are more likely to live longer and are less likely to report poor health status or health-related activity limitations (4). Moreover, socioeconomic disparities have been reported for multiple different diseases, including diabetes (2, 4). A major cause of mortality and morbidity, diabetes has been shown to disproportionately impact the poor. Not only are there higher rates of diabetes among the low-income, but they also face a two-fold increase in diabetes-related mortality (5).

There is evidence that these disparities may be related to differences in health care utilization and differences in patterns of health behavior (6). For example, low-income individuals report lower rates of important preventive screening measures. Among individuals with diabetes, those with lower wages are less likely to receive hemoglobin A1C testing, eye examinations, and foot examinations, measures that are important for decreasing diabetes-related morbidity and mortality (7). Moreover, due to financial barriers, low-income individuals are more likely to delay or forego care (8, 9). In one study, lower wage earners were almost two and a half more likely than those with higher wages to report cost-related

problems with medication adherence (10). This cost-related nonadherence is likely clinically significant: higher levels of medication adherence have been shown to be associated with lower rates of diabetes-related complications and emergency department visits (11).

Value-based insurance designs (VBID) have the potential to help mitigate some of these financial barriers to health care services, with the goal of improving patient outcomes (12). By reducing patients' out-of-pocket payments for important medications and services, the hope is that patients will increase their use of these high-value services, thus leading to improved clinical outcomes (12, 13). Evidence thus far has found that the implementation of a VBID can lead to modest improvements in medication adherence, especially when targeting specific patient populations (13–15). The Diabetes Health Plan (DHP) is one such VBID that specifically targets individuals with diabetes and pre-diabetes. Hallmarks of this innovative plan include lower cost sharing for office visits and medications that reduce the incidence of and complications for diabetes. Additionally, this insurance plan offers enrollees free or low-cost resources for diabetes management. Thus far, our group has found that the DHP has led to modest improvements in employer-level adherence to evidence-based medications and lower rates of incident rates of diabetes among beneficiaries with pre-diabetes (16, 17).

How low-income patients who bear a disproportionate disease burden might respond to the DHP and other VBIDs remains unclear. Given the higher rates of cost-related non-adherence among individuals with lower incomes, it is possible that these patients may be more likely than high-income patients to respond to interventions that decrease their out-of-pocket payments, leading to relatively greater uptake of high-value services (6). Indeed, one study found that eliminating cost-sharing for cardiovascular medications led to a greater increase in medication adherence among non-whites, a group with historically lower rates of adherence (18). Thus, the primary objective of this study is to examine if income influences an individual's response to reduced cost sharing under the DHP, by comparing changes in medication adherence over time among individuals of different incomes who were and were not offered this VBID.

Methods

Setting

The Diabetes Health Plan (DHP), developed by UnitedHealthCare, is an innovative disease-specific opt-out health plan for beneficiaries with diabetes and pre-diabetes (19). Key features include reduced or eliminated copayments for office visits to primary care providers and endocrinologists and for recommended antiglycemic, antihypertensive and statin medications. The DHP also provides access to diabetes-specific telephone case management and other online resources. In addition to these benefits, the DHP provides scorecards with reminders to complete health maintenance activities, such as biannual hemoglobin A1C and cholesterol screening, an annual retinal eye exam, and age-appropriate cancer screening. Employers who purchase the DHP can modify the standard benefit design to meet their needs. Altogether, the DHP provides $150–500 in annual out-of-pocket savings for enrollees (16).

Study Design/Population

For this study, we used a pre-post quasi-experimental “intent-to-treat” design, with a concurrent control group of employers that did not offer the DHP for comparison. Administrative data provided by the plan, including enrollment, prescription claims, medical claims, and laboratory results, were used to identify the study sample and create the analytic measures. Our study population included commercially insured employees and their covered dependents (together considered “beneficiaries”), classified according to whether their employer offered the DHP (i.e., DHP beneficiaries) vs. a standard medical insurance plan (i.e., controls). We began with 43 DHP employers (n = 1,224,890 individuals). We excluded 21 employers (n = 964,746 individuals) who did not have at least 3 years of continuous enrollment data defining the study period—one year pre-DHP implementation and two years post-implementation—and 12 employers (n = 165,609 individuals) that did not have complete claims data. We then limited our study sample to individuals from the remaining DHP employers who had three years of continuous enrollment, who were 18–63 years old, who did not receive Medicare coverage during the entire study period, who were not pregnant during the study period, and who had a diagnosis of diabetes (Appendix). A diabetes diagnosis was defined as having any of the following prior to the implementation of the DHP: 1) at least one 250.X ICD-9 diagnosis code from an inpatient, outpatient, or emergency department claim; 2) laboratory value of a hemoglobin A1C value of 6.5% or greater; last fasting plasma glucose level of 125 mg/dl or greater; or a 2-hour value on an oral glucose tolerance test of greater than 200 mg/dl; or 3) at least one prescription fill for insulin, or anti-glycemic medication other than metformin. Altogether, our study sample included 2,397 individuals with diabetes employed by 10 employers, prior to propensity score matching (Appendix).

We applied the same exclusion criteria to our initial 658 control employers. In addition, we also excluded 39 employers (n = 79,202 individuals) located in the Mid-Atlantic region, where there were no DHP employers were located, and 22 employers (n = 67,685 individuals) in which > 90% of their beneficiaries had a high-deductible health plan. This left 472 employers (n = 38,934 individuals) as potential control employers who offered standard health plans (Appendix). For these control employers, we defined the “pre-period” as calendar year 2010 and the post-period as January 2011 to December 2012, to match the most common implementation date for employers who purchased the DHP.

Outcome Measures

The primary outcome variable was individual-level medication adherence for metformin, ACE/ARBs, and statins in the first year and the second year after DHP implementation. Adherence was calculated as the mean proportion of days covered over the last 9 months of each year in the post-period, using the first three months in each post-period year to account for medication carry-forward. We did not control for multiple prescriptions within a drug class, but if two or more prescriptions were filled on the same day, we included the prescription with the greater number of days’ supply in calculating adherence.

Income

Household income was estimated by UnitedHealthCare using an algorithm powered by the Amerilink Consumer Database. This model predicted household income using information such as net worth, home

value, mortgage amount, bankruptcy suppression, credit card information, buying behavior, investment interests, and occupation, that were obtained from a national survey of household financial behavior, the census (income distribution), and the Internal Revenue Service (zip level income). We used the following income categories: <$50,000; $50–74,000; and >$75,000. Notably, small sample sizes limited our ability to further stratify individuals with annual household incomes less than $50,000.

Statistical Analysis

To minimize potential selection bias, particularly at the employer level, we used an employer-level propensity score match and a beneficiary-level propensity score weighting approach, similar to Wharam et al. (Fig. 1) (20). First, we sought to identify control employers that are the most likely to be similar to DHP employers. This propensity score model predicted the likelihood that an employer would purchase the DHP. The model included the following variables: employer size, geographic region; an estimated measure of the overall generosity of benefits for each health plan; proportion of beneficiaries with a high-deductible health plan; proportion of beneficiaries in age strata; proportion of beneficiaries in income strata; race/ethnicity; gender, proportion of beneficiaries with diabetes, hypertension, coronary artery disease, congestive heart failure, dementia, schizophrenia, anxiety, depression, osteoarthritis, rheumatoid arthritis, non-skin cancer, chronic obstructive pulmonary disease, atrial fibrillation, end-stage renal disease, stroke, peripheral vascular disease, or hyperlipidemia. Propensity score matching yielded 190 control employers in the region of common support.

We then used inverse propensity score weighting to adjust for individual-level differences between beneficiaries of companies that offered the DHP versus those who did not offer the DHP. To do so, we calculated an individual-level propensity score for every individual within each matched sample among the complete cases (N = 2,065 DHP beneficiaries; 17,704 control beneficiaries). These propensity scores reflected the probability of an individual having a DHP employer instead of a control employer, based on age, gender, race/ethnicity, education, income, baseline medication adherence to the drug of interest, the number of other chronic conditions, baseline utilization (defined as the presence of 2 + outpatient claims vs 1 or less in the last year), and diabetes severity (defined as diet and lifestyle controlled vs any antiglycemic medications). We used these estimated propensity scores to assign a weight to each individual that was inversely proportional to the probability of each beneficiary being in the treatment group in which they were actually included.

These weights were then applied to our full analytical model. We first constructed a difference-in-difference (DID) model examining the effect of the DHP on change in adherence to metformin, statins, and ACE/ARBs. We then constructed a second DID model to examine the effect of income on changes in adherence to these medications. Finally, we used a linear differences-in-differences-in-differences (DDD) regression model to examine pre-post changes in medication adherence in individuals with a DHP versus a standard insurance plan who fall into one of three income groups. The DDD term of interest was a 3-way interaction between indicators of DHP versus standard insurance, pre versus post study period, and indicators for each income category. This reflects the impact of DHP on medication adherence among

different income groups. All relevant two-way interaction terms were also included in the model. Analyses were conducted using SAS 9.3 and Stata 14.2.

Results

Sample Characteristics

The final analytic sample included 2,065 DHP and 17,704 control beneficiaries (Table 1). At baseline, DHP beneficiaries were older (53.9 vs 52.6, $p < 0.001$) and a greater percentage of DHP beneficiaries were female (44.9% vs 41.9%, $p = 0.008$). Additionally, there were racial and ethnic differences between DHP vs. control beneficiaries, with a greater proportion of DHP beneficiaries who were African American and a greater proportion of control employers who were Hispanic ($p < 0.001$, Table 1). There were no statistically significant differences in the baseline number of comorbidities, healthcare utilization (i.e., outpatient visits in the preceding year 0–1 versus 2+, $p = 0.792$), and diabetes severity (i.e., in the percentage taking antiglycemic medications versus those with diet and lifestyle-controlled diabetes). Baseline medication adherence to metformin was similar between groups, but baseline adherence to statins and ACEs/ARBs was lower in the DHP group (71.5% versus 74.2%, $p < 0.001$; and 76.0% versus 78.4%, $p = 0.001$, respectively). After weighting with medication-specific individual weights, there were no statistically significant differences between DHP beneficiaries and control beneficiaries in demographic characteristics who were taking one of the medications under study.

Table 1
Unadjusted Baseline Demographic Characteristics, Among Beneficiaries With and Without Exposure to DHP

	DHP	Control	
	N = 2,065	N = 17,704	p-value
Mean Age (SD)	53.9 (6.6)	52.6 (7.2)	< .001
Female %	44.9%	41.9%	.008
Race/Ethnicity			< .001
Hispanic	10.8%	15.2%	
Caucasian	69.0%	70.7%	
African American	18.2%	11.6%	
Asian/Pacific Islander	1.5%	2.1%	
Other Race	0.4%	0.4%	
Income			< .001
<$50,000	39.3%	33.5%	
$50,000-$74,999	31.5%	31.6%	
$75,000+	29.2%	34.8%	
Education			< .001
At least some High School	50.3%	41.4%	
Some College	44.6%	49.1%	
College Degree	5.1%	9.4%	
Mean Comorbidity Count	2.3 (2.2)	2.1 (2.1)	.528
Baseline Outpatient Visits			.792
0–1	20.6%	20.3%	
2+	79.4%	79.7%	

1: These numbers reflect the number of complete cases available among beneficiaries for each of the three medication classes.

2: The larger total number of individuals taking medications is larger than our sample size as individuals may be taking more than 1 medication.

Abbreviations: DM – diabetes mellitus, ACEi – Angiotensin converting enzyme inhibitor, ARB – angiotensin receptor blocker

	DHP		Control		
	N = 2,065		N = 17,704		p-value
Taking DM Medication	43.7%		45.7%		.091
Baseline PDC[1,2]					
Metformin	N = 808	0.699 (.28)	N = 7,376	.712 (.27)	.206
Statins	N = 1,211	0.715 (.27)	N = 10,179	.742 (.27)	< .001
ACEi/ARBs	N = 1,357	0.760 (.26)	N = 11,048	0.784 (.25)	.001
1: These numbers reflect the number of complete cases available among beneficiaries for each of the three medication classes.					
2: The larger total number of individuals taking medications is larger than our sample size as individuals may be taking more than 1 medication.					
Abbreviations: DM – diabetes mellitus, ACEi – Angiotensin converting enzyme inhibitor, ARB – angiotensin receptor blocker					

Medication Adherence and DHP Uptake (Difference-in-Differences)

In adjusted results (Table 2), the changes in mean predicted adherence rates over time among beneficiaries offered the DHP were similar to those among beneficiaries offered standard insurance plans, irrespective of income (all $p > 0.10$). The difference-in-differences interaction effects between DHP classification and time were not statistically significant for any of the three medication classes among all income groups combined.

Table 2
Predicted medication adherence among beneficiaries with and without exposure to the DHP (Difference-in-Differences)

		Predicted adherence		Absolute difference	Relative difference	p-value
		Control	DHP			
Metformin	Baseline	71.0%	71.4%	+ 0.4 percentage points	0.5%	.725
	Year 1	73.4%	75.3%	+ 1.9 percentage points	2.5%	.054
	Year 2	72.8%	74.3%	+ 1.5 percentage points	2.1%	.124
Statin	Baseline	73.9%	72.5%	-1.4 percentage points	1.9%	.076
	Year 1	74.6%	73.9%	-0.7 percentage points	0.9%	.392
	Year 2	74.0%	72.7%	-1.3 percentage points	1.7%	.125
ACE/ARBs	Baseline	78.3%	76.6%	-1.7 percentage points	2.2%	**.018**
	Year 1	79.4%	78.6%	-0.8 percentage points	1.0%	.272
	Year 2	78.5%	77.9%	-0.6 percentage points	0.8%	.417

Medication Adherence by Income Group (Difference-in-Differences)

In the adjusted results, the mean predicted rates of adherence to all medication categories examined were higher among those with higher incomes, during all years examined (Table 3). At baseline, medication adherence to metformin, statins, and ACE/ARBs was 6.8, 5.7, and 5.4 percentage points higher among those in the highest income strata (> $75K) compared to those in the lowest income strata (<$50K), respectively. The difference-in-differences interaction effects between income and time were not statistically significant for any of the three medication classes, without regard to DHP classification. That is, the differences between the lowest and highest income strata in changes in medication adherence over time were not statistically significant.

Table 3
Predicted Medication Adherence among Beneficiaries in the Lowest Income Strata (<$50K) versus the Highest Income Strata ($75 + K) Irrespective of DHP (Difference-in-Differences)

		Predicted adherence		Absolute difference	Relative difference	p-value
		<$50K	$75 + K			
Metformin	Baseline	67.9%	74.7%	+ 6.8 percentage points	10.1%	**< .001**
	Year 1	70.6%	78.0%	+ 7.3 percentage points	10.4%	**< .001**
	Year 2	70.3%	77.3%	+ 7.0 percentage points	10.0%	**< .001**
Statin	Baseline	69.9%	75.6%	+ 5.7 percentage points	8.1%	**< .001**
	Year 1	71.9%	76.0%	+ 4.2 percentage points	5.8%	**< .001**
	Year 2	71.1%	75.4%	+ 4.3 percentage points	6.1%	**< .001**
ACE/ARBs	Baseline	74.7%	80.1%	+ 5.4 percentage points	7.2%	**< .001**
	Year 1	76.3%	82.4%	+ 6.1 percentage points	8.0%	**< .001**
	Year 2	75.7%	81.8%	+ 6.1 percentage points	8.0%	**< .001**

Change in Medication Adherence with DHP, by Income (Difference-in-Difference-in-Differences)

The 3-way interaction term examining the impact of income on the DHP effect on adherence over time was not significant for any of the three medication classes (Table 4). That is, the absolute differences in predicted changes in adherence between baseline and year 1 or year 2 with DHP versus a standard insurance plan were not significantly different (all $p > 0.10$) for the highest income (> $75K) and lowest income groups (< $50K).

Table 4
Predicted change in adherence with DHP exposure, relative to no exposure, by income (Difference-in-Difference-in-Differences)

		DHP Metformin Adherence Change from Baseline, Relative to Controls		DHP Statin Adherence Change from Baseline, Relative to Controls		DHP ACE/ARB Adherence Change from Baseline, Relative to Controls	
		Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
<$50K		+ 0.3%	+ 1.5%	+ 1.7%	+ 1.8%	+ 1.0%	+ 0.7%
$75K+		+ 0.8%	+ 0.9%	+ 0.6%	− 0.3%	+ 2.9%	+ 3.2%
Absolute difference	<$50K vs $75K+	-0.5%	0.5%	1.2%	2.2%	-1.9%	-2.5%
p-value	<$50K vs $75K+	0.821	0.833	0.506	0.300	0.243	0.207

Discussion

In summary, we examined the association between the Diabetes Health Plan, a disease-specific value-based insurance design product, and individual-level adherence to evidence-based medications among individuals with diabetes and pre-diabetes, across different income groups. Our study has 2 notable findings: 1) there was no difference in how individuals with different incomes responded to the DHP and 2) we did not observe an association between DHP implementation and medication adherence at the individual level.

Consistent with what has been previously reported, in our sample, medication adherence increased with income (21). However, we did not observe a differential effect in how individuals with different incomes responded to the DHP. There are many reasons why low-income individuals may not preferentially respond to a VBID. First, VBIDs often involve complex cost-sharing structures. Multiple studies have demonstrated that as cost-sharing structures become more complex, patients' understanding of their insurance benefits decreases (10, 22, 23). Moreover, understanding appears to be associated with income: in one study, those with higher incomes had improved knowledge of their benefits in a VBID, compared to those with lower incomes (24). As a result of their lower levels of health insurance literacy, low-income individuals may not be able to fully take advantage of benefits offered by VBIDs like the DHP and may avoid preventive services due to perceived cost-related concerns (9, 10, 24–27). Indeed, those with lower health insurance literacy in one study were more likely to avoid preventive services, despite the ACA mandate that these services be provided free of charge (9). If the low-income beneficiaries in our population did not realize that the DHP eliminated or reduced cost-sharing for high-value services, barriers to utilization may have inadvertently been created. We did not have information on strategies employers used to discuss benefits of the DHP and could not account for this in our analyses.

Others have hypothesized about the role of scarcity: because individuals with lower incomes have more financial stressors, they may not have the bandwidth to prioritize health and may not be influenced by a VBID structure (28). Consistent with this hypothesis, studies have found that colorectal screening rates and adherence to statins improved upon cost-sharing reduction in those with middle and high income, there was not a detectable improvement among the lower-income (20, 29).Further studies should continue to include income in their analyses to clarify its relationship with response to VBID offerings.

There are also methodological limitations that may explain why response to the DHP did not vary by income. First, our sample was limited to individuals with employer-based insurance. Due to sample size, we were also limited to analyzing those with incomes less than $50,000 as the lowest income group. In other words, we could not disaggregate those with smaller incomes. As a result, our study is not generalizable to those with very low incomes, who may have responded differently. Furthermore, we did not have information on household size and could not generate a measure of federal poverty level (FPL) for each family. This has important implications as different incomes translate into different levels of poverty depending on family size. For example, an annual income of $50,000 is 400% of FPL for a household of one, but only 194% of the FPL for a household of four (30). Nevertheless, we set $50,000 as the upper threshold for our lowest income strata, since this annual income would qualify even the smallest household for financial assistance in the Affordable Care Act insurance marketplaces (31).

Prior studies evaluating the impact of VBIDs on medication adherence have found modest, but significant, improvements in adherence, ranging from 0.1 to 14% (13, 14). Similarly, our group previously demonstrated an improvement in medication adherence after DHP implementation, at the employer-level (16). The lack of an association between DHP implementation and medication adherence in the current study was somewhat surprising, but there are important differences in study design that must be considered. First, the sample populations differed somewhat across the two papers. We updated the dataset for the current analysis, and only eight of the ten DHP employers included in this study overlapped with those included in the previous study. Second, there were some differences between the two papers in the included covariates and in the structure of the propensity score. Finally, this was an individual-level study, compared to the prior employer-level aggregate analysis. While the employer-level analysis does help mitigate against selection bias, it has been well-established that relationships seen at the aggregate level do not necessarily transfer to the individual level and vice versa, resulting in inferences that are specific to the level of analysis used (42–44).

Differences in study design may also explain the lack of associations between the DHP and medication adherence in our study as compared to evaluations of other VBID programs that demonstrated positive findings. For example, one study reported no change in medication adherence among those with a VBID alone, but a significant 6.5 percentage point increase in medication adherence among VBID patients who also participated in a disease management program (32). We did not have details of disease management or wellness programs among our employers, precluding our ability to control for these variables or conduct subgroup analyses. Additionally, in contrast to prior studies which used area-level income measures, our study used a measure of individual household income which incorporated

individual financial behavior (32–35). Given the well-established relationship between income and adherence, it is possible that individual household income may impact the effectiveness of any VBID (28, 36, 37).

This study has several limitations, in addition to those previously described. While we used propensity matching at the employer level and weighting at the individual level to minimize confounding, there may still be unmeasured differences between the populations (e.g., employer-level “wellness culture”, individual engagement). We also conducted a complete case analysis: this may have biased our results if this sample differs systematically from those with any missing data. However, only 11.8% of the sample was removed due to missing data. Our study also has several notable strengths. For example, we measured medication adherence one and two years after DHP implementation, allowing us to explore its short-term and long-term impacts. Additionally, unlike prior studies that used area-level income, we used an estimate of individual household-level income, allowing us to more precisely examine the effect of income on VBID effectiveness (32, 34).

Altogether, this study may have implications for policies that aim to encourage the uptake of high-value, evidence-based therapies through thoughtful benefit designs that aim to promote equity. The lack of an observed effect suggests that lowering the consumer cost sharing may not be sufficient. Other strategies to consider involve education through improved communication that aim to increase the understanding of benefits available. Some have proposed providing this information during health care professional visits, as numerous surveys interviewing patients have reported a desire to discuss costs with their providers (38–40). Future studies should examine additional interventions and strategies that can optimize the impact of these VBIDs.

Conclusions

In conclusion, we did not observe a statistically significant change in individual-level medication adherence among beneficiaries with diabetes or pre-diabetes who were offered the Diabetes Health Plan, a disease-specific value-based insurance plan. Moreover, we also did not observe a difference in effect across individuals with different income groups. These results highlight the challenges of translating value-based insurance designs into changes in patient behavior that will ideally improve their health outcomes. Further research should be conducted to clarify additional strategies that can improve consumer engagement, with the goal of designing more targeted, impactful policies.

Declarations

Ethics Approval and Consent to Participate

This study uses de-identified data from UnitedHealthcare. UnitedHealthcare has given permission for us to use data via the Data Use Agreement signed by both UHC and UCLA. Written informed consent for all parts of the described programs were obtained by UnitedHealthcare for each person in this study. All

methods were carried out in accordance with relevant guidelines and regulations. This study received approval from the UCLA IRB Office, IRB#16-000276-CR-00005.

Consent for Publication

Not Applicable.

Availability of Data and Material

The datasets generated and/or analyzed during the current study are not publicly available due to the data being owned by UnitedHealthCare, but are available from the corresponding author on reasonable request.

Competing Interests

I declare that the authors have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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Author's Contributions

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in BMC Health Services Research.

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Figures

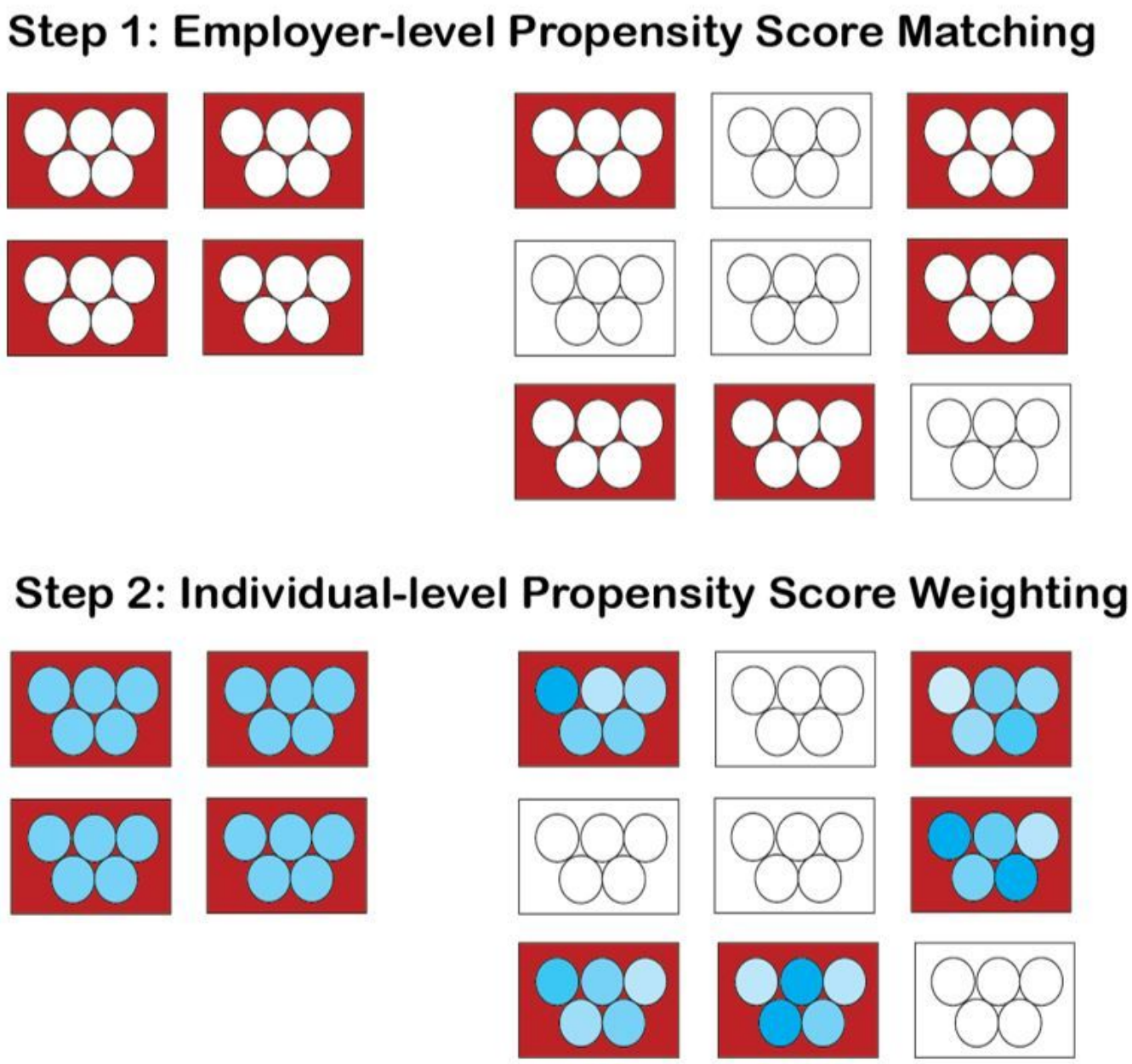

Figure 1

Employer-level propensity score matching and individual-level propensity score weighting. First, propensity score matching is used to identify control employers that are the most similar to DHP employers. Within the matched employer sample, individual-level differences were controlled for using inverse propensity score weighting.

Supplementary Files

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- Appendix.docx