Evaluation Of The West Virginia Medicaid Diabetes Health Home Program

Final Report

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Executive Summary

The West Virginia Diabetes Health Home Program (DHHP) officially began a two-year pilot period beginning on April 1, 2017. During this pilot period, the DHHP was available to Medicaid beneficiaries in a 14 county region who suffer from diabetes, pre-diabetes, or obesity, and who are also at risk for anxiety or depression. The care coordination provided by the DHHP is intended to reduce potentially unnecessary healthcare utilization and consequently lower Medicaid costs for this population. This evaluation was conducted to provide evidence as to whether or not the DHHP should be continued and expanded statewide at the conclusion of the two-year pilot period. Our evaluation included both a qualitative and a quantitative portion. The qualitative portion of this evaluation included focus groups and individual interviews with 25 DHHP participants. The quantitative portion employed robust statistical methodology to examine the impact of the DHHP on healthcare utilization and Medicaid costs. In speaking to DHHP participants, we learned that enrollees were generally very satisfied with the program, and these individuals expressed tremendous gratitude for the services provided by DHHP care coordinators. Our quantitative evaluation revealed that DHHP enrollment is associated with 17% and 54% reductions in the likelihood of emergency department (ED) visits and hospital admissions respectively, compared to individuals not enrolled in the program. We also observed that DHHP enrollment was associated with nearly $200 lower monthly Medicaid costs. The DHHP appears to be achieving its intended goals, however, we provide several recommendations that we believe will strengthen the program moving forward. Based on the evidence presented here, we strongly recommend both continuing and expanding the DHHP program in the future.

I. Background

In 2010, the Affordable Care Act established an optional Medicaid state plan benefit for states to establish Health Homes to provide care coordination for Medicaid beneficiaries with chronic conditions. Health Homes are comprised of a multidisciplinary team of providers who are responsible for integrating and coordinating all primary, acute, behavioral health, and long-term services for Health Home members. Health Homes also provide comprehensive transitional care/follow-up, patient and family support, and referrals to community and social support services.

On May 4, 2017, the Centers for Medicare and Medicaid Services (CMS) approved West Virginia's State Plan Amendment (SPA) #16-0008 to implement a Health Home program for Medicaid beneficiaries with diabetes, pre-diabetes, or obesity, who also are at risk for anxiety and/or depression. The stated objectives of the Diabetes Health Home Program (DHHP) include "a reduction in emergency department use, hospital admissions and re-admissions, health care costs, reliance on long-term care facilities, and improving the health care experience, quality and outcomes" for Health Home members. Members enrolled in the DHHP receive an individualized care plan from a multidisciplinary team of care providers and also receive monthly outreach calls from a care coordinator. The SPA authorizing the Health Home initiative is officially in effect from April 1, 2017, until March 31, 2019. Health Homes are currently available in 14 of West Virginia's 55 counties, and the state is considering expanding the program statewide at the conclusion of the current SPA.

Before expanding the Diabetes Health Home initiative statewide, it is important that key stakeholders within the West Virginia Department for Health and Human Resources (DHHR) understand the impact of the DHHP on members' quality of life, healthcare utilization, and Medicaid costs. CMS requires state Medicaid agencies to report an established core set of Health Home quality and utilization measures for ongoing monitoring and evaluation purposes. In addition to these required core measures, CMS also encourages states to pursue more rigorous, independent program evaluations. The West Virginia Bureau for Medical Services (BMS) has contracted with the West Virginia University (WVU) School of Public Health to conduct both a qualitative and quantitative evaluation of the West Virginia DHHP.

This report begins by describing the West Virginia DHHP and stating the overarching objectives of our evaluation. Next, we provide a detailed description of the methodology and results from the qualitative portion of the evaluation. After that, we provide an explanation for the methodology and results from the quantitative portion of the evaluation. Finally, we discuss the validity and implications of these results and ultimately conclude by recommending that the program be expanded statewide.

Objectives:

1. Understand what DHHP participants like about the program and what could be improved moving forward

2. Assess the impact of the DHHP on members' quality of life and disease management
3. Examine associations between DHHP enrollment and members' healthcare utilization and Medicaid costs

II. Qualitative Methods

The qualitative component of the evaluation of the DHHP evaluation was conducted using focus groups and individual telephone interviews with DHHP participants to gain an understanding of what DHHP participants like about the program and what could be improved as well as the impact of the program on participants' quality of life and disease management. Typically, researchers do not develop a priori hypotheses for qualitative studies; however, we expected that individuals would report that participation in the DHHP improves both diabetes management and consequently overall quality of life.

Design

Qualitative methods provide an in-depth and detailed assessment of the program's impact from the perspective of its end users. Specifically, using focus groups and interviews for data collection affords evaluators the ability to obtain rich information on the lived experiences of program recipients which cannot be gleaned from quantitative methods alone.[1, 2] Data gathered included DHHP participants' general experiences in the program, facilitators and barriers to participation, and overall impacts on disease management and quality of life as a result of program participation. Focus groups are an ideal method for answering these evaluation questions, as they leverage social or professional interaction among peers who are experiencing a similar issue or phenomenon.[3] Probing can be employed in focus groups, as well as individual interviews, to obtain more information on a topic of interest, including contextual details that can inform future program adoption, implementation, and/or expansion efforts.

Sampling and Recruitment

A purposeful sampling strategy was used to recruit a sample of DHHP participants in the 14-county region where the program is being piloted. Contact information for DHHP representatives and case managers at each targeted program site were obtained by the evaluation team. Evaluators reached out to the case managers and care coordinators at each site via email and telephone with information about the project. Phone calls were arranged with care coordinators to discuss the purpose of the project, assess interest and availability, and discuss accommodations needed for successful participation. Care coordinators then discussed the project during monthly outreach calls with DHHP participants and provided them with the date, time, and location of focus groups. At one site, the care coordinator expressed concern about DHHP participants' abilities to travel to attend a focus group in-person. Thus, at this site, telephone interviews were arranged, wherein the care coordinator shared information about the project and obtained permission for the evaluators to contact the participants via telephone at a preferred time to participate in an interview.

Data Collection

Focus groups were scheduled at locations and during times convenient to the majority of interested DHHP participants. At three sites that participated in focus groups, this was within the clinic where the DHHP care coordinator operated. Dr. Davidov, Assistant Professor at WVU who has expertise in qualitative research and group facilitation, including focus groups with diabetes patients, lead each focus group session. Dr. Pauly co-facilitated each session and asked probing questions when appropriate. A notetaker was also present at each session. Focus group discussions were facilitated using a semi-structured interview guide and audio-recorded with participant permission. Focus groups lasted 90 – 120 minutes and meals and refreshments were provided. All participants received a $25 gift card as thank you for their participation. Individual interviews were facilitated via telephone by Dr. Davidov and were audio-recorded. After completion, a $25 gift card was mailed to the site care coordinator to give to the participant at their next in-person meeting.

Analysis and Interpretation

All qualitative data were analyzed using content analysis with constant comparison. Recordings from each focus group and interview session were transcribed and all identifying information was removed. The data was analyzed for themes surrounding participants' experiences in the program, with emphasis on the program's impact on changes in quality of life and disease management, using conventional content analysis. Conventional content analysis is often used within a study whose aim is to gather more information on a phenomenon about which theory or research literature is limited.[4] Each transcript was reviewed and a list of preliminary codes was developed. The preliminary list of codes was revised and transcripts were recoded to fit the data into the final coding structure. Data were analyzed for corroborations as well as discrepancies. Data were compared and contrasted across sites and sources to identify core themes which were paired with illustrative quotes.

III. Qualitative Results

Three focus groups and 3 individual telephone interviews were conducted with 25 DHHP participants across four programs (see Table 1).

Table 1: Health Home Provider, Location, Data Collection Method and Number of Participants Involved in Qualitative Phase of Evaluation

HH Provider	Location	Method	# of Participants
FMRS	Beckley	Focus Group	4
WV Health Right	Charleston	Focus Group	8
Prestera Center	Huntington	Focus Group	10
Tug River Health Association	Gary/Welch	Individual Phone Interviews	3
TOTAL			**25**

Approximately one-third of participants disclosed a diagnosis of Type II Diabetes, while two-thirds indicated they were "close", "borderline", "high risk", or had a family history of diabetes. Duration of participation in the program was split evenly into thirds: one-third of participants had been enrolled in the DHHP program for one year or more, one-third had been enrolled for several months, and the remaining third were new to the program, having only participated for one week to one month. Participants disclosed multiple comorbid conditions, including high blood pressure, high cholesterol, obesity, thyroid problems, diabetic neuropathy, gout, angina, back and leg pain, anxiety, depression, COPD, and arthritis. In addition, multiple participants disclosed being in recovery from substance abuse issues.

General Experiences with the DHHP

Participants were asked how they would describe the DHHP. Most participants revealed that the program was helpful. One participant described the DHHP as "a wellness program", while another said, "*I would describe it to them as counseling and therapy. That they would get a phone call every week or so and as a checkup to make sure that they're taking their medication and following up with their doctors.*"

In an individual interview, one participant described the program as follows:

> I guess I would just say that it's a program to help us have a better life, healthy life, and there's someone that we can go and talk to if we have questions or if there's something going on, there's an answer for questions that we have. Firstly, we're not knowledgeable of medicine at all or any kind of things that's going on in your life so it's always good to have someone that is knowledgeable that I can talk to. I guess that's what I would tell them.

There was a consensus that the DHHP offers useful information to participants about managing diabetes. One individual stated, "It's just helping me just think about how diabetes works, what I should have to eat, you know, stuff like that. Different foods I should eat, different foods that I can't eat." Another participant said, "You know you just talk to somebody and we were just talking, and she comes in for a month when I have office visits and talks to me. [We talk about] my health, my diabetes, and other stuff and sicknesses that I have."

It is clear from the discussions with participants that the DHHP serves as a vehicle for participants to initiate and maintain engagement with the healthcare system and community resources. Many participants, especially those in Charleston and Huntington, spoke at length about the DHHP as a gateway to supplemental educational classes and offerings at clinic sites. They were appreciative of the information provided, as one woman who frequented the classes at WV Health Right said, "This class is no joke - this is dead serious. These people are not playing. The information that they're giving you is right there and all you gotta do is come and get it. Show up." Participants were also able to take advantage of classes centered on weight management and smoking cessation, which they recognized as directly connected to diabetes. Several participants mentioned teaching kitchens where they could try new recipes and learn

how to prepare nutritious foods. One participant stated, "The teaching kitchen is really [good]—I liked that because of the offering of different kinds of foods, that we might not try otherwise that then, we like it and can get the recipes."

Engagement with the Program

Participants described the various ways they engaged with the DHHP. For many, they describe weekly, biweekly, or monthly check-in calls with a DHHP care coordinator. Others mentioned in-person interactions with their care coordinators during clinic appointments. Participants revealed that the conversations with their care coordinators center on medication checks, appointment reminders and scheduling, general questions about health and whether or not participants need anything that the program or coordinator can provide. One participant described the interactions with his care coordinator, "She'll call me and she'll remind me of my appointments and when she sees me in person, she'll do a follow-up and see how I'm reacting and everything. She's checked my weight, she's checked my sugar. She can look at those vital signs right there and then she'll ask me what the doctor said and I'll tell her and she'll say well, you need to do this or you need to do that."

Facilitators: Things Participants Like about the DHHP

Throughout the focus groups and interviews, there was a consensus that the various types of support participants receive from the DHHP facilitated their engagement in the program as well as diabetes management. Participants described instances of emotional, instrumental, informational, and structural support provided by the program (see Table 2).

Table 2: Various Support Types Provided by the DHHP

Type of Support	Definition	Illustrative Quotes
Emotional Support	Expressions of empathy, love, trust, and caring	*"You know, it's nice you know, you can call [coordinator] and talk to her if you feel like you need a support. You know, she's good about that."* *"Just call[ing] and checking on me all the time, kind of makes you feel good somebody cares."* *"It's the fact that they care, you know? We know they care about us."*
Instrumental Support	Provision of Tangible Aid and Services	*"Then she said she'll call me when it's my appointment time. I like that because sometimes I forget. I lose my appointment cards and if I don't write it down on a calendar, I forget sometimes. So, that comes in handy."*

		"Before if I run out of medicine, I would have to try and get ahold of the doctor or something to get the prescriptions filled. Now all I have to do is call [coordinator] and she will pretty well take care of it. That's one good advantage. It helps every patient about getting their medication and if you couldn't make it to the doctor's appointment or something, my doctor even told me to just call [coordinator]. Amazing thing." *"Any time you need anything, go to her and she will do it. She will make it happen."*
Informational Support	Provision of advice, suggestions, and information	*"The educational material is presented is just like a college course every week. Sometimes it's just educational like about our feet or about, the insulin receptors and how insulin works. About diet, about exercise, about a sick plan, just everything. She presents it to us in a very well oiled, very understandable, very educational teaching way."* *"I love the educational aspect. She teaches us how to recognize if we're having diabetic, ups and downs, like if our blood sugar is dropping and what to do about it. And that's very important for me, not only for myself but for all the other diabetics that I know."*
Structural Support	Connections to social, informational, and healthcare networks	*"And the doctor's so close, next door. That's number one in my book. She told me next door and I went over there and got in with the doctor. Now, that's my permanent doctor."* *"And this place has become my support group. And when I lost my dad, I lost my brother, I lost my sister, I lost my mind. These people took me in, taught me how to take care of myself again, how to eat right, how to take care of my diabetes and brought me all the way back."* *"Health Right is a jewel in our community that provides us with not only a support group in each of our forces, including the diabetic program but with the administrators and the staff who are very much vested in us as human beings like no one else is and have shown us that."*

Facilitator: The Care Coordinators

The main facilitator to program engagement that was mentioned by most participants included the DHHP care coordinators. It was clear that participants viewed the coordinators at tireless advocates. One participant called his care coordinator, a "very good person and a friend." Another added, "She's there for you, yeah. It's like having another mom, kind of." There was a

consensus that the participants believed the care coordinators would go to great lengths to help them. One participant stated, "Any time you need anything, go to her and she will do it. She will make it happen." Another appreciated how the care coordinator would explain to the participant why she needed to take certain medications, "Yeah, most of the time it's to keep me informed on how to keep my diabetes and my blood pressure under control. She's good. I've got to admit that she's real good. . . Because she sits and she'll talk to you. she wants you to understand what you're taking."

Barriers: Things that are Challenging and Recommendations for the Future

Participants were asked about barriers, that is, things that made DHHP participation or diabetes management challenging. It should be noted that when discussing barriers, no significant criticisms of the DHHP emerged. Instead, participants discussed things that made following through on recommendations and advice learned in the DHHP challenging. They also mentioned recommendations or things they would like to see in the future to improve the program.

Transportation emerged as a significant barrier to attending healthcare visits and other appointments related to diabetes management for those participants without a personal vehicle. One participant stated, "Transportation is my biggest problem . . . Have to give a week's notice to go anywhere." Another participant in a different focus group described how transportation issues impact her ability to eat healthily and take advantage of the advice and recommendations learned in the DHHP:

> They [patient transport] come and pick me up at the house at like 9:50. I'd rather go to the meeting at 12:00 but they always pick me up at 9:50 so I'm here for two hours earlier than what I would like to be. But I'm here 'til almost 4:30 because we see the doctor at 4. They're always getting me an hour to two hours early…It's hard to eat healthy when you're on the go.

A recommendation mentioned by many participants included more education about nutrition. Specifically, one participant stated, "I would like to have a lot of stuff about what's the right kind of food . . . I've been a diabetic for 10 years and I try to do real good, but when you talk to another diabetic, they tell you different. So, you don't know what's really the truth. You got to kind of go with the flow." Other participants described the importance of having nutrition plans or advice that match their personal tastes, "It was a dietitian that my doctor send me to, but they're the ones that got me really confused. You know, they gave me a couple of papers that said this is what you should eat and what carbs and fat, but it's food that I don't even eat you know. I want to know what I eat." Other participants participating in the WV Health Right Health Home that had a teaching kitchen described that because their budgets are tight, it is important for them to know they will like a certain type of food before they purchase: "Having the teaching kitchen is really important because. . . You get to sample it before you have to invest." Another participant added, "Cause you know, it's such a tight budget. I'm not going to expand, you know, just to try something that might not like."

Participants in several focus groups and during individual interviews also mentioned that they would like more resources for weight loss and access to exercise classes or facilities. One participant stated, "I think we do, I really do, I think we need a weight loss program to go along with the diabetic program because me myself, like I said, I'm five foot 11, I'm 400 pounds today when I should be weighing 180, 185. That's a lot of weight." Another participant said, "I think it'd be fun [to exercise] like a group. But, it'd have to be slow because the way my body is, my back and legs and stuff. There's time I fall."

Program Impacts

Focus groups and interviews concluded with a discussion of impacts that the DHHP had on participants lives. Specifically, they were asked about impacts on diabetes management, interactions with the healthcare system, and quality of life. Positive program impacts were noted by participants in each of these areas and are outlined below.

In terms of diabetes management, several participants mentioned initiating healthier eating habits as a result of DHHP participation and discussions with their care coordinator. Examples include eating spinach, replacing pudding with fruit, and drinking water instead of chocolate milk. The following interaction between a participant and the facilitator during an individual interview is representative of the positive impact that participants reported on the way that they managed diabetes as a result of participating in the program:

Participant: I was real out of control. Number one, I wasn't taking my medicine right. What I could have for breakfast, what I could have for lunch, what I could have for dinner. I mean, it was just stuff like that that she [coordinator] would tell me. She would say, Barbara, you can't have this, or you don't need that. She gave me a planner, an eating planner to manage out for each week.

Facilitator: Were you able to use the planner?

Participant: Oh yeah. I done even lost weight.

Facilitator: You did? How much weight? If you don't mind me asking?

Barbara: No, I don't mind you asking me. A hundred and something pounds…When I started in that program with [coordinator] and them, I was 3 pounds away from weighing 300 pounds and now I don't weigh but 160.

Participants reported significant impacts on their interactions and engagement with the healthcare system as a result of the DHHP. Specifically, it appeared that the accountability provided by the program, in the form of support, reminders, and coordination by the care coordinators, facilitated these interactions. One participant stated about her care coordinator, "She's always asking, 'Are you taking your medicine? Are you doing this?' I watch it more so I have an answer. I hate not having an answer when she asks me something." Other participants

discussed the importance of the care coordinator being embedded within health clinics due to the proximity to their doctors. Some described how their care coordinators physically walked them over to the doctor: "[The care coordinator will say], 'How long has it been since your doctor's checked your A1C?' If it's been a while she will say 'Let's go over to the doctor right now.'" Other participants reported talking to their doctors more as well. There were also discussions about how being enrolled in the DHHP kept participants out of the hospital due to having the care coordinator to talk with: "She'll check and make sure I'm getting in to see the doctor. In that way, she's kept me out of the hospital, I'd say many times. Because she'll listen to what I have to say about how I'm feeling."

Finally, participants mentioned various instances of how their enrollment in the DHHP improved their quality of life. One participant stated, "I'm getting around the house a little bit better. I've begun to exercise a little bit more. I'm on a walker so I don't get around that good and a lot of times I lay in bed too long so I try to force myself now to get up and move around, stuff like that." Another who lost a significant amount of weight revealed:

> I used to just sit around, mope around and not do housework, not do nothing. Didn't want to go nowhere, had to send the kids to the store for me because I refused to do that. I gets up. I cleans my house myself. I cooks myself. I go to the grocery store or anywhere else I want to go, myself.

Importantly, participants discussed how the positive impacts of the DHHP are not limited to their own lives but have the potential to reach their families as well. One participant stated, "I think one of the things that we haven't touched on is that it's not just beneficial to me coming here. I take this back to my family. And so that spreads it farther." During a focus group session, one participant shared, "It's helping me to educate my daughter and her children. And I just love the educational aspect of it and I love the caring part of it, that, that [coordinator] and the other people will call us if we're absent and make sure we're okay. The fact that we can get all of our diabetic supplies, and not the way, you know, so it's not out of pocket for those of us who are very poor."

IV. Quantitative Methods

Study Design

This portion of the evaluation was designed to assess the impact of the DHHP on members' Medicaid spending and utilization. We were specifically interested in examining whether DHHP enrollment led to changes in members' monthly costs and utilization. In order to attribute these changes to the DHHP itself, we also examined trends in costs and utilization among a population of Medicaid beneficiaries who never enrolled in the DHHP. In this sense, we used Medicaid claims data to construct both a 'treatment' and a 'control' group. The treatment group was comprised of Medicaid beneficiaries who were enrolled in the DHHP, while the control group was made up of clinically and demographically similar beneficiaries who were

never engaged in the DHHP. We compared trends in monthly Medicaid costs and utilization among members of the treatment and control groups before and after the DHHP was available.

Time Period

We sought to examine trends in Medicaid costs and utilization both before and after the DHHP was available to Medicaid beneficiaries. The DHHP was officially implemented on April 1, 2017, and was authorized for a two-year pilot period concluding on March 31, 2019. With this in mind, we constructed a study period that ran from October 1, 2016, to November 30, 2018. We chose to begin our study period in October 2016 because this provided us with six months of baseline data before the DHHP was available. We chose to end our study period in November 2018 because these were the most recent claims data we had available. This study period allowed us to examine trends in Medicaid costs and utilization among the treatment and control groups for six months before and twenty months after the DHHP was available.

Treatment and Control Group Selection

We constructed a treatment group of Medicaid beneficiaries who were enrolled in the DHHP and a control group of Medicaid beneficiaries who were demographically and clinically similar to the treatment group but were not enrolled in the DHHP. The treatment and control groups were designed in such a way that all members of the control group could have been in the treatment group, but for whatever reason, these individuals were not enrolled in the DHHP.

In order to be included in the treatment group, individuals had to meet the following criteria:
- Reside in one of the 14 counties where the DHHP was available, as assessed in the first month that a person was observed during the study period.
- Continuously enrolled in Medicaid for at least 6-months during the study period prior to being enrolled in the DHHP
- Continuously enrolled in the DHHP for at least 6-months during the study period. Enrollment in the DHHP was assessed using the indicator variable 'Health Home 3 Enrollment' in the monthly Medicaid enrollment files.

Individuals were included in the control group if they met the following criteria:
- Reside in one of the 14 counties where the DHHP was available. County of residence was assessed in the first month that a person was observed during the study period.
- Continuously enrolled in Medicaid for at least 12 months during the study period
- Were never enrolled in the DHHP.
- Had at least one claim with a DHHP eligible diagnosis at some point during the study period. DHHP eligible diagnoses included diabetes, pre-diabetes, and obesity.

Data Source

This portion of the DHHP evaluation was completed using West Virginia Medicaid administrative claims data. The WVU School of Public Health receives a limited data set of Medicaid claims data from the West Virginia BMS through a previous contractual arrangement. Through this partnership, BMS provides the WVU School of Public Health with regularly updated claims data to be used for research and program evaluation. These data include fee-for-service claims as well as managed care encounter data and information on Medicaid beneficiaries' eligibility and demographic characteristics. The limited data set does not include certain elements of private health information (PHI) such as names, social security numbers, or addresses. Importantly, the data set does contain some limited PHI including dates of services, diagnoses, and procedures. These data are housed on a secure virtual private network that is only accessible to authorized users with the WVU School of Public Health. All analyses for this portion of the DHHP evaluation were conducted within the WVU School of Public Health's secure virtual private network.

Outcomes of Interest

We sought to examine a number of outcomes related to both Medicaid costs and utilization. In examining Medicaid costs, we calculated the total costs observed for each person in each month of the study period for several categories of service. Separate analyses were conducted for each different type of cost to identify which categories act as the primary drivers of cost savings. Monthly costs were calculated as the sum of the 'plan paid amount' and 'net payment' fields observed for all claims for a given person in a given month. Costs were further categorized by type of service. Table 3 presents each of the categories of service that were examined, as well as the identification strategy for each service type.

Table 3: Cost categories of service and identification methods

Category of Service	Identification method
Total Costs	Sum of plan paid amount and net payment for all facility, professional, and pharmacy claims
Inpatient Medical Costs	Sum of plan paid amount and net payment for professional and facility claims where 'place of service code Medstat' equals 13, 14, 16, 21, 35, 51, 55, 56 or 61
Outpatient Medical Costs	Sum of plan paid amount and net payment for professional and facility claims where place of service code Medstat does not equal 13, 14, 16, 21, 35, 51, 55, 56 or 61
Diabetes related medical Costs	Sum of plan paid amount and net payment for all professional and facility claims where primary diagnosis is diabetes or prediabetes
Mental health related medical costs	Sum of plan paid amount and net payment for professional and facility claims where primary diagnosis is a mental health condition

Emergency Department Costs	Sum of plan paid amount and net payment for professional and facility claims that meet the following criteria: UB Rev code = 045x, or 0981; *or* CPT code = 10040 – 69979 and place of service code medstat = 23; *or* CPT code = 99281 – 99285
Pharmacy Costs	Sum of plan paid amount and net payment for pharmacy claims

Our evaluation also sought to compare trends in several indicators of healthcare utilization among the treatment and control groups before and after the DHHP was available. These measures were chosen as they represent services that should ostensibly be utilized less frequently given the care coordination and case management provided by the DHHP. These measures were again identified at the person-month level. A series of binary indicator variables were constructed to identify whether patients had any of these particular outcomes in a given month. Individuals were counted as having an outcome if they had at least one claim meeting any of the criteria presented below. Table 4 below presents the utilization measures of interest as well as the identification strategy for each measure.

Table 4: Healthcare utilization outcome measures and identification methods

Measure	Identification method
Emergency department visits	Professional and facility claims that meet the following criteria: UB Rev code = 045x, or 0981; *or* CPT code = 10040 – 69979 and place of service code medstat = 23; *or* CPT code = 99281 – 99285
Diabetes related emergency department visits	Professional and facility claims where the primary diagnosis is diabetes or pre-diabetes that also meet the following criteria: UB Rev code = 045x, or 0981; *or* CPT code = 10040 – 69979 and place of service code medstat = 23; *or* CPT code = 99281 – 99285
Mental health related emergency department visits	Professional and facility claims where the primary diagnosis is a mental health condition that also meet the following criteria: UB Rev code = 045x, or 0981; *or* CPT code = 10040 – 69979 and place of service code medstat = 23; *or* CPT code = 99281 – 99285
Inpatient hospital admissions	Facility claims where inpatient hospital is the place of service (place of service code medstat = 21) and the date of service begin is different than the date of service end

30-day hospital re-admissions	Facility claims where inpatient hospital is the place of service (place of service code medstat = 21) and the date of service begin is different than the date of service end, that occur within 30 days of a previous hospital discharge

Covariates of Interest

We hypothesized that DHHP enrollment would be associated with lower rates of potentially preventable healthcare utilization, and consequently, lower Medicaid spending. However, Medicaid spending and utilization are also influenced by other individual-level factors such as Medicaid beneficiaries' age, gender, and existing comorbidities. With this in mind, our evaluation was careful to control for individual-level characteristics that may impact monthly Medicaid costs or utilization.

Demographic characteristics of interest included age, race, gender, FFS / MCO enrollment, and Medicaid eligibility categories. Clinical characteristics of interest included comorbidities related to diabetes, obesity, cancer, thyroid disorders, hypertension, heart disease, peripheral vascular disease, chronic obstructive pulmonary disease, diabetic neuropathy, anxiety disorder, depression, bipolar disorder, and schizophrenia. Additional details on how each of these demographic and clinical characteristics was identified are presented in Table 5 below. These characteristics were assessed for each person in each month that they were observed during the study period.

Table 5: Demographic and clinical covariates and identification methods

Covariate	Identification Method
DHHP Enrollment	
Yes No	Monthly Health Home 3 Enrollment Indicator in eligibility file
Age	
Age in years	Beneficiaries birth date used to define age in each month of study period
Gender	
Male Female	Gender reflected in eligibility file
Race	
Caucasian, Hispanic, African American, American Indian, Unknown	Race reflected in eligibility file
MCO / FFS enrollment	

Carelink, Unicare, Health Plan, PAAS, FFS, West Virginia Family Health	Plan code indicator in eligibility file
Eligibility Category	
Medicaid Expansion Pregnant women Aged / Medicare eligible Child Blind / Disabled Other	Primary rate code in eligibility file
Comorbidities of Interest	
Diabetes / Pre-diabetes	AHRQ CCS categories 49 and 50
Obesity	ICD-10 codes beginning with 'E66'
Cancer	AHRQ CCS categories 11 – 41
Thyroid disorders	AHRQ CCS category 48
Hypertension	AHRQ CCS categories 98 and 99
Heart disease	AHRQ CCS categories 100, 101, 103, 104 and 108
Peripheral vascular disease	AHRQ CCS category 114
Chronic obstructive pulmonary disease (COPD)	AHRQ CCS category 127
Diabetic Neuropathy	ICD-10 codes E084, E08610, E094, E09610, E104, E10610, E114, E11610, E134, E13610
Anxiety disorder	AHRQ CCS category 651
Depression	AHRQ CCS category 657
Bipolar disorder	AHRQ CCS category 657
Schizophrenia	AHRQ CCS category 659

Data Structure

We transformed raw claims data from October 1, 2016 – November 30, 2018, into an analytical file containing one observation (row) per person per month, for each month that a person was enrolled with Medicaid during the study period. Given that beneficiaries had to be enrolled for at least 12 months to be included in either the treatment or control group, Individuals were able to have anywhere from 12 to 26 observations in the final analytical file. This analytical file was also constructed so that there was one field (column) for each outcome, as well as each demographic and clinical comorbidity of interest. Both the outcomes and covariates of interest were assessed independently for each person in each month of the study period. Importantly, this file also included a binary field indicating whether or not a person was enrolled in the DHHP in a particular month. A sample of this data structure is presented in Table 6 below. Please note, these are all fake data and are included for visual purposes only.

Table 6: Example data structure of analytical file

ID	Month	Total cost	ED use	Hospital admission	DHHP enroll	Age	Sex	Diabetes DX	Cancer DX
A23	Jun-18	0	No	No	No	47	M	No	No
A23	Jul-18	$100	No	No	No	47	M	Yes	No
A23	Aug-18	$500	No	Yes	No	48	M	Yes	No
B17	Jan-17	$0	No	No	Yes	25	F	No	Yes
B17	Jan-18	$250	Yes	No	Yes	25	F	Yes	No

Unadjusted analysis

Descriptive analyses were conducted to examine differences in demographic and clinical characteristics, as well as outcomes of interest among the treatment and control groups. Demographic and clinical characteristics were examined at the person level for ease of interpretation, while differences in the outcome measures were examined at the person-month level. Chi-square tests were employed to examine whether statistically significant differences existed between the treatment and control groups for categorical variables (IE gender or eligibility category). Two-sided T-tests were used to assess whether statistically significant differences existed between the treatment and control groups for continuous variables (IE Rate of ED use or mean age).

Adjusted Analyses- Utilization Outcomes

We employed two distinct statistical modeling approaches to examine associations between DHHP enrollment and healthcare utilization. In the first approach, we constructed simple logistic regression models to examine the likelihood of an individual having an outcome of interest while controlling for DHHP enrollment and other demographic and clinical characteristics assessed at the person-month level. Separate models were constructed for each of the utilization outcomes of interest presented in Table 4. Each model was adjusted for DHHP enrollment, age, gender, and each of the clinical comorbidities presented in Table 5 above. The unit of analysis for these models was the person-month, and each of the covariates of interest was assessed for each person, in each month that they were enrolled during the study period. Results of these models allow us to estimate the difference in the likelihood of DHHP participants and non-participants having one of the outcomes of interest in a particular month.

In the second phase of adjusted analyses, we employed a more statistically robust modeling approach that allows us to make a stronger argument in terms of the causal relationship between DHHP enrollment and the utilization outcomes of interest. For this portion of the analysis, we used a difference-in-difference regression model with two-way fixed effects to examine the impact of DHHP enrollment on ED and hospital utilization. Separate models were built for each of the utilization outcome measures of interest. Models included individual-level fixed effects to control for time-invariant factors that may affect outcomes and selection into the DHHP. For example, certain people may be more or less willing to "engage" with the health

care system, but this is something we cannot observe in our data. Including fixed effects accounts for these types of unmeasured traits, along with characteristics that are more easily measured, such as DHHP enrollment. Models also included time indicator variables to account for time-varying trends common to all individuals in the study population. For example, ED visits for broken hips may increase in the winter, when surfaces are more slippery. We also controlled for the number of months individuals had been enrolled in the DHHP in each month, because those who have been in the program longer may have different results relative to those who have only been enrolled for a short time. All models also controlled for age, and comorbidities related to diabetes, obesity, cancer, anxiety, depression, bipolar disorder, schizophrenia, and SUD. We did not adjust for covariates such as race, gender, or eligibility category because these are unchanging over time and are accounted for by the individual fixed effects.

Adjusted Analyses- cost outcomes

Once again, we employed two distinct statistical modeling approaches to examine associations between DHHP enrollment and Medicaid costs, In the first approach, we constructed simple multivariable linear regression models to model monthly Medicaid costs while adjusting for DHHP enrollment as well as other demographic and clinical characteristics of interest. Different models were built for each of the categories of service presented above in Table 3. Models were adjusted for each of the covariates displayed in Table 5 above. The unit of analysis for these models was the person-month. Results of these models allow us to estimate the average difference in monthly costs between beneficiaries who were and were not enrolled in the DHHP in a given month.

In the second phase of adjusted analyses, we constructed 'two-part' regression models. The first part of these models examines the impact of demographic and clinical covariates of interest on whether beneficiaries had any spending at all in a given month. It is important to account for this "zero inflation", given the high number of enrollees who do not have any expenditures in a given month. The second part then models how much the actual monthly expenditures were, conditional on having any at all. The final results combine the results from these two parts to give us an overall estimate of cost differences between DHHP participants and non-participants accounting for their probability of having any spending at all in a particular month. Once again separate models were constructed for each cost category of service. Models were adjusted for age, as well as comorbidities related to diabetes, obesity, cancer, anxiety, depression, bipolar disorder, schizophrenia, and substance use disorder (SUD). These models are more statistically robust than the aforementioned simple linear regression models because they account for the probability of an individual having zero spending in a particular month. Finally, to improve the utility of our results for the state, these models were calculated assuming all individuals have a diabetes diagnosis. That is, our results can be interpreted as the average effect the DHHP would have on participants if everyone in our analytic sample had diabetes. Thus, we calculate a more robust estimate of the causal impact of the DHHP for individuals who ostensibly have the most to gain from participation.

V. Quantitative Results

Descriptive results

A total of 43,989 distinct Medicaid beneficiaries met all inclusion criteria and were included in the study population. The study group was comprised of 1,782 (4.1% of the entire sample) individuals in the treatment group and 42,207 (95.9%) individuals in the control group. The 43,989 individuals in the entire study group contributed 1,084,908 months of person-time to the study sample.

Uptake of the DHHP program was generally slow during the first year the program was available. Figure 1 displays the total number of individuals enrolled in the treatment group during each month of the study period. The majority of individuals in the treatment group were not enrolled in the DHHP until May 2018—a full year after the program was first made available. This is due in part to a limited number of DHHP providers available during the first year of the program.

Figure 1: Monthly study group enrollment
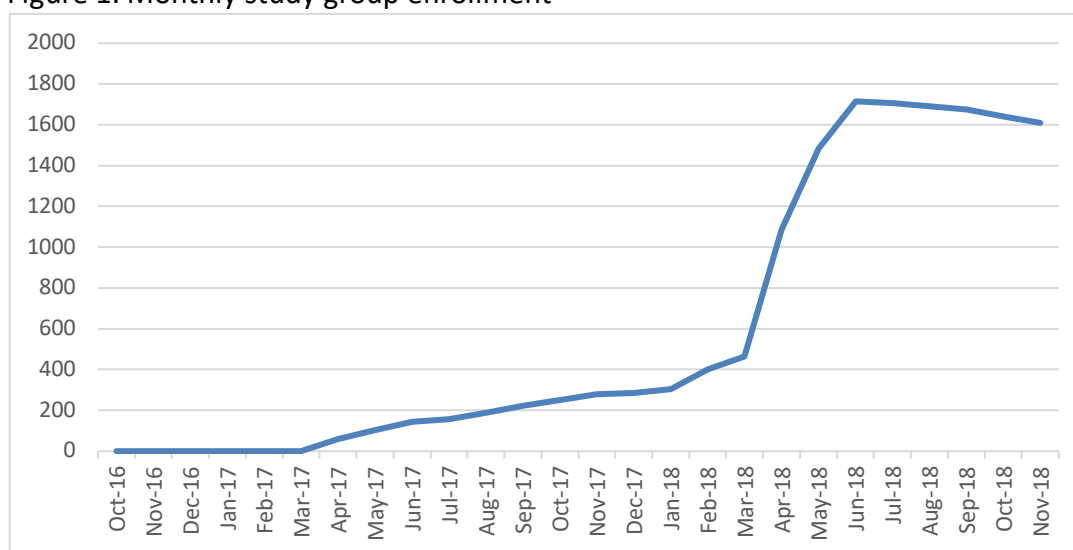
We observed wide variation in DHHP enrollment amongst the different DHHP provider groups. Table 7 displays the number of individuals enrolled with each of the 11 DHHP providers that were active during our study period. Enrollment size varied from 1 member enrolled with each Logan Mingo Mental Health and FMRS health system to over 1,100 members enrolled with Family Healthcare Associates. Indeed, Family Healthcare Associates accounted for 64.5% of the total individuals enrolled in the treatment group during the study period. Importantly, these findings are only indicative of the number DHHP enrollees who were included in the study sample for the purposes of this evaluation. However, these findings are consistent with external data from KEPRO that indicate that approximately 60% of the 6,000+ total individuals engaged in the DHHP are enrolled with Family Healthcare Associates.

Table 7: Study group enrollment by DHHP facility

Facility	DHHP Members (N=1,782)
Bali Surgical Practice	134 (7.5%)
Bradshaw Medical Clinic	115 (6.5%)
Family Healthcare Associates	1,149 (64.5%)
FMRS Health Systems	1 (0.1%)
Logan-Mingo Area Mental Health	1 (0.1%)
Prestera	96 (5.4%)
Tug River Health Association	13 (0.7%)
Marshall	12 (0.7%)
West Virginia Health Right	116 (6.5%)
Women Care Inc	40 (2.2%)
Yukon Medical Clinic	99 (5.6%)

Table 8 below compares the demographic characteristics of the treatment and control groups included in the study population. Statistically significant differences were observed for each of the demographic characteristics of interest. On average, members of the treatment group were significantly older at the time that they were first observed in the study period relative to members of the control group (36 years vs. 29.4 years). The treatment group also had a significantly greater proportion of females relative to the treatment group (67.8% vs. 62.6%). While both the treatment and control groups were predominantly white, the control group had a greater proportion of African Americans (6.9% vs. 2.6%) and individuals of unknown race (7.8% vs. 3.4%) relative to the treatment group. Finally, the treatment group had a significantly greater proportion of individuals in the Medicaid expansion population relative to the control group (77.3% vs. 61.8%), while the control group included a greater proportion of children relative to the treatment group (32.8% vs. 18.7%).

Table 8: Demographic characteristics of treatment and control groups

	Control Group (N= 42,207)	Treatment Group (N= 1,782)
Mean age (SD)	29.4 (16.7)	36.0 (14.6)
Gender		
Female	26,422 (62.6%)	1,208 (67.8%)
Male	15,785 (37.4%)	574 (32.2%)
Race		
Caucasian	35,889 (85.0%)	1,672 (93.8%)
Hispanic	57 (0.14%)	3 (0.17%)
African American	2,931 (6.9%)	46 (2.6%)
American Indian	41 (0.1%)	0 (0%)
Unknown	3,289 (7.8%)	61 (3.4%)
Eligibility Category		
Expansion	26,062 (61.8%)	1,378 (77.3%)
Disabled	1,353 (3.2%)	48 (2.7%)

Child	13,849 (32.8%)	334 (18.7%)
Pregnant	814 (1.9%)	19 (1.1%)
Other	129 (0.31%)	3 (0.17%)

Rates of comorbidities among the treatment and control groups are displayed in Table 9 below. The treatment group included in this study sample had significantly greater rates of each of the comorbidities of interest. Every person included in the control group was required to have a diagnosis of either diabetes or obesity at some point during the study period, however, the treatment group had higher rates of these conditions overall. Over 41% of people in the treatment group had a diabetes diagnosis while only 25.8% of individuals in the control group had a diabetes diagnosis. The treatment group also had substantially higher rates of hypertension (58.7% vs. 37.2%), heart disease (16.2% vs. 10%), COPD (21.7% vs. 14.4%), and thyroid disorders (25.9% vs. 15.1%) relative to the control group. Finally, members of the treatment group had significantly higher rates of each of the four behavioral health conditions of interest. The DHHP is intended for individuals with diabetes or pre-diabetes who are also at risk for anxiety or depression—our results show that 48.4% of the treatment group received an anxiety disorder diagnosis and 45.4% had a depression diagnosis at some point during the study period.

Table 9: Percentage of individuals in treatment and control group with comorbidities of interest

Comorbidity	Control Group (N= 42,207)	Treatment Group (N= 1,782)
Diabetes	25.8%	41.7%
Obesity	79.8%	96.9%
Cancer	6.5%	8.0%
Hypertension	37.2%	58.7%
Heart Disease	10.0%	16.2%
Peripheral Vascular Disease	3.5%	6.1%
Diabetic Neuropathy	5.2%	9.5%
COPD	14.4%	21.7%
Thyroid disorder	15.1%	25.9%
Anxiety	38.4%	48.4%
Depression	33.0%	45.4%
Bipolar	7.7%	10.1%
Schizophrenia	2.0%	3.1%

Unadjusted results-

Table 10 below displays the unadjusted rates of each of the utilization outcome measures of interest for the treatment and control groups. Note these rates are calculated as the total number of events per 1,000 person-months observed. For example, we observed a total of 15,459 person-months where members of the treatment group were enrolled in the DHHP. Out of these 15,459 person-months we observed 1,062 that had an ED visit, giving a rate of 68.7 visits per 1,000 person-months. Chi-square tests were used to assess if DHHP enrollment was

associated with statistically significant differences in the outcome measures of interest. In these unadjusted analyses, we observed that DHHP enrollment was associated with significantly lower rates of ED use (68.7 per 1,000 vs. 73.0 per 1,000 person-months; p-value: 0.0425). We also found that DHHP enrollment was associated with slightly higher rates of inpatient hospital admissions (11.8 per 1,000 vs. 10.9 per 1,000 person-months) however this result was not statistically significant. ED visits related specifically to diabetes and mental health diagnoses, as well as 30-day hospital readmissions, were relatively rare events in both groups, and statistically significant differences were not observed for any of these measures.

Table 10: Unadjusted utilization rates per 1,000 person-months

Outcome	Control Group	Treatment Group	p-value
ED Visits	72.97	68.70	0.0425
Diabetes-related ED visit	1.76	2.07	0.3662
MH-related ED visit	5.37	4.66	0.2306
Hospital admission	10.89	11.77	0.2926
30-day hospital readmission	1.78	2.26	0.1539

Unadjusted results comparing each of the cost outcome measures of interest are presented in Table 11 below. These are calculated as the average monthly costs out of all person-months observed. For example, we observed a total of 15,459 person-months where members of the treatment group were enrolled in the DHHP. Total pharmacy and medical costs for these 15,459 person-months summed to $10,118,417, giving an average monthly cost of $654.53. T-tests were used to assess whether DHHP enrollment was associated with statistically significant differences in the cost measures of interest. We observed that DHHP enrollment was generally associated with greater monthly costs. DHHP enrollment was associated with nearly $200 greater overall monthly costs ($654.53 vs. $471.87; p-value: <0.001). This was primarily driven by significantly higher pharmacy costs in person-months where members were enrolled in the DHHP ($254.87 vs. $126.63; p-value <0.001). We also observed that DHHP enrollment was associated with significantly greater outpatient costs ($308.49 vs. $252.18; p-value <0.001) as well as costs on diabetes-related care ($95.49 vs. $54.65; p-value: <0.001).

Table 11- Unadjusted average monthly costs by category of service

Category of service	Control group	Treatment group	p-value
Total Medical + pharmacy	$471.87	$654.53	< 0.001
Total Medical	$345.20	$399.70	< 0.001
Inpatient medical	$93.46	$91.28	0.836
Outpatient medical	$252.18	$308.49	<0.001
ED-related	$22.52	$23.60	0.285
Diabetes-related	$54.65	$95.49	<0.001
Mental health-related	$114.86	$108.99	0.4170
Pharmacy	$126.63	$254.87	< 0.001

Adjusted results- utilization outcomes

In adjusted analyses, we observed that DHHP enrollment was associated with significantly lower likelihood of each of the outcome measures of interest. Results from the fully adjusted logistic regression model assessing the likelihood of ED visits in each month are displayed in Table 12 below. These results can be interpreted as odds ratios. Table 12 displays the adjusted odds ratios (AOR) and confidence intervals (CI) for each covariate included in the fully adjusted model. For the purposes of this evaluation, we are primarily interested in the result associated with the DHHP enrollment indicator (highlighted). This result indicates whether DHHP enrollment was associated with a significantly greater or lower likelihood of having an ED visit. In this model, we saw that Medicaid beneficiaries who were enrolled in the DHHP had 0.64 times the odds of having an ED visit in any given month relative to individuals who were not enrolled in the DHHP. This is equivalent to a 36% reduction in the likelihood of having an ED visit among the population enrolled in the DHHP.

Table 12: Results from logistic regression model assessing monthly likelihood of ED visits

	AOR	95% CI lower	95% CI upper
DHHP Enrollment yes vs. no	0.641	0.600	0.685
Age	0.990	0.989	0.990
Gender Male vs. Female	0.789	0.776	0.802
Diabetes yes vs. no	1.664	1.620	1.709
Obesity yes vs. no	1.425	1.340	1.515
Cancer yes vs. no	1.082	1.043	1.123
Thyroid disorder yes vs. no	1.866	1.821	1.912
Hypertension yes vs. no	1.571	1.531	1.613
Heart disease yes vs. no	1.878	1.800	1.958
Peripheral vascular disease yes vs. no	3.628	3.329	3.954
COPD yes vs. no	2.707	2.645	2.770
Diabetic neuropathy yes vs. no	2.929	2.821	3.043
Anxiety disorder yes vs. no	1.628	1.495	1.772
Depression yes vs. no	2.208	2.134	2.283
Bipolar disorder yes vs. no	0.979	0.922	1.040
Schizophrenia yes vs. no	1.266	1.239	1.295

For ease of interpretation, Table 13 below only displays the adjusted odds ratios and confidence intervals associated with the DHHP enrollment indicator variable from each of the fully adjusted utilization models. For reference, tables containing the full results for each of these models may be found in the appendix. In addition to being associated with reduced odds of ED use overall, DHHP enrollment was also associated with a significantly lower likelihood of mental health-related ED use (AOR: 0.616; 95% CI: 0.486 – 0.780). We also found that DHHP enrollment was associated with significantly lower odds of inpatient hospital admissions, with DHHP enrollees having 0.529 times the odds of having an admission in any particular month relative to individuals not enrolled in the program. This is equivalent to a 48% reduction in the

odds of having a hospital admission relative to non-DHHP participants. DHHP enrollment was not significantly associated with odds of having a diabetes-related ED visit or 30-day hospital readmission.

Table 13: Adjusted odds ratios (AORs) and confidence intervals (CIs) associated with DHHP enrollment indicator variable from each logistic regression models

Outcome	AOR	95% CI lower	95% CI upper	Difference in likelihood of outcome for DHHP participants relative to non-participants
ED visit	0.641	0.600	0.685	-36%
Diabetes-related ED visit	0.756	0.529	1.080	-24%
Mental Health-related ED visit	0.616	0.486	0.780	-38%
Inpatient Hospital Admission	0.529	0.453	0.617	-47%*
30-day Hospital Readmission	0.898	0.635	1.270	-10%

*Interpretation: DHHP participants had 47% lower odds of having a hospital admission in any particular month relative to individuals who were not enrolled in the program

Results from our simple logistic regression models were generally consistent with results from our more statistically robust two-way fixed effect models. Table 14 below displays the results of a fully adjusted two-way fixed effect model assessing the likelihood of monthly ED utilization. Once again, we are primarily interested in the results associated with the DHHP enrollment indicator variable. This result can be used to calculate the expected rate of ED use among DHHP participants and non-participants while adjusting for the demographic and clinical characteristics of interest. The adjusted log odds ratios below can be interpreted as follows: DHHP enrollment is associated with a 0.18 decrease in the log-odds of having an ED visit in a particular month relative to individuals not enrolled in the program. These log odds can be converted to the more familiar odds-ratio through exponentiation—i.e. e^(-0.1842) = 0.832. This means that individuals enrolled in the DHHP have 0.831 times the odds of having an ED visit in a particular month relative to individuals not in the program. This is equivalent to a 17% reduction in the likelihood of having an ED visit.

Table 14: Results from two-way fixed effect model assessing monthly likelihood of ED visits

	Adjusted log odds	Standard error	P value	95% CI lower	95% CI upper
DHHP enrollment	-0.1842	0.0727	0.011	-0.3268	-0.0415
Months in DHHP	0.0123	0.0113	0.277	-0.0099	0.0346
Age	-0.2144	0.0079	< 0.001	-0.2300	-0.1989
Diabetes dx	1.2765	0.0185	< 0.001	1.2402	1.3128
Obesity dx	0.4842	0.0197	< 0.001	0.4454	0.5230

|					
Cancer dx	0.6077	0.0411	< 0.001	0.5272	0.6883
Anxiety dx	0.4905	0.0161	< 0.001	0.4589	0.5220
Depression dx	0.2637	0.0175	< 0.001	0.2292	0.2982
Bipolar dx	0.2569	0.0313	< 0.001	0.1954	0.3184
Schizophrenia dx	0.9999	0.0659	< 0.001	0.8707	1.129
Substance Use Disorder dx	2.3461	0.0151	< 0.001	2.3165	2.376

For ease of interpretation, table 15 below only displays the adjusted odds ratios and confidence intervals associated with the DHHP enrollment indicator variable from each of the two-way fixed effect utilization models. Consistent with results from our more rudimentary logistic regression, we again found that DHHP enrollment was associated with reduced rates of each of the outcomes of interest relative to individuals who were not enrolled in the program. We observed that DHHP enrollment was associated with a 54% reduction in predicted rates of inpatient hospital admissions relative to individuals not enrolled in the program. We also found that DHHP enrollment was associated with 79% lower rates of mental health-related ED visits and 19% lower rates of diabetes-related ED visits relative to individuals not enrolled in the program. Finally, we observed in these models that DHHP enrollment was associated with a statistically significant 71% decrease in 30-day hospital readmissions. The primary results of interest from both our simple logistic regression models ('Method 1') as well as the two-way fixed effect models ('Method 2') are displayed side-by-side in Figure 2.

Table 15: Adjusted odds ratios (AORs) and confidence intervals (CIs) associated with DHHP enrollment indicator variable from each two-way fixed effect model

Outcome	AOR	95% CI lower	95% CI upper	Difference in likelihood of outcome for DHHP participants relative to non-participants
ED visit	0.832	0.721	0.959	-17%
Diabetes-related ED visit	0.809	0.347	1.883	-19%
Mental health-related ED visit	0.212	0.116	0.387	-79%
Hospital admission	0.461	0.331	0.645	-54%*
30-day hospital readmission	0.287	0.116	0.713	-71%

*Interpretation: DHHP participants had 54% lower odds of having a hospital admission in any particular month relative to non-particiapnts

Figure 2: Difference in likelihood of outcome for DHHP participants relative to non-participants
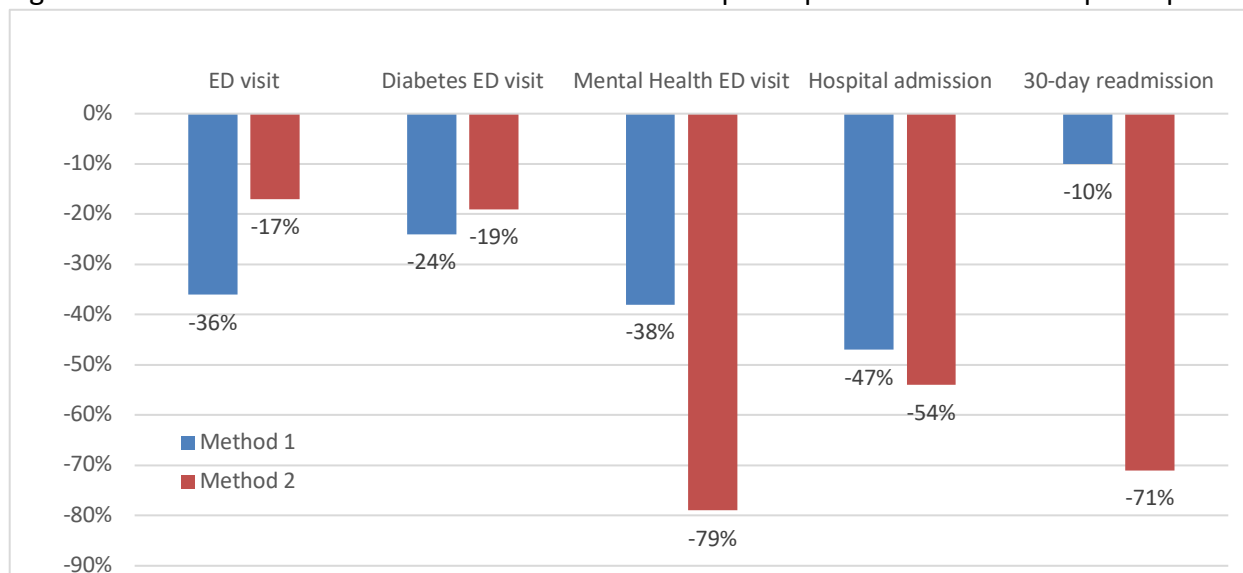
Adjusted results- cost outcomes

In adjusted analyses, we observed that DHHP enrollment was associated with lower monthly medical costs but higher monthly pharmacy costs. Table 16 below displays results from a fully adjusted linear regression model assessing total monthly costs. These results can be interpreted as the average difference in total monthly costs attributable to each covariate in the model. For the purposes of this evaluation, we are primarily interested in the results associated with the DHHP enrollment indicator variable (Highlighted). This result indicates whether DHHP enrollment was associated with significantly greater or lower total monthly costs relative to individuals who were not enrolled in the program. We found that DHHP enrollment was associated with an average of $103.69 lower monthly costs (p-value <0.001) relative to individuals who were not enrolled in the program. Importantly, these total costs also include the $51 per-member per-month (PMPM) reimbursement paid to DHHP providers. With that in mind, the impact of the DHHP is actually greater than the $103 in lower total monthly costs suggests, as this result is offset by the $51 PMPM payment made to DHHP providers.

Table 16: Results from fully adjusted linear regression model assessing total monthly costs

	Estimate ($)	Standard Error	P-value
Intercept	1275.947965	15.936825	<.0001
DHHP Enrollment	-103.689433	14.274572	<.0001
Age	-0.853647	0.163487	<.0001
Gender			
Female	-31.112885	3.515948	<.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	5.995089	6.085507	0.3246
Hispanic	-16.345018	70.530723	0.8167

African American	50.337241	8.674847	<.0001
American Indian	76.042263	52.399121	0.1467
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-42.094496	5.228863	<.0001
Unicare	-35.713654	5.538229	<.0001
Health Plan	73.432780	6.831149	<.0001
PAAS	-130.375659	1730.595375	0.9399
FFS	479.047009	8.084644	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	4586.214673	79.944341	<.0001
Child	-1068.025667	13.864645	<.0001
Disabled	-591.064516	16.414441	<.0001
Expansion	-1017.571448	13.669022	<.0001
Other	-1665.243199	41.269041	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	487.700878	8.115845	<.0001
Obesity	323.512636	5.945934	<.0001
Cancer	1392.316979	17.665734	<.0001
Thyroid disorders	106.345410	10.776049	<.0001
Hypertension	357.981684	6.940567	<.0001
Heart disease	1899.655351	14.118177	<.0001
Peripheral vascular disease	1528.376417	29.663476	<.0001
Chronic obstructive pulmonary disease (COPD)	715.152404	11.225993	<.0001
Diabetic Neuropathy	600.744130	19.463585	<.0001
Anxiety disorder	265.858869	7.313623	<.0001
Depression	533.970034	7.716775	<.0001
Bipolar disorder	582.840827	13.634143	<.0001
Schizophrenia	1653.944107	32.139784	<.0001

Table 17 displays the results associated with the DHHP enrollment indicator from each of the fully adjusted cost models. For reference, tables displaying the full results from each of these models may be found in the appendix. We found that the overall lower costs associated with DHHP enrollment were driven by significantly lower total medical costs among members enrolled in the DHHP. DHHP enrollment was associated with an average of $158.95 lower monthly medical costs relative to individuals who were not enrolled in the program. Enrollment in the DHHP was also associated with significantly lower costs related to both diabetes and mental health care specifically (-$124.03 and -$55.07 respectively). We also observed that DHHP enrollment was associated with slightly—but still statistically significant—lower costs related to ED utilization (-$10.18). The only category of service where DHHP enrollment was associated with greater monthly costs was pharmacy utilization. Here, we observed that DHHP

enrollment was associated with an average of $55.26 greater monthly pharmacy costs relative to individuals who were not enrolled in the program.

Table 17: Differences in monthly costs among DHHP enrollees relative to non-participants, by category of service

Category of service	Estimate	Standard Error	P-value
Total Medical + pharmacy	-$103.69	14.274572	<.0001
Total Medical	-$158.95	12.780438	<.0001
Inpatient Medical	-$84.62	10.494327	<.0001
Outpatient medical	-$74.84	6.6757297	<.0001
ED-related	-$10.18	0.9980909	<.0001
Diabetes-related	-$124.03	5.2118273	<.0001
Mental health-related	-$55.07	7.0296248	<.0001
Pharmacy	+$55.26	6.1072416	<.0001

Once again we saw that results from our simple linear regression models were generally consistent with results from more robust two-part regression models. Tables 18 and 19 display results from a fully adjusted two-part model estimating monthly diabetes-related costs. Again, we are primarily interested in the results associated with the DHHP enrollment indicator variable. This result can be used to estimate the total diabetes-related monthly costs for DHHP participants relative to individuals not enrolled in the program while controlling for other demographic and clinical characteristics of interest. Using this model, we found that DHHP enrollment was associated with an average of $284.17 lower monthly diabetes-related costs relative to individuals not enrolled in the program.

Table 18: Results from part 1 of two-part regression model assessing diabetes-related costs

	Adjusted log odds	Standard error	P value	95% CI lower	95% CI upper
DHHP enrollment	3.792	0.041	< 0.001	3.712	3.871
Months in DHHP	-0.284	0.007	< 0.001	-0.298	-0.270
Age	0.003	0.0003	< 0.001	0.002	0.003
Diabetes dx	4.751	0.126	< 0.001	4.727	4.776
Obesity dx	5.264	0.217	< 0.001	5.221	5.307
Cancer dx	0.642	0.033	< 0.001	0.577	0.707
Anxiety dx	0.639	0.015	< 0.001	0.608	0.669
Depression dx	0.400	0016	< 0.001	0.367	0.432
Bipolar dx	0.091	0.028	< 0.001	0.035	0.145
Schizophrenia dx	-0.393	0.056	< 0.001	-0.502	-0.283
SUD dx	0.549	0.014	< 0.001	0.522	0.575

Table 19: Results from part 2 of two-part regression model assessing diabetes-related costs
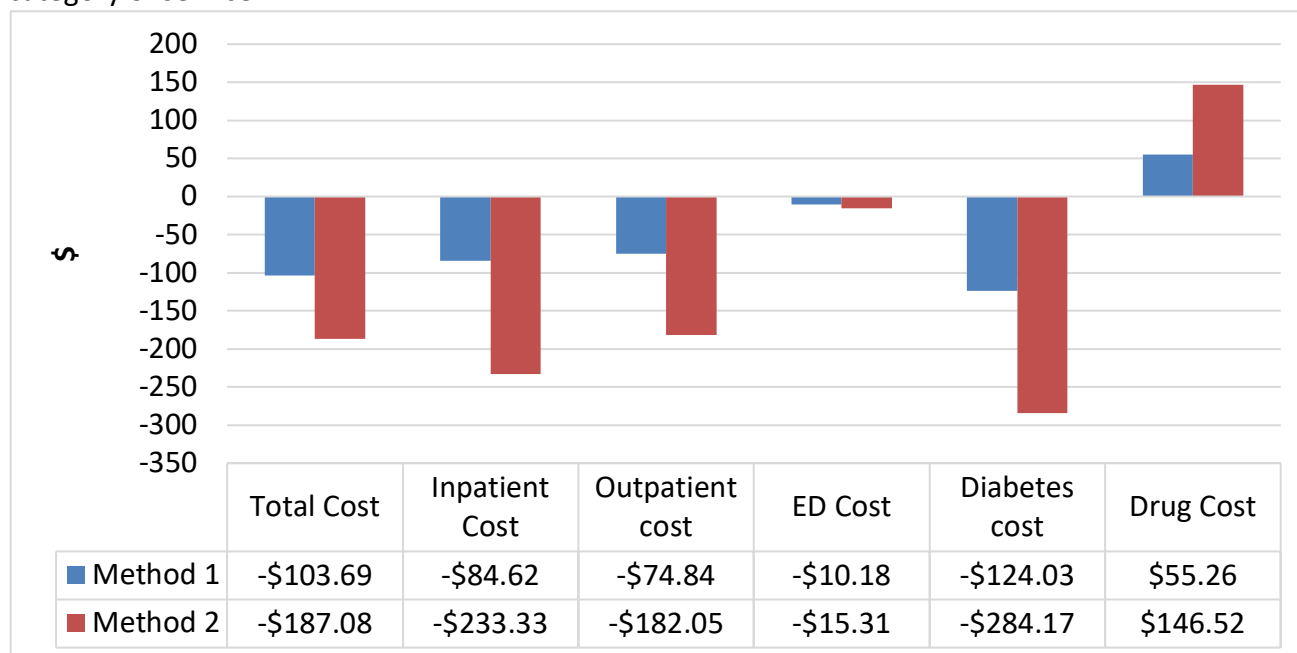
	Adjusted log odds	Standard error	P value	95% CI lower	95% CI upper
DHHP enrollment	-1.026	0.065	< 0.001	-1.154	-0.898
Months in DHHP	0.013	0.011	0.206	-0.007	0.033
Age	0.008	0.0008	< 0.001	0.006	0.009
Diabetes dx	0.950	0.0223	< 0.001	0.906	0.993
Obesity dx	0.944	0.023	< 0.001	0.898	0.991
Cancer dx	0.748	0.060	< 0.001	0.631	0.866
Anxiety dx	0.132	0.027	< 0.001	0.077	0.186
Depression dx	0.356	0.029	< 0.001	0.298	0.413
Bipolar dx	0.294	0.053	< 0.001	0.189	0.397
Schizophrenia dx	1.136	0.101	< 0.001	0.939	1.334
Substance Use Disorder dx	0.548	0.026	< 0.001	0.497	0.600

Table 20 presents the predicted monthly costs, as well as the differences in predicted costs associated with DHHP enrollment for each category of service. We once again saw that DHHP enrollment was associated with significant reductions in monthly costs for each category of service with the single exception being pharmacy costs. Using these models, we saw that DHHP enrollment was associated with $187.08 lower total monthly costs relative to individuals not enrolled in the program. Again, these total costs include the PMPM payment made to DHHP providers. DHHP enrollment was also associated with $233.33 and $182.05 lower costs for inpatient and outpatient medical services respectively. Enrollment in the DHHP was again associated with slightly lower ED-related costs ($15.31). Models estimating costs related specifically to mental health-related services did not converge. Finally, we observed that DHHP enrollment was associated with an average of $146.52 greater monthly pharmacy spending relative to individuals who were not in the program. The primary results from both the simple linear regression models ('Method 1') as well as the more robust two-part models ('Method 2') are presented side-by-side in Figure 3.

Table 20: Differences in predcited monthly spending among DHHP participants and non-participants by category of service

Category of service	Predicted costs-non-DHHP participants	Predicted costs-DHHP participants	Difference in costs- DHHP participants relative to non-participants
Total Medical + pharmacy	$1,471.01	$1,283.93	-$187.08
Inpatient Medical	$373.14	$139.80	-$233.33
Outpatient medical	$697.71	$515.66	-$182.05
ED-related	$67.11	$51.81	-$15.31
Diabetes-related	$483.66	$199.49	-$284.17
Pharmacy	$366.82	$513.34	$146.52

Figure 3: Differences in monthly costs among DHHP participants relative to non-participants by category of service

	Total Cost	Inpatient Cost	Outpatient cost	ED Cost	Diabetes cost	Drug Cost
■ Method 1	-$103.69	-$84.62	-$74.84	-$10.18	-$124.03	$55.26
■ Method 2	-$187.08	-$233.33	-$182.05	-$15.31	-$284.17	$146.52

Sensitivity analyses

Given that over 60% of the treatment group included in this evaluation were enrolled with a single DHHP provider, our quantitative results were largely driven by the performance of this group. With that in mind, we conducted a sensitivity analysis to assess whether our primary results still held even if we removed these individuals from the study sample. We replicated the logistic and linear regression procedures described above to examine the impact of the DHHP on Medicaid utilization and costs while excluding all individuals enrolled with the Family Healthcare Associates DHHP. All models were constructed with the same covariates as described above.

Tables 21 and 22 below present results from our sensitivity analyses that excluded individuals enrolled with the Family Healthcare Associates DHHP. We observed that our primary results were generally similar even when we excluded these individuals from the study sample. Results from this sensitivity analysis were similar to results in the main evaluation in both the direction and magnitude of the results. We again observed that DHHP enrollment was associated with 38% and 40% lower likelihood of ED visits and hospital admissions respectively relative to individuals not enrolled in the DHHP. Once again, we also observed that DHHP enrollment was associated with significantly lower costs for each category of service with the single exception being pharmacy spending.

Table 21: Results of logistic regression models assessing monthly likelihood of outcomes associated with DHHP enrollment, excluding DHHP members enrolled with Family Healthcare Associates

Outcome	Adjusted Odds Ratio	95% CI lower	95% CI upper	Difference in likelihood of outcome for DHHP participants relative to non-participants
ED visit	0.625	0.570	0.685	-38%
Diabetes-related ED visit	0.794	0.501	1.259	-21%
Mental Health-related ED visit	0.734	0.539	0.999	-27%
Inpatient Hospital Admission	0.605	0.499	0.733	-40%
30-day Hospital Readmission	1.089	0.722	1.645	+9%

Table 22: Results of linear regression models assessing differences in monthly costs among DHHP participants relative to non-participants, excluding DHHP members enrolled with Family Healthcare Associates

Category of service	Estimate	Standard Error	P-value
Total Medical + pharmacy	-$130.71	21.029	<0.001
Total Medical	-$191.06	18.844	<0.001
Inpatient Medical	-$86.50	15.497	<0.001
Outpatient medical	-$105.22	9.821	<0.001
ED-related	-$14.10	1.445	<0.001
Diabetes-related	-$152.35	7.692	<0.001
Mental health-related	-$71.15	10.380	<0.001
Pharmacy	+$60.35	8.961	<0.001

In presenting results of this analysis to DHHR leadership, questions arose regarding a potential differential impact of the DHHP on individuals enrolled in different MCOs. Thus, we conducted a second sensitivity analysis to see if this was the case. To do this, we repeated the logistic and

linear regression procedures described above, however, we stratified the analyses by MCO / FFS enrollment. These models were constructed with the same covariates as those described above.

Generally, we observed that the impact of the program was similar across individuals enrolled in different MCOs and those enrolled in FFS Medicaid. Tables 23 and 24 below present results of models assessing the impact of the DHHP on the likelihood of ED visits, and total monthly costs respectively, stratified by MCO / FFS type. We observed that DHHP enrollment was associated with significantly lower odds of ED utilization regardless of MCO / FFS enrollment. This trend was also consistent across each of the different MCOs. We also observed that DHHP enrollment was generally associated with lower total monthly costs regardless of MCO / FFS enrollment, however, the statistical significance of this finding varied slightly by MCO. Interestingly, we found that the magnitude of cost savings associated with DHHP enrollment was substantially higher for individuals enrolled in FFS Medicaid relative to those enrolled with different MCOs.

Table 23: Results of logistic regression models assessing monthly likelihood of ED visits associated with DHHP participation, stratified by MCO / FFS enrollment

MCO / FFS	Adjusted odds ratio	95% CI lower	95% CI Upper
Carelink	0.756	0.667	0.856
Unicare	0.603	0.543	0.668
Health Plan	0.574	0.459	0.717
FFS	0.527	0.375	0.741
WV Family Health	0.621	0.530	0.728

Table 24: Results of linear regression models assessing differences in monthly total costs among DHHP participants relative to non-participants, stratified by MCO / FFS enrollment

MCO / FFS	Estimate	Standard Error	P- value
Carelink	-$2.10	22.013	0.924
Unicare	-$106.91	18.529	<0.001
Health Plan	-$89.49	49.148	0.069
FFS	-$548.85	136.994	<0.001
WV Family Health	-$68.40	35.760	0.056

VI. Discussion

Both the qualitative and quantitative portions of this evaluation strongly support the continuation and expansion of the Medicaid DHHP. In speaking with current DHHP participants, we found that individuals were generally very satisfied with the program, and expressed tremendous appreciation for the work and support provided by care coordinators. Our quantitative evaluation also demonstrated that the program was broadly achieving its intended goals of reducing potentially unnecessary healthcare utilization and consequently reducing overall medical costs for this population. We have confidence in the results presented here

because they are generally consistent with previous research on this topic and because they show internal validity.

The quantitative findings presented here are consistent with several previous studies of health homes and patient-centered medical homes. In 2016, Shane et al. evaluated the impact of Iowa's Medicaid Health Home program using a very similar difference-in-difference regression design as the method employed here.[5] They found that Iowa's Medicaid Health Home program led to significantly lower total costs as well as lower rates of ED utilization among the population enrolled in the program. Results presented here are also generally consistent with previous studies examining medical homes outside the context of Medicaid. In 2013 Jackson et al. conducted a systematic review of evidence for patient-centered medical homes, which are similar in principle to Medicaid health homes.[6] They found three observational studies that reported small to moderate decreases in rates of inpatient hospital admissions and ED utilization among the medical home population.[6-10] Jackson et al. also report that medical homes are generally associated with improvements in patient experiences and satisfaction.[6] In short, this previous research supports the results found in our evaluation.

In addition to being supported by previous research, the results presented here also demonstrate tremendous internal consistency. In the quantitative portion of the evaluation, we observed that DHHP enrollment was associated with significantly lower overall medical costs, even when these costs included the PMPM payment made to DHHP providers. This finding makes sense, though, in the context of our other results showing that DHHP enrollment was also associated with significantly lower rates of both inpatient hospital admissions and ED visits. Hospital admissions and ED visits are major drivers of Medicaid costs, so we would expect overall medical costs to be lower given lower rates of utilization. Importantly, the results of our quantitative evaluation were also broadly consistent with findings from the qualitative evaluation.

During focus groups and interviews with DHHP participants, we ascertained that approximately one-third of the individuals we spoke to actually had received an official diabetes diagnosis. This finding is consistent with our quantitative evaluation, where we observed that approximately 40% of the study population had a diabetes diagnosis at some point in the Medicaid claims data. In the qualitative portion of the evaluation, we also learned that many of the individuals we spoke to were relatively new to the DHHP. We estimated that only about one-third of the individuals we spoke to had been enrolled in the program for a year or longer. Again, this was consistent with the results of our quantitative evaluation where we saw that uptake of the program was generally slow, and most members did not join the DHHP until over a year after the program was actually made available.

In the quantitative portion of the evaluation, we observed that DHHP enrollment was associated with significantly greater monthly pharmacy spending. This was the only category of service where we observed that DHHP enrollment was associated with increased costs relative to individuals not enrolled in the program. The DHHP—and health homes in general—are intended to reduce potentially unnecessary healthcare utilization such as ED visits and hospital

admissions. Generally speaking, we would not expect the DHHP to reduce prescription drug utilization. In fact, we learned from speaking to DHHP participants, that the outreach provided by care coordinators actually encouraged increased prescription drug use in a positive way. Individuals reported that they were more likely to take their medication because they knew that their care coordinator would ask about this during monthly outreach calls. We also heard from some participants that this effect went beyond just medications related to diabetes, and these outreach calls led them to use other prescribed medications more frequently as well. Given that these calls broadly support medication adherence, it is unsurprising that we observed DHHP enrollment was associated with greater pharmacy costs relative to individuals not enrolled in the program.

Finally, we also observed consistencies between the qualitative and quantitative portions of the study in terms of the impact of the DHHP on hospital admissions and ED utilization. We observed that DHHP enrollment was associated with significantly lower rates of hospital admissions as well as ED visits. In speaking with DHHP participants, we heard from several individuals that the monthly outreach calls from care coordinators helped prevent participants from using these services unnecessarily. Speaking to care coordinators on a regular basis helps DHHP participants better understand how and why they should pursue care for unmet needs in settings other than hospitals or EDs. We also heard from some participants that they were comfortable with proactively reaching out to care coordinators if they had concerns or questions about certain health issues. In these situations, proactive outreach to care coordinators may be immediately preventing the patient from seeking care in an emergency setting. Finally, we also heard from DHHP participants who said that care coordinators had taught them how to recognize and respond to symptoms of abnormally high or low blood pressure. Again, this knowledge may directly prevent these patients from pursuing emergency care in these situations.

Room for Improvement

The results presented here suggest that the DHHP is broadly achieving its intended goals. However, throughout the course of this evaluation we have identified several areas for potential program improvement moving forward. We believe the DHHP would be able to have a stronger impact on patients if it improved the use of individualized care plans, standardized the use of educational materials, and facilitated collaboration between different DHHP provider groups.

One of the primary tenants of the DHHP is the development of individualized care plans. According to the approved DHHP SPA, these plans are developed by a team of multidisciplinary providers and shared with patients at the time that they begin the program. In speaking with DHHP participants, nearly all of them expressed tremendous appreciation for the care coordinators and their monthly outreach calls, but almost none mentioned the individualized care plans. When asked directly about the use of these care plans, some participants recalled that they were developed initially, but they did not imply that they were regularly utilized as a part of the DHHP care coordination. These care plans can only realistically achieve their

intended benefits if they are regularly distributed, discussed, and updated while working with DHHP participants. We recommend that BMS revise requirements around the use of care plans to ensure that they are more actively utilized within the DHHP.

While the DHHP SPA is relatively prescriptive in terms of requiring individualized care plans and monthly outreach calls, it provides relatively little guidance in terms of other services the DHHP must provide. All of the DHHP programs that we engaged with to conduct focus groups and interviews for this evaluation provided some form of educational materials to program participants. However, the breadth and subject matter of these educational materials varied markedly across the programs. Some DHHP participants we spoke to expressed satisfaction with the educational materials they had been provided while others expressed that this was an area where the program could be improved. To address these concerns, we recommend that BMS work with existing DHHP programs to both improve and standardize the educational materials that are available to program participants.

Beyond just educational materials, we also observed that different DHHP providers varied substantially in terms of supplemental offerings and activities associated with the program. One facility we engaged with provided cooking classes and bus passes to program participants. Another facility incentivized participants to lose weight by offering gift cards when patients hit certain goals. Yet another facility told us how they worked particularly closely with a nearby FQHC to help participants find primary care providers. Each of these activities is outside the scope of the DHHP SPA, however they are all things that can strengthen the impact of the program. Given this variation, we recommend that BMS work with the various DHHP providers to facilitate collaboration and lesson sharing across the disparate programs. This could potentially take the form of a 'learning cooperative' where key personnel from the various DHHP programs gather to share different strategies and initiatives that have worked well for the programs or the patients. These could include things like tips to improve recruitment and retention, ideas for how to improve patient engagement, or success stories related to different supplemental offerings at the different programs. We believe that this type of cooperation and collaboration across the disparate providers will ultimately make the program more robust and consistent overall. This may be particularly important should the state choose to expand the program statewide.

Limitations

Both the qualitative and quantitative portions of this evaluation were not without limitations. Specifically, although qualitative research is not intended to be generalizable, non-response bias may have occurred during the qualitative phase of this project. Although all health homes in the 14-county area providing diabetes health home services were contacted for participation, only 4 sites participated. Furthermore, we did not have participation from the largest health home in WV. Despite repeated attempts to contact care coordinators and DHHP representatives at each site via email and telephone, non-response was a significant issue. Some sites also expressed initial interest, but then did not return subsequent emails or phone calls.

The quantitative portion of this evaluation primarily suffered from limitations due to both data availability and programmatic constraints. Data provided by KEPRO suggest that over 6,000 Medicaid beneficiaries have been enrolled in the DHHP since the program was first available. However, only about 1,200 of these individuals were included in the study sample for the purposes of this evaluation. In order for us to assess the impact of the program over time, it was important that we have adequate data on DHHP participants both before and after they were enrolled in the program. As discussed in the results section, uptake of the program was relatively slow, with most individuals joining over a year after the program was initially available. This, coupled with the fact that we only had access to Medicaid claims data through October 2018 (as of the time of this writing) led us to severely restrict the sample size included in this study. This limitation may be particularly salient given previous research suggesting that the impact of health home programs may take time to accrue.[5]

Our evaluation was also limited by data available in the Medicaid Data Warehouse. The outcomes of interest available for study in this evaluation were limited to things that could be ascertained through fields in the Medicaid Data Warehouse. Things like healthcare utilization and Medicaid costs are readily available through the Data Warehouse. However, other things like blood or laboratory tests and clinician documentation are not available. We heard from DHHP participants that involvement in the program improved their ability to manage their diabetes and also lose weight. While we would have like to include things like A1C score and BMI as outcomes in this evaluation, these data are not available in the Medicaid Data Warehouse. We could have potentially obtained some of these data from KEPRO however we chose not to as they would only have this information for individuals who were enrolled in the DHHP. Even if we had obtained these data from KEPRO, we would not have had these measures for individuals in the comparison group and consequently would not have been able to attribute any observed improvements in these outcomes to the DHHP itself.

Finally, both the quantitative and qualitative portions of the study were limited by the fact that the majority of DHHP participants are enrolled with a single provider. In both the study population as well as the overall DHHP population, roughly 60% of DHHP participants are enrolled with Family Healthcare Associates. This impacted the qualitative portion of the evaluation because they were one of the providers who did not participate in the focus groups or individual interviews. Thus, we were de facto unable to engage with a majority of individuals enrolled in the DHHP. However, with that said, we still believe our results are valid given the consistency of themes that emerged during our focus groups and interviews. This limitation also impacted the quantitative portion of the evaluation because it means that our results are predominantly driven by outcomes among participants enrolled in this single program. However, as evidenced by the results of our sensitivity analysis presented above, our results still held even when we excluded individuals enrolled in this particular program from the study population.

VII. Conclusion

Based on the evidence presented here, we strongly recommend that the DHHP be both continued and expanded statewide. The results of this evaluation demonstrate that the DHHP essentially acts as a vehicle to drive positive engagement with the healthcare system. Outreach from care coordinators improves participants' ability to seek care in appropriate settings and also helps these individuals address unmet health needs beyond just diabetes. This care coordination outreach eventually leads to lower rates of ED visits and hospital admissions among DHHP participants and ultimately reduces overall Medicaid costs. Despite the limitations of this study, we believe these results will still hold even if the program is expanded state-wide. This expansion may also provide an opportunity to introduce changes to the program that will allow it to be even more effective moving forward.

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Appendix Tables-

Table A1: Results from adjusted linear regression model assessing total monthly medical costs

	Estimate ($)	Standard Error	P-value
Intercept	1316.473471	14.268701	<.0001
DHHP Enrollment	-158.950020	12.780438	<.0001
Age	-3.814657	0.146375	<.0001
Gender			
Female	-17.187732	3.147930	<.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	-7.613352	5.448531	0.1623
Hispanic	-37.963248	63.148200	0.5477
African American	59.098649	7.766842	<.0001
American Indian	-63.354190	46.914451	0.1769
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-46.986862	4.681552	<.0001
Unicare	-41.389100	4.958537	<.0001
Health Plan	44.307755	6.116125	<.0001
PAAS	-90.791021	1549.452190	0.9533
FFS	441.963782	7.238416	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	4121.355443	71.576485	<.0001
Child	-1101.534408	12.413418	<.0001
Disabled	-787.808426	14.696325	<.0001
Expansion	-1041.592106	12.238272	<.0001
Other	-1617.981716	36.949368	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	279.601035	7.266351	<.0001
Cancer	1152.294029	15.816644	<.0001
Thyroid disorders	106.674235	9.648109	<.0001
Anxiety disorder	235.549368	6.548099	<.0001
Depression	493.706852	6.909052	<.0001
Bipolar disorder	475.530839	12.207043	<.0001
Schizophrenia	1535.663901	28.775680	<.0001
Hypertension	346.926662	6.214090	<.0001
Heart disease	1815.998707	12.640413	<.0001
Peripheral vascular disease	1437.082045	26.558570	<.0001
Chronic obstructive pulmonary disease (COPD)	551.777246	10.050957	<.0001
Diabetic Neuropathy	379.138154	17.426311	<.0001
Obesity	280.160542	5.323567	<.0001

Table A2: Results from fully adjusted linear regression model assessing total inpatient monthly medical costs

	Estimate ($)	Standard Error	P-value
Intercept	667.855650	11.716376	<.0001
DHHP Enrollment	-84.620592	10.494327	<.0001
Age	-1.936212	0.120192	<.0001
Gender			
Female	-20.844472	2.584841	<.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	-9.267407	4.473920	0.0383
Hispanic	-150.056953	51.852514	0.0038
African American	49.272907	6.377541	<.0001
American Indian	-48.716493	38.522590	0.2060
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-26.055636	3.844136	<.0001
Unicare	-5.478334	4.071574	0.1785
Health Plan	30.012123	5.022098	<.0001
PAAS	-33.507743	1272.292661	0.9790
FFS	164.127313	5.943639	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	-966.943178	58.773183	<.0001
Child	-603.506319	10.192958	<.0001
Disabled	-655.608101	12.067508	<.0001
Expansion	-580.910509	10.049141	<.0001
Other	-785.531212	30.340020	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	120.471139	5.966577	<.0001
Cancer	284.272907	12.987429	<.0001
Thyroid disorders	-14.076063	7.922296	0.0756
Anxiety disorder	49.675089	5.376802	<.0001
Depression	236.829835	5.673190	<.0001
Bipolar disorder	256.045483	10.023498	<.0001
Schizophrenia	921.193723	23.628407	<.0001
Hypertension	126.312603	5.102540	<.0001
Heart disease	1256.993142	10.379349	<.0001
Peripheral vascular disease	972.127961	21.807884	<.0001
Chronic obstructive pulmonary disease (COPD)	289.048097	8.253084	<.0001
Diabetic Neuropathy	203.370630	14.309166	<.0001
Obesity	87.577601	4.371310	<.0001

Table A3: Results from fully adjusted linear regression model assessing total outpatient monthly medical costs

	Estimate ($)	Standard Error	P-value
Intercept	649.160844	7.4531084	<.0001
DHHP Enrollment	-74.837700	6.6757297	<.0001
Age	-1.885686	0.0764574	<.0001
Gender			
Female	3.703788	1.6442887	0.0243
Male	Ref.	Ref.	Ref.
Race			
Caucasian	1.579744	2.8459836	0.5788
Hispanic	111.034087	32.9848091	0.0008
African American	9.749057	4.0569293	0.0163
American Indian	-15.221642	24.5052783	0.5345
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-19.899411	2.4453604	<.0001
Unicare	-35.827756	2.5900404	<.0001
Health Plan	14.247976	3.1946948	<.0001
PAAS	-56.840309	809.3403244	0.9440
FFS	277.854067	3.7809119	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	5084.290315	37.3872368	<.0001
Child	-498.859086	6.4840205	<.0001
Disabled	-132.898264	7.6764732	<.0001
Expansion	-461.199486	6.3925345	<.0001
Other	-832.978513	19.3001203	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	159.085041	3.7955033	<.0001
Cancer	868.778280	8.2616603	<.0001
Thyroid disorders	121.059840	5.0395901	<.0001
Anxiety disorder	186.341368	3.4203318	<.0001
Depression	257.714927	3.6088720	<.0001
Bipolar disorder	219.909524	6.3762227	<.0001
Schizophrenia	623.725329	15.0306787	<.0001
Hypertension	221.774643	3.2458658	<.0001
Heart disease	561.946199	6.6025892	<.0001
Peripheral vascular disease	465.646427	13.8725942	<.0001
Chronic obstructive pulmonary disease (COPD)	262.827358	5.2500133	<.0001
Diabetic Neuropathy	175.185575	9.1024536	<.0001
Obesity	192.879534	2.7807103	<.0001

Table A4: Results from fully adjusted linear regression model assessing monthly ED-related costs

	Estimate ($)	Standard Error	P-value
Intercept	62.4164816	1.1143171	<.0001
DHHP Enrollment	-10.1779667	0.9980909	<.0001
Age	-0.6423147	0.0114312	<.0001
Gender			
Female	0.9372684	0.2458382	0.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	-2.7853649	0.4255041	<.0001
Hispanic	-7.7441326	4.9315712	0.1163
African American	-1.2046011	0.6065530	0.0470
American Indian	-3.6917751	3.6637934	0.3136
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-7.9760201	0.3656068	<.0001
Unicare	-7.8088055	0.3872379	<.0001
Health Plan	-2.0374529	0.4776400	<.0001
PAAS	-15.2521326	121.0047772	0.8997
FFS	0.4519566	0.5652856	0.4240
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	-91.0214660	5.5897799	<.0001
Child	-37.2220141	0.9694284	<.0001
Disabled	-37.3328618	1.1477124	<.0001
Expansion	-18.5944141	0.9557503	<.0001
Other	-45.3417036	2.8855683	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	18.9765830	0.5674671	<.0001
Cancer	12.6677399	1.2352039	<.0001
Thyroid disorders	2.0792902	0.7534710	0.0058
Anxiety disorder	27.5582073	0.5113751	<.0001
Depression	22.9524489	0.5395638	<.0001
Bipolar disorder	42.9496431	0.9533115	<.0001
Schizophrenia	145.2213128	2.2472424	<.0001
Hypertension	42.5010609	0.4852906	<.0001
Heart disease	103.3681132	0.9871556	<.0001
Peripheral vascular disease	39.1125068	2.0740968	<.0001
Chronic obstructive pulmonary disease (COPD)	41.6603132	0.7849315	<.0001
Diabetic Neuropathy	4.7347249	1.3609113	0.0005
Obesity	4.4786192	0.4157450	<.0001

Table A5: Results from fully adjusted linear regression model assessing monthly diabetes-related costs

	Estimate ($)	Standard Error	P-value
Intercept	84.263759	5.8187368	<.0001
DHHP Enrollment	-124.030077	5.2118273	<.0001
Age	-1.172280	0.0596913	<.0001
Gender			
Female	-4.161457	1.2837171	0.0012
Male	Ref.	Ref.	Ref.
Race			
Caucasian	-0.630510	2.2218957	0.7766
Hispanic	-3.357503	25.7516611	0.8963
African American	-2.743676	3.1672965	0.3864
American Indian	6.603348	19.1315833	0.7300
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	0.490526	1.9091240	0.7972
Unicare	-1.869012	2.0220776	0.3553
Health Plan	9.325271	2.4941390	0.0002
PAAS	12.353912	631.8623137	0.9844
FFS	81.743322	2.9518061	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	3301.623448	29.1886926	<.0001
Child	-82.925073	5.0621575	<.0001
Disabled	-102.558545	5.9931205	<.0001
Expansion	-59.098879	4.9907332	<.0001
Other	-119.006912	15.0678501	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	345.473985	2.9631978	<.0001
Cancer	116.335248	6.4499836	<.0001
Thyroid disorders	-0.950188	3.9344722	0.8092
Anxiety disorder	15.234888	2.6702966	<.0001
Depression	38.750264	2.8174924	<.0001
Bipolar disorder	36.422574	4.9779984	<.0001
Schizophrenia	272.046632	11.7346426	<.0001
Hypertension	46.667044	2.5340889	<.0001
Heart disease	537.869766	5.1547256	<.0001
Peripheral vascular disease	380.812318	10.8305112	<.0001
Chronic obstructive pulmonary disease (COPD)	81.634125	4.0987523	<.0001
Diabetic Neuropathy	444.257493	7.1064016	<.0001
Obesity	273.726168	2.1709360	<.0001

Table A6: Results from fully adjusted linear regression model assessing monthly mental health-related costs

	Estimate ($)	Standard Error	P-value
Intercept	201.687265	7.8482141	<.0001
DHHP Enrollment	-55.069334	7.0296248	<.0001
Age	-1.741282	0.0805106	<.0001
Gender			
Female	-33.723067	1.7314560	<.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	0.826610	2.9968554	0.7827
Hispanic	47.529366	34.7334062	0.1712
African American	80.137809	4.2719961	<.0001
American Indian	-42.768889	25.8043569	0.0974
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	-2.612409	2.5749943	0.3103
Unicare	-10.887111	2.7273441	<.0001
Health Plan	56.478021	3.3640526	<.0001
PAAS	-34.586690	852.2452311	0.9676
FFS	372.659871	3.9813463	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	4388.303588	39.3692163	<.0001
Child	-148.525015	6.8277527	<.0001
Disabled	-87.783250	8.0834199	<.0001
Expansion	-119.272770	6.7314168	<.0001
Other	-506.351323	20.3232621	<.0001
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	10.327884	3.9967112	0.0098
Cancer	99.644818	8.6996290	<.0001
Thyroid disorders	2.684784	5.3067498	0.6129
Anxiety disorder	206.850236	3.6016510	<.0001
Depression	487.097722	3.8001862	<.0001
Bipolar disorder	429.852157	6.7142402	<.0001
Schizophrenia	1459.675584	15.8274880	<.0001
Hypertension	94.730524	3.4179363	<.0001
Heart disease	398.538341	6.9526069	<.0001
Peripheral vascular disease	361.478310	14.6080108	<.0001
Chronic obstructive pulmonary disease (COPD)	138.459036	5.5283280	<.0001
Diabetic Neuropathy	67.032552	9.5849946	<.0001
Obesity	47.462244	2.9281219	<.0001

Table A7: Results from fully adjusted linear regression model assessing monthly pharmacy costs

	Estimate ($)	Standard Error	P-value
Intercept	-40.5255061	6.8184208	<.0001
DHHP Enrollment	55.2605869	6.1072416	<.0001
Age	2.9610108	0.0699465	<.0001
Gender			
Female	-13.9251536	1.5042652	<.0001
Male	Ref.	Ref.	Ref.
Race			
Caucasian	13.6084411	2.6036269	<.0001
Hispanic	21.6182308	30.1759072	0.4737
African American	-8.7614087	3.7114516	0.0182
American Indian	139.3964529	22.4184716	<.0001
Unknown	Ref.	Ref.	Ref.
Plan Type			
Carelink	4.8923662	2.2371198	0.0287
Unicare	5.6754455	2.3694792	0.0166
Health Plan	29.1250252	2.9226428	<.0001
PAAS	-39.5846382	740.4189764	0.9574
FFS	37.0832272	3.4589391	<.0001
West Virginia Family Health	Ref.	Ref.	Ref.
Eligibility category			
Aged	464.8592295	34.2034355	<.0001
Child	33.5087418	5.9318579	<.0001
Disabled	196.7439101	7.0227644	<.0001
Expansion	24.0206580	5.8481627	<.0001
Other	-47.2614830	17.6565715	0.0074
Pregnant	Ref.	Ref.	Ref.
Diabetes / Pre-diabetes	208.0998432	3.4722880	<.0001
Cancer	240.0229503	7.5581185	<.0001
Thyroid disorders	-0.3288247	4.6104315	0.9431
Anxiety disorder	30.3095006	3.1290651	<.0001
Depression	40.2631826	3.3015497	<.0001
Bipolar disorder	107.3099886	5.8332399	<.0001
Schizophrenia	118.2802063	13.7507046	<.0001
Hypertension	11.0550222	2.9694562	0.0002
Heart disease	83.6566443	6.0403296	<.0001
Peripheral vascular disease	91.2943724	12.6912396	<.0001
Chronic obstructive pulmonary disease (COPD)	163.3751571	4.8029356	<.0001
Diabetic Neuropathy	221.6059756	8.3273119	<.0001
Obesity	43.3520945	2.5439121	<.0001

Table A8: Results from logistic regression model assessing monthly likelihood of diabetes-related ED visits

	AOR	95% CI lower	95% CI upper
DHHP Enrollment yes vs. no	0.756	0.529	1.080
Age	0.995	0.992	0.998
Gender Male vs. Female	1.380	1.258	1.513
Cancer yes vs. no	0.696	0.468	1.035
Thyroid disorder yes vs. no	1.143	0.957	1.367
Anxiety disorder yes vs. no	1.223	1.065	1.405
Depression yes vs. no	1.475	1.285	1.693
Bipolar disorder yes vs. no	1.586	1.266	1.988
Schizophrenia yes vs. no	1.951	1.308	2.910
Hypertension yes vs. no	5.530	4.909	6.230
Heart disease yes vs. no	1.890	1.616	2.210
Peripheral vascular disease yes vs. no	1.524	1.146	2.028
COPD yes vs. no	1.372	1.161	1.621
Diabetic neuropathy yes vs. no	11.168	9.839	12.675
Obesity yes vs. no	1.109	0.982	1.253

Table A9: Results from logistic regression model assessing monthly likelihood of mental health-related ED visits

	AOR	95% CI lower	95% CI upper
DHHP Enrollment yes vs. no	0.616	0.486	0.780
Age	1.003	1.001	1.005
Gender Male vs. Female	1.251	1.187	1.319
Diabetes yes vs. no	0.901	0.820	0.991
Cancer yes vs. no	0.803	0.626	1.031
Thyroid disorder yes vs. no	1.403	1.250	1.574
Hypertension yes vs. no	3.331	3.094	3.586
Heart disease yes vs. no	1.421	1.255	1.609
Peripheral vascular disease yes vs. no	0.581	0.401	0.842
COPD yes vs. no	1.911	1.722	2.120
Diabetic neuropathy yes vs. no	0.978	0.790	1.210
Obesity yes vs. no	1.298	1.205	1.399

Table A10: Results from logistic regression model assessing monthly likelihood of hospital admission

	AOR	95% CI lower	95% CI upper
DHHP Enrollment yes vs. no	0.529	0.453	0.617
Age	0.987	0.986	0.988
Gender Male vs. Female	0.914	0.877	0.951
Diabetes yes vs. no	2.081	1.970	2.199
Cancer yes vs. no	2.420	2.177	2.689
Thyroid disorder yes vs. no	1.089	1.009	1.176
Anxiety disorder yes vs. no	1.538	1.460	1.621
Depression yes vs. no	3.221	3.066	3.384
Bipolar disorder yes vs. no	2.853	2.645	3.078
Schizophrenia yes vs. no	7.815	6.941	8.800
Hypertension yes vs. no	2.304	2.188	2.425
Heart disease yes vs. no	5.850	5.504	6.217
Peripheral vascular disease yes vs. no	2.759	2.439	3.121
COPD yes vs. no	2.438	2.289	2.598
Diabetic neuropathy yes vs. no	1.559	1.415	1.718
Obesity yes vs. no	2.133	2.039	2.230

Table A11: Results from logistic regression model assessing monthly likelihood of 30-day hospital readmission

	AOR	95% CI lower	95% CI upper
DHHP Enrollment yes vs. no	0.898	0.635	1.270
Age	0.961	0.958	0.965
Gender Male vs. Female	1.429	1.300	1.571
Diabetes yes vs. no	2.367	2.063	2.715
Cancer yes vs. no	3.284	2.607	4.136
Thyroid disorder yes vs. no	1.147	0.952	1.382
Anxiety disorder yes vs. no	1.526	1.354	1.721
Depression yes vs. no	7.938	7.104	8.870
Bipolar disorder yes vs. no	4.051	3.495	4.694
Schizophrenia yes vs. no	6.891	5.611	8.464
Hypertension yes vs. no	1.934	1.696	2.206
Heart disease yes vs. no	6.077	5.231	7.059
Peripheral vascular disease yes vs. no	2.373	1.780	3.165
COPD yes vs. no	2.468	2.115	2.880
Diabetic neuropathy yes vs. no	1.729	1.396	2.141
Obesity yes vs. no	1.313	1.168	1.476