

The Value of a Well-Being Improvement Strategy: Longitudinal Success across Subjective and Objective Measures Observed in a Firm Adopting a Consumer-Driven Health Plan

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Objective: The objective of this study is to evaluate effectiveness of a firm's 5-year strategy toward improving well-being while lowering health care costs amidst adoption of a Consumer-Driven Health Plan. **Methods:** Repeated measures statistical models were employed to test and quantify association between key demographic factors, employment type, year, individual well-being, and outcomes of health care costs, obesity, smoking, absence, and performance. **Results:** Average individual well-being trended upward by 13.5% over 5 years, monthly allowed amount health care costs declined 5.2% on average per person per year, and obesity and smoking rates declined by 4.8 and 9.7%, respectively, on average each year. The results show that individual well-being was significantly associated with each outcome and in the expected direction. **Conclusions:** The firm's strategy was successful in driving statistically significant, longitudinal well-being, biometric and productivity improvements, and health care cost reduction.

As a part of the Affordable Care Act (ACA), there is a new excise tax ("Cadillac health plan tax") that will be levied against health benefits packages with rich benefits. Beginning in 2018, a 40% excise tax will be assessed against any policy that exceeds the annual limit of \$10,200 per individual or \$27,500 per family. According to a survey conducted by Mercer in 2011, 61% of 2844 public and private companies said their plans would qualify for the excise tax.¹ Although there are proponents and opponents of this somewhat controversial component of the ACA, the reality is that most employers are facing a difficult decision and must balance consideration of two seemingly opposing goals; on the one hand, optimize the well-being and productivity of their valuable workforces, and on the other hand, the goal to minimize the firm's financial exposure to plan participant health care costs while increasing participant accountability by shifting a proportion of paid claims to the participant. As evidenced in recent data from the Bureau of Labor Statistics,² the median employee annual deductible in a consumer-driven health plan (CDHP) was four times the deductible in a non-CDHP, thus considering just the financial burden to employees renders the employer's decision to be one of considerable complexity.

A typical employer providing health care coverage for its employees effectively has the option to provide a self-insured group health plan, by which an employer assumes partial or entire financial risk of employee and dependent healthcare with its own funds, or a fully insured plan, wherein the employer contracts with an insurance company to cover enrollee health care costs.³ According to an Employee Benefit Research Institute report,⁴ more than

58% of employees at private sector firms nationwide receive benefits through self-insured group health plans sponsored by their employers. The Self-Insurance Institute of America⁵ reports that employers often choose the self-insured option for reasons related to fiscal prudence, regulatory complexity, and customization. The research presented here is a case study of a self-insured employer that transitioned to CDHP. Such a transition is becoming more common, with 58% of employers recently surveyed (representing more than 20 million individuals) reporting having offered a CDHP⁶; this rate was 41% higher relative to the prior year survey results.

In this study, the employer transitioned entirely to a CDHP in 2010 and over the next 3 years gradually increased plan participant cost share, along with concomitant increases in health savings account and flexible spending account levels, in order to pace and balance the movement toward consumer-driven care. Several studies⁷⁻¹⁰ have recommended gradual adoption of a CDHP along with complementary plans and consumer accountability in order to incentivize and educate members and in doing so, lower the likelihood and magnitude of adverse consequences to employee productivity, engagement, and retention. However, it takes time to provide complementary plans and then to evaluate the effectiveness of a combined strategy; none of the studies referenced above followed a population over the duration investigated here.

The firm studied here developed a 5-year strategy to optimize well-being while adopting a CDHP. A part of this strategy was enabling covered lives to make intelligent decisions concerning the management and improvement of their overall well-being. Of primary concern was employee well-being because employees are considered to be the greatest asset of the company. In an environment defined by a strong corporate culture of well-being, the firm began to further optimize the well-being of its workforce while administering a CDHP. In order to mitigate adverse consequences stemming from the increased share of health care costs borne by plan participants, such as lower employee engagement, increased turnover, and deferred utilization, a multi-year/multi-tier benefits package was incorporated into the overall strategy.

The multi-tier aspect of the benefits component to the CDHP strategy was designed to address the "educate, engage, and empower" goals of the strategy. As described in more detail below, a series of tangible and intangible benefits were afforded to plan participants and included options such as the well-being assessment (WBA), health savings account contributions for participation in onsite fitness classes, workout clothes as work attire, and flexible work schedules and environments. The objective of affording a diversity of benefit offerings was to allow participants the freedom to choose one or more options that best enabled the participant to set attainable personal goals reflective of where he/she was on their path to higher well-being, better health, and enhanced productivity. Of course, the diversity of offerings was also purposeful in helping individuals make informed tradeoffs when choosing how to pursue the goals along their path, the commitment required to meet the goals, and the financial costs of their choices.

To evaluate effectiveness of the firm's strategy toward improving well-being while lowering costs, we conducted a 5-year longitudinal study. We hypothesized that the integration of a

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Conflicts of interest: All authors are employees of Healthways, Inc.

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multi-year/multi-tiered benefits component into the consumer-driven strategy would result in improved individual well-being and performance in addition to reduced health care costs, absenteeism, smoking rate, and obesity prevalence. By assessing the association of selected outcomes with well-being, we expected to see that positive outcomes become more apparent and negative outcomes less evident with increasing well-being. This study reports results of statistical analyses on the aforementioned outcomes over time and as a function of well-being while also providing insight into the strategy implemented by the evaluated firm. These findings will help inform, guide, and spur additional innovation and research into a well-being focused consumer-driven strategy.

PROGRAM DESCRIPTION

A wide range of benefits options, collectively termed the well-being improvement solution (WBIS), were provided at the firm beginning in 2009 and added each year to promote well-being. Some selected examples of the WBIS included company-sanctioned fitness activities that ranged from intense “bootcamp,” multiple levels of yoga, kickball, volleyball, kettle bells, down to less intensive activities such as ping pong and fitness classes for older adults. These activities were allowed during normal business hours, and all levels of employees were encouraged to participate, even in multiple activities per day. Additional more intensive programs were offered to all plan participants, including one of the largest and most successful smoking cessation programs.¹¹ A research-based and longitudinally proven intensive weight loss program¹² was also made available to employees who qualified.

As a part of the well-being improvement strategy, the firm encouraged and supported healthier lifestyles for the entire population through the offering of wellness resources that promoted a culture of well-being. All employees were given access to online well-being improvement plans, health coaches, free annual blood screening and biometric exams, free nationwide gym membership at thousands of gyms, online fitness trackers, well-being management tools, and social networking to promote well-being. A well-being strategy for improving total population health and performance allowed individual needs to be met, thereby providing an efficient, logical, and individualized means to improve overall business performance and reduce cost. Collectively, outcomes related to health, performance, and cost were quantitatively associated with the effectiveness of the WBIS by the Individual Well-Being Score (IWBS),¹³ a multidimensional measure of overall well-being derived from the WBA. The IWBS was developed to measure the overall well-being status of individuals, including physical health, purpose, social, financial, and community; the score reflects the impact of the WBIS on each individual. By leveraging well-being as a strategy for total population health improvement, as opposed to independent focus on physical health, benefits structure, or work environment, the firm was able to capitalize on the full dimensionality of individual behavior change. In doing so, the firm progressed toward a wide range of benefits associated with higher performing employees, including lower absenteeism, reduced obesity, smoking, and health care costs. Research has shown that individuals with high well-being cost less and perform better;^{14,15} thus, the expectation was that similar results would hold for the firm under study.

DATA AND METHODS

The study population consisted of 2265 members who met the following criteria between the years 2009 and 2013: enrolled in the CDHP for 2 or more years during the 5-year period; were medically eligible for at least 3 months in each enrolled year; participated in a WBA and biometric screening during each enrolled year; and were between 18 and 65 years of age. Basic demographic attributes including age, sex, employee type, annual allowed amount health care costs, and utilization related to emergency

room (ER) and hospitalizations were derived from transactional databases containing health insurance claims, medical eligibility, and employment status. Data pertinent to well-being were derived from annual WBA administrations. Biometric data specific to body weight, height, blood pressure, and nicotine presence were obtained from electronically stored annual medical screenings administered by a registered clinician; the screening data were based on physical measurements as well as venipuncture. Individual-level data from each of these independent sources were distilled into an annual record, where applicable, and then joined by a unique individual identifier to create a panel data set per person. As individual study members did not have the same number of enrolled years over the study period, the study was an unbalanced panel design. The number of years members were in the study ranged from 2 to 5, with an average of 3 years.

In addition to the most important explanatory variable under investigation, the measure of well-being captured by IWBS, the following covariates were entered into each regression equation: age (years), sex (reference, female), year (reference, 2009; 1, 2010; 2, 2011; 3, 2012; 4, 2013), and employee type (reference, Type A; 1, Type B; 2, Type C; 3, Type D, dependent). The different employee types within the study population were categorized into these four classes for the purpose of generalizing the results. In other words, our intent was not to make inferences about specific roles and expected outcomes and instead to quantify variance explained as a function of being a dependent versus employee, and further, the general work type of the employee. In addition, two limited dependent variables, ER visits and hospitalizations, were also evaluated in the statistical analyses of each outcome.

Outcome Measures

Five outcomes were assessed in this retrospective, observational study, ranging from objective to subjective individual-level outcomes of interest to firms evaluating benefit design changes. Specifically, we investigated the relationship between key demographic factors, employment type, individual well-being, and health care utilization on allowed amount health care costs, obesity, smoking, absence, and performance. Health care costs, nicotine use or alternatively, smoking status, and obesity were derived from objective data sources, whereas the productivity outcomes of job performance and absenteeism were derived from completed WBA questionnaires.

Objective Outcomes

Health Care Cost

A principal outcome of interest in this study was the observed level of allowed amount of health care costs each year and over the 5-year period. Individual-level, annual allowed amount expenditures were computed as the sum over all dates of service within each calendar year, accounting for 3 months of runout. The annual estimate was then divided by the individual's number of eligible months during the year to derive a per member per month (PMPM) cost estimate. Allowed expenditure amount was evaluated as opposed to the amount ultimately paid by the firm in order to account for year to year differences in deductible, co-pay, and out-of-pocket maximums. Moreover, by utilizing allowed expenditures, we are able to understand whether changes over time in health care costs are systemic and thereby a function of the evolving WBIS, demographic composition, and firm culture as opposed to simply attributed to negotiated rates with providers, medical inflation, higher deductibles, and/or higher individual out-of-pocket rates.

Health care expenditures included costs associated with outpatient services, ER visits, hospitalizations, and pharmacy expenditures over the duration of the study. To mitigate the impact of individual-level annual outlier expenditure amounts on the

estimated regression models, individuals whose PMPM cost exceeded the 99th percentile cost level of a given year were excluded from the analysis. Furthermore, and specific to the relationship between expenditures and the explanatory variable IWBS, multiple different functional forms were tested and the most efficient form was double-log. Log-transformation of health care expenditures is a commonly applied transform, as doing so reduces nonnormality and heteroskedasticity in the cost distribution.^{16,17} The double-log functional form results in an elasticity interpretation of the estimated coefficients for log-transformed continuous and limited dependent variables and percent change interpretation for dummy variables.

Smoking and Obesity

Individual-level smoking status was determined directly from the nicotine level obtained via venipuncture during the annual biometric screening. A dichotomous variable was constructed such that a value of 1 denoted affirmative smoking status and zero otherwise. Similarly, a value of 1 was assigned to a given individual if the calculated body mass index (BMI) exceeded 30 kg/m², denoting obesity; a value of zero indicated that the individual was not obese. The biometric data for both smoking and obesity indication were collected annually across the 5-year study period by registered clinicians. Most individuals received their biometric screening at prescheduled events held in central locations, such as the firm's three main offices. The balance of individuals received their screening at alternate locations including medical offices and personal residence.

Subjective Outcomes

Job Performance and Absenteeism

Data pertinent to the productivity outcome of job performance assessed in the WBA were adapted from a presenteeism question contained within the World Health Organization's (WHO) Health and Work Performance Questionnaire (HPQ).^{18,19} The HPQ is a widely used survey for measuring productivity in the workplace and the particular performance question we evaluated is commonly referenced, and as a result, facilitates comparison of our results to similar research. The specific question included in the WBA was "On a ladder from 0 to 10, where 0 is the worst job performance anyone could have at your job and 10 is the performance of a top worker, how would you rate your overall job performance on the days you worked during the past 4 weeks (28 days)?" This particular question yields a measure of relative job performance, where the term relative implies actual to possible performance evaluated by the individual. We maintained the original ordinal scale of this measure in our analyses such that higher responses indicate lower levels of lost productivity.¹⁸ The absenteeism component of job productivity was calculated on the basis of individual responses to the WBA question, "During the past 28 days, how many days did you miss an entire work day because of problems with your physical or mental health?" This question was also adapted from the WHO HPQ and we preserved the range of 0 to 28. We considered both productivity outcomes to have a limited dependent distribution. These outcomes were not included in the WBA until 2010; thus, these measures were evaluated over a 4-year period.

Statistical Analysis

We employed a repeated-measures, multivariate statistical model²⁰ to evaluate the association between key demographic factors, employment type, individual well-being, health care utilization, and the evolving suite of factors defining the firm's benefits and well-being improvement programs on the outcomes of health care costs, obesity, smoking, absence, and performance. Application

of a repeated measures model allowed us to account for individual-level, correlated error terms generated by the panel data sets; accordingly, the statistical analyses directly controlled for the longitudinal aspects of the study. The estimated coefficients from the repeated measures models yielded robust estimates of the marginal contribution of each evaluated explanatory factor to a given outcome. All analyses were performed using the generalized estimating equations (GEE) method available in the statistical software SAS Version 9.2 (SAS Institute Inc, Cary, NC).

The statistical methodology we employed to model each outcome consisted of two principal steps. First, we identified the covariance structure that most efficiently modeled the correlation among repeated outcome measurements obtained on the same individual. We found the unstructured covariance structure to be the optimal choice based on QIC and QICu²¹ for all outcomes except for job performance, which required an independent covariance structure. Following this, we estimated the contribution of each covariate on the five different outcomes considering the unbalanced panel.

A separate repeated measures model was estimated for each of the five outcomes, with the same set of covariates included in each model. The GEE method with normal distribution and identity link function was applied to the primary outcome variable of allowed amount health care costs. For the dichotomous outcomes of obesity and smoking indication, the GEE method with binary distribution and logit link function was estimated. Due to the presence of an excessive number of zero values in the distribution of self-reported absenteeism values (78.9% zero responses on average across the 4 years), a zero-inflated negative binomial model for repeated measures was estimated. Last, for the ordinal job performance outcome, the GEE method with multinomial distribution and ordered link function was estimated.

RESULTS

A unique contribution of this study to the literature is the 5-year longitudinal design in which a myriad of individual characteristics, ranging from demographics to well-being risks to health care use, and outcomes were collected on more than 2000 individuals. Table 1 provides descriptive statistics of the individuals included in the study. Noted earlier, and not presented in Table 1, is that over the course of the 5-year study period, individuals recorded on average more than 3 years of exposure to the benefit plan and WBIS. The average profile of evaluated study members was defined by a mean age of approximately 44 years, 70% female, Type C employee disposition, increasing well-being, and employee productivity, and declining levels of ER visits, hospitalizations, health care costs, smoking, and obesity prevalence. Consistently, nonnegative year-over-year trends were noted for the percentage of male individuals in the analysis as well as individuals responding a 9 or 10 to the job performance question. The average number of ER visits consistently declined year-over-year as did the PMPM of allowed amount health care expenditures. The most significant change in characteristic representation over the 5-year period occurred for Type D prevalence (which referred to dependent status). Interestingly, on average over the study period, the average annual age remained relatively static.

Figure 1 (a–c) contrasts temporal change in IWBS with three of the evaluated outcomes; these graphs highlight the inverse trend between certain individual outcomes and well-being over time within the population. Over the course of the 5-year study period, average IWBS trended upward by 9.8 points or 13.5% but reached a stable period in the last 3 years. On the contrary, the allowed amount PMPM declined by 5.2% on average between 2009 and 2013, with the most significant decline observed between the first and second years of the study period. This is an important finding given that inflation alone would have yielded an expectation of a positive trend

TABLE 1. Descriptive Statistics for Covariates and Outcomes Evaluated Across the Longitudinal Study Period

Variables	Year*				
	2009	2010	2011	2012	2013
Predictors					
IWBS [†]	72.4	75.4	81.4	80.7	82.2
Age	44.3	44.1	44.3	43.8	44.6
Male	27.9%	29.0%	29.7%	32.1%	34.1%
Emergency room visit	0.19	0.14	0.16	0.15	0.11
Hospital admission count	0.04	0.03	0.05	0.04	0.05
Employee type					
Type A	28.8%	23.9%	23.5%	17.8%	14.8%
Type B	4.6%	6.3%	5.4%	7.1%	6.9%
Type C	66.5%	69.7%	71.0%	56.7%	59.0%
Type D	0.1%	0.1%	0.1%	18.4%	19.3%
Five outcomes					
Amount PMPM (SD) [‡]	\$455.9 (687.4)	\$367.9 (648.1)	\$414.0 (749.9)	\$395.3 (736.1)	\$357.8 (971.3)
Nicotine (%)	8.7%	8.0%	7.7%	5.4%	5.5%
Obesity (%)	36.9%	34.5%	35.4%	32.1%	30.2%
Job Performance ^{§,} (SD)	—	8.47 (1.04)	8.52 (1.05)	8.59 (1.05)	8.64 (1.05)
Level 0	—	0.0%	0.0%	0.0%	0.0%
1	—	0.0%	0.0%	0.0%	0.0%
2	—	0.0%	0.0%	0.1%	0.0%
3	—	0.1%	0.1%	0.0%	0.0%
4	—	0.1%	0.2%	0.1%	0.3%
5	—	1.2%	0.9%	1.0%	1.1%
6	—	2.9%	2.3%	2.1%	2.7%
7	—	9.0%	11.0%	9.4%	6.5%
8	—	35.8%	30.8%	29.3%	29.4%
9	—	35.9%	37.8%	39.2%	40.2%
10	—	15.0%	16.9%	18.8%	19.8%
Absenteeism (SD)	—	0.51 (1.67)	0.47 (1.37)	0.39 (1.28)	0.44 (1.62)

IWBS, Individual Well-Being Score; PMPM, per member per month; SD, standard deviation.

*Unless otherwise noted by a percent sign, mean values are presented.

[†]First row of results for Job Performance reflects the overall average and standard deviation across the ordinal scale ranging from 0 to 10. Values in the corresponding levels reflect the relative proportion of members in each level of the scale.

^{||}Data for Job Performance and Absenteeism were not available until 2010 due to these questions not having been included in the 2009 Well-Being Assessment questionnaire. Absenteeism was reported on a 28-day basis.

over the study period. In total, allowed amount health care costs were 21.5% lower in 2013 than 2009. Similar findings during the 5-year study period were also evidenced in a subset of 5-year continuously enrolled members ($n = 502$; refer to Figure 2a and b). Compared with the study population, the 5-year continuously enrolled members maintained a higher well-being score and lower average health care cost over the study period. With the exception of 1 year, the prevalence of obesity declined every year of the study to the lowest point in 2013 at approximately 30%. The prevalence of smokers was at the lowest level in 2012 and increased slightly in the last study year, with the most significant year-over-year decline occurring between 2011 and 2012. The prevalence of obesity and smoking declined by 4.8 and 10%, respectively, on average each year between 2009 and 2013.

The productivity outcomes, measured by responses to the job performance and absenteeism questions assessed during the 4-year period of 2010–2013, demonstrated positive relationships over time and with well-being (see Figure 3 a and b). Between 2010 and 2013, mean self-reported performance increased 2%. Specifically, the proportion of members reporting in the highest levels of job performance (9+) continuously increased each year by an average of 3.8% with a standard deviation of just 1.4%, while low-to-moderate levels of performance (4 to 8) showed an average annual decrease of 6.5% with a standard deviation of 1.7%. The high variability and low frequency of responses observed in the lowest

job performance range renders further consideration of these data tenuous. The second measure of productivity, absenteeism, was marked by high variability around the mean and a resulting level in 2013 less than the initial 2010 reported mean level. In the first 3 study years in which absenteeism was measured, the average reported level of absence declined each year for a total change of 12%, but in the last year, a 13% increase was observed. Between 2013 and 2010, absence on average declined by 4.0% or approximately six-tenths of one day per person per year.

Results from the estimated multivariate statistical models are presented in Table 2. The results show that individual well-being (IWBS) was significantly associated with each outcome and in the expected direction. Specific to health care costs, the results show that for each 1% increase in IWBS, log-transformed amount allowed PMPM decreased by 0.46% ($P < 0.001$), ceteris paribus. In order to convert this elasticity result to dollars, we multiplied the 2009 PMPM value by a 1% increase in mean IWBS, resulting in a \$1.52 PMPM cost reduction associated with the well-being change [$1\% \times 72.4 \times (-0.46\%) \times \$455.9 = \$1.52$]. Extending this computation to the 5-year study period, we found an average cost reduction of \$5.01 PMPM on the basis of the average annual improvement in well-being of 3.3% and baseline values [$3.3\% \times 72.4 \times (-0.46\%) \times \$455.9 = \$5.01$].

Similar to the analysis of health care costs over time, an inverse relationship was found between well-being improvement

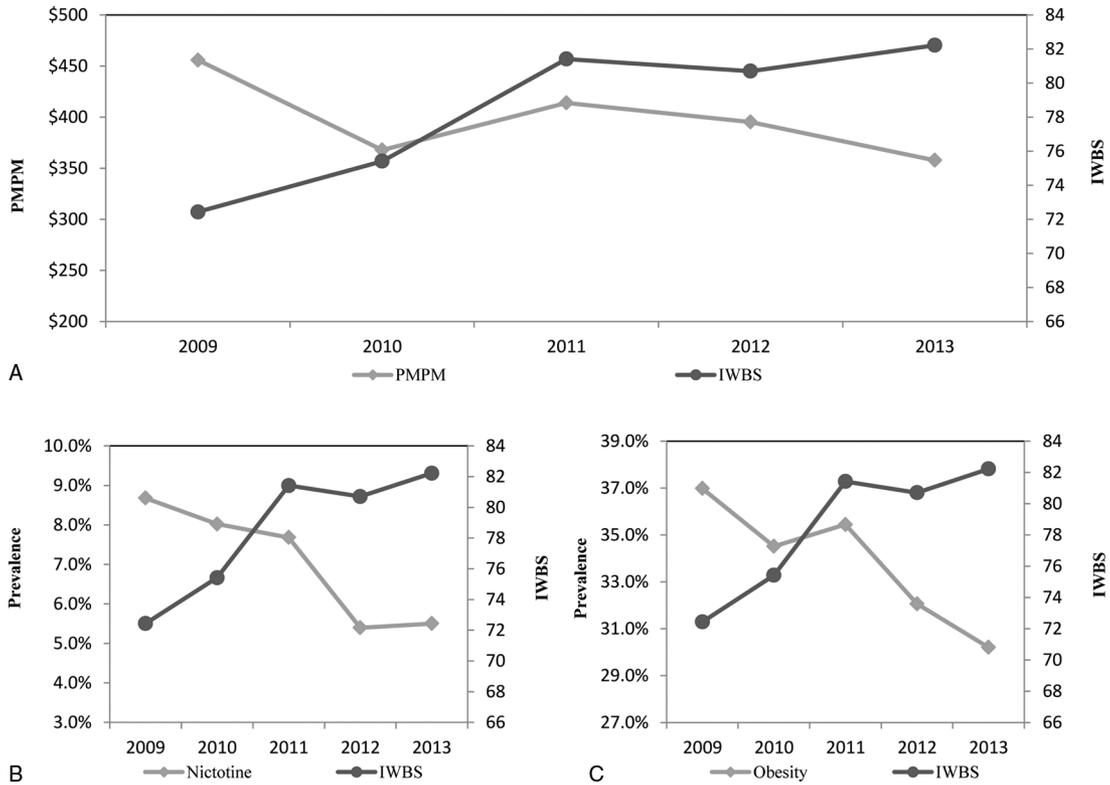


FIGURE 1. (a–c) Trend of three outcomes, allowed amount PMPM, nicotine or smoking prevalence and obesity prevalence, and the explanatory variable IWBS from 2009 through 2013.

and smoking rate, obesity prevalence, and self-reported absenteeism after controlling for multiple individual-level factors. For each one-point increase in well-being, the results show that the odds of being a smoker or being obese significantly declined ($P = 0.002$ and $P < 0.001$, respectively). For absence, the expected number of days missed due to one’s own physical or emotional health was found to have decreased by 4.2% (per 28 days, or approximately one day per year on average) for each one point increase in well-being, *ceteris paribus* ($P < 0.001$). Last, a one-point increase in well-being

was associated with a 5.1% increase in the likelihood of reporting higher performance ($P < 0.001$).

Table 2 also demonstrates the positive association between increasing time from the baseline year, which is a reflection of the evolving suite of factors defining the firm’s benefits and well-being improvement programs, and allowed amount PMPM. Compared with the baseline of 2009 and controlling for the aforementioned factors, the annual allowed amount decreased every year at an increasing rate ($P < 0.001$), with the exception of 2011; this result

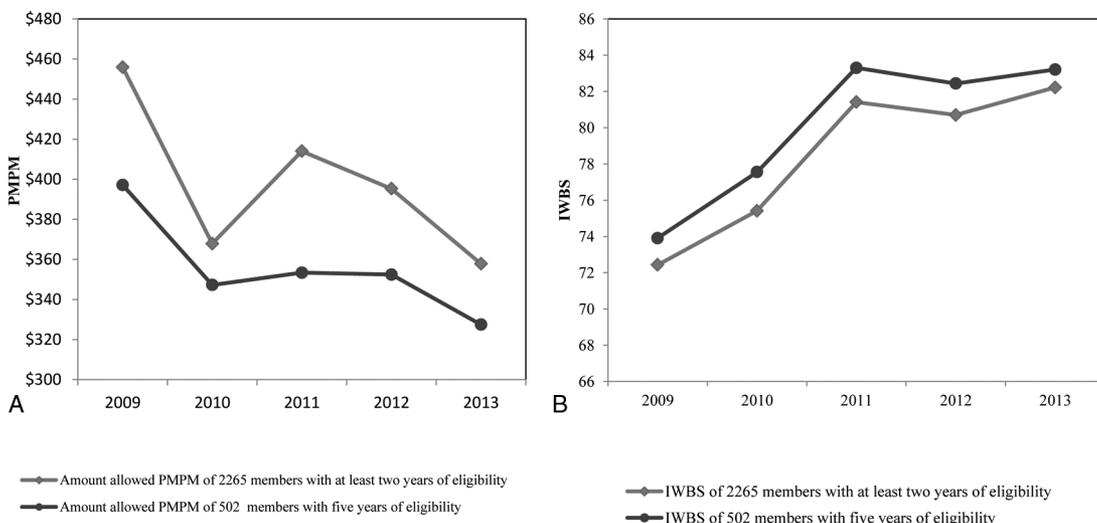


FIGURE 2. (a and b) Trend of allowed amount PMPM and IWBS for the study population and the 5-year continuously enrolled members from 2010 through 2013.

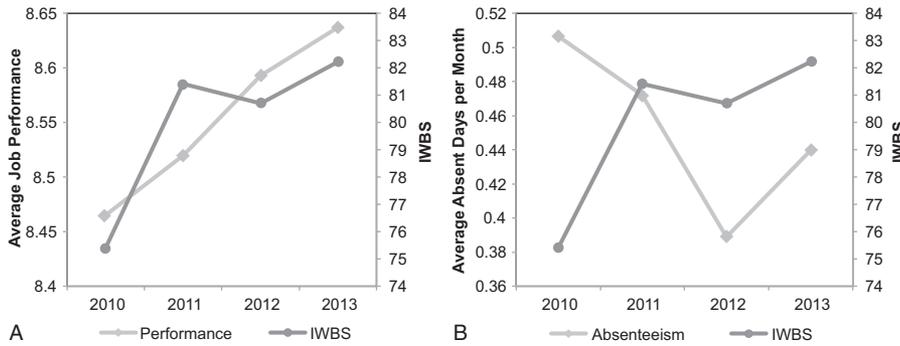


FIGURE 3. (a and b) Trend of job performance, absenteeism, and the explanatory variable IWBS from 2010 through 2013.

substantiates the descriptive finding shown in Figure 1. In addition, significant reductions in the prevalence of smoking were evident in 2012 ($P < 0.05$) and 2013 ($P < 0.05$). No significant relationship was observed, though, between time and the other three outcomes. Statistically significant association between sex and average allowed amount ($P < 0.001$), performance ($P < 0.05$), and absenteeism ($P < 0.05$) were observed in the repeated measures models. Specifically, male study members tended to have lower allowed amount health care expenditures, report lower performance, and report fewer days absent. Typical to studies controlling for the association between age and health care costs, we observed a direct relationship such that increasing age was correlated with increasing allowed amount expenditures. Moreover, we found a direct relationship between age and the probability of being obese ($P < 0.001$) as well as reporting higher job performance ($P < 0.001$).

As expected, the number of ER visits and hospital admission count were directly associated with allowed amount PMPM ($P < 0.001$). We also examined the association between ER use and hospital admissions on the other four outcomes, but only found a statistically significant relationship between ER use and absenteeism ($P < 0.001$). Employee type was examined separately for each

of the five different outcomes and found to be significantly associated with all outcomes except smoking prevalence (Table 2). Individuals were categorized as type A, B, C, or D, and compared with the reference type A. On a comparative basis, the other three types of members shared common characteristics of lower health care costs, smoking rate, obesity prevalence, higher performance, and fewer days absent.

DISCUSSION

Employee well-being is of primary concern when employees are the ultimate asset of the firm. Transitioning employees to a CDHP can create challenges to well-being and may impact access to care by increasing the individual's share of health care costs.⁷ A focus on a culture of well-being^{22,23} can help to offset the potentially undesirable effects created by moving to a CDHP. This study demonstrates the possibility of achieving the dual goals of well-being improvement and health care cost reduction, and not just over 1 year but 5 years to both the employer and employee. As health care costs discussed here included both the amount paid by the firm and the amount paid out of pocket by the employee, the results affirm an overall decline in health care cost. Specifically, health care savings

TABLE 2. Results of Multivariate, Longitudinal Repeated Measures Analysis of Five Outcomes

	Log (amount allowed PMPM) [†]		Nicotine [‡]		Obesity [‡]		Job performance [‡]		Absenteeism [‡]	
	β	SE	β	SE	β	SE	β	SE	β	SE
IWBS	-0.46**	0.1173	-0.01*	0.0029	-0.01**	0.0015	0.05**	0.0026	-0.04**	0.0028
Year [§]										
2010	-0.27**	0.0472	-0.001	0.0514	-0.001	0.0344			0.05	0.1287
2011	-0.24**	0.0542	-0.05	0.0765	0.07	0.0419	-0.15*	0.0599		
2012	-0.32**	0.0570	-0.20**	0.0904	-0.02	0.0447	0.02	0.0646	-0.12	0.1379
2013	-0.50**	0.0607	-0.34*	0.1014	-0.04	0.0480	0.02	0.0665	0.10	0.1401
Age	0.04***	0.0031	0.01	0.0081	0.03**	0.0041	0.01**	0.0035	-0.01	0.0048
Sex										
Male	-0.99**	0.0778	0.24	0.1665	0.08	0.0991	-0.22*	0.0758	-0.33*	0.1144
Emergency room visits	0.68**	0.0355	-0.03	0.0484	0.04	0.0304	0.07	0.0562	0.24*	0.0612
Hospital admission count	1.71**	0.0936	-0.37*	0.1879	0.07	0.0581	0.10	0.1132	0.09	0.1675
Employee type [¶]										
Type B	-0.42*	0.1584	-0.63	0.4662	-0.92**	0.2258	0.37*	0.1729	-0.31	0.1932
Type C	-0.35***	0.0822	-0.06	0.2285	-0.58**	0.1160	0.61**	0.1042	-0.63**	0.1249
Type D	-0.44*	0.1362	-0.38	0.3222	-0.76**	0.1649	0.76**	0.1495	-0.51*	0.1795

IWBS, Individual Well-Being Score; PMPM; per member per month; SE, standard error.

** $P < 0.001$; * $P < 0.05$.

[†]Model specified with log-transformed IWBS, age, ER visits, and hospital inpatient stays as well as log-transformed amount allowed PMPM.

[‡]Model specified with untransformed IWBS.

[§]For the three outcomes of log-transformed amount allowed PMPM, nicotine, and obesity, 2009 was the reference group. 2010 was the reference group for the productivity outcomes of job performance and absenteeism.

^{||}Reference group is female.

[¶]Reference group is colleague type A.

accounted for expenses related to factors, including co-pay, co-insurance, and deductible. Given significance of the IWBS covariate in addition to demographic and employee type covariates, the results show that the cost savings were not a direct consequence of implementing a CDHP. Total health care cost on a PMPM basis continuously decreased from \$456 in 2009 to \$358 in 2013, a decrease of 21.5% in 5 years.

Research has shown that transition to a CDHP may limit access to care^{24,25} and lower adherence to drugs,^{10,26} which in turn may affect well-being. Similarly, in this study, there was concern that the annual increases in deductibles from 2009 levels may have limited access to care and negatively affected well-being. In addition, there was concern for potential employee disengagement, frustration, and perceived lack of support on behalf of the employer due to the health plan changes. Despite these concerns and prior research, we hypothesized that well-being would remain stable or improve during the transition due to the comprehensive WBIS combined with a firm-wide commitment to a culture of well-being. The results demonstrated an elevated level of well-being, relative to the baseline, during each year of the transition. These findings suggest that focus on well-being improvement may have offset negative perceptions and behaviors that employees would exhibit when transitioned to a CDHP. Moreover, the decline in hospitalizations and ER use indicated that potentially unnecessary and/or reactionary health care utilization was eliminated in contrast to the expectation of restricted access to care.

By collecting and analyzing repeated outcomes on the same individuals over time, we also established important relationships between clinical improvements (obesity prevalence), behavior change (smoking rate), productivity enhancements (absence and presenteeism), and well-being over time while transitioning to a CDHP. Both smoking and obesity rates declined throughout the course of the study, while well-being simultaneously improved. Specifically, compared with 2009 when the CDHP was initiated, smoking and obesity prevalence rates in 2013 were 36% and 18% lower, respectively. Self-reported levels of absence decreased and performance improved, leading to increased productivity; the results found here were nearly identical to those reported in the study by Hamar et al.²⁴ Our findings are supported by a considerable level of prior research demonstrating significant relationships between changes in key measures of population health and programs designed to educate, encourage, and empower participants.^{13,27-40} Collectively, these results show that well-being improvement strategies can deliver more than just health care cost savings.

Considering the health care cost associated with smoking⁴¹ and obesity⁴² alone, realized savings in health care cost over the longitudinal period studied here are plausible. Magnifying the benefits of reduced obesity and smoking rates in the population in long run, individuals reported more days at work and higher performance while on the job. Combined, the firm gained a more robust workforce from multiple different facets. The expectation is that as more employees are exposed to different well-being improvement programs in follow-up years beyond the present study period, additional savings would accrue to both employer and employee.

The longitudinal design and control variables employed in this study resulted in findings that are more robust than the typical cross-sectional study. This is one of the first longitudinal studies of the effect of a well-being improvement strategy on outcomes over an extended period of time. Our results are robust due to the use of repeated measures, multivariate statistical models that explicitly modeled the covariance structure of the data while accounting for the influence of other important individual level factors. Specifically, improvement in individual well-being was significant even after controlling for demographics, health care utilization, and prior year values of the dependent variable. We also controlled for time in

the analyses, which was a significant factor in the model of health care cost as it measured the increasing levels of individual cost sharing over time. Our findings suggest that well-being, measured by the IWBS, is sensitive to information health care claims are not measuring. If utilization had not been controlled for, the estimated coefficient for IWBS would have been of greater magnitude, and conversely, if IWBS had not been modeled, the contribution of utilization factors to each outcome would have been overstated. Collectively, the results further emphasize the importance of IWBS in predicting and explaining outcome levels and change over time.

This study has shown the effectiveness of a comprehensive, multi-year well-being improvement strategy to optimize employee well-being while transitioning to a CDHP. Such a strategy enables a firm to both reduce health care costs and create more engaged, healthy, and productive employees. Our results confirm that well-being can be improved and costs can be reduced on both the employer and employee side, while also driving significant physical health and productivity improvements.

As with other retrospective study designs, the present study has limitations. First, any generalization to other firms requires consideration of the unique employee composition, current culture of well-being, and executive-level support for well-being. Under-scoring this limitation, our dataset was defined by an increasing proportion of males and dependents over the 5-year period. Generalization of our results to other firms would require detailed understanding of the benefit designs in place at the time of investigation in addition to the short, intermediate, and long-term objectives of the firm in regard to its human capital. Future research should be focused on the comparison of our population to a matched external group consisting of pooled employers, wherein benefit design elements are ascertainable and capable of being modeled. With a larger dataset based on a diversity of employers, researchers will be able to confirm and extend our findings. A second limitation of our study concerned the individual-level factors analyzed. Principally, we could not examine the relationship between outcome levels, IWBS change, and socio-demographic characteristics such as race, education level, and income. Moreover, our data suggest there is an effect of age on different outcomes. Further research is needed to determine which specific age groups of the population are more sensitive to IWBS change as it pertains to outcomes. Last, we demonstrate that a significant association, not causality, between well-being and outcomes of health care cost, obesity, smoking, absence, and performance analysis of casualty is for future research.

CONCLUSIONS

This study reports positive findings for population well-being amidst a shift to a CDHP; well-being improved while significant savings in health care cost for both employer and employee were realized over 5 years. In addition to cost savings and well-being improvement, clinical (obesity), behavioral (smoking), and productivity (presenteeism and absence) outcomes improved. Transitioning to a CDHP combined with a robust well-being improvement strategy is an effective means for both employer and employees to benefit. Both entities save money and are more productive as a result. Focusing on well-being improvement for the most important asset of the employer will create a more engaged, high performing workforce that is healthier and costs less.

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