shapa

Utilization of the Shapa Health platform through the Shapa numberless scale and digital health management program in partnership with coaching optimized virtual care with improved outcomes and engagement for diabetes prevention

SHAPA HEALTH WHITEPAPER

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ABSTRACT

Due to the increased prevalence of diabetes mellitus type 2 (type 2 diabetes) both nationally in the United States and globally, there is a pressing need for clinical trials and an effective digital health intervention to halt or prevent transition to diabetes mellitus type 2. The process of recruitment for clinical trials can be expensive and challenging and there are limited studies addressing a cost-effective solution. The purpose of this study is to investigate the impact of Shapa, a personalized behavior change program paired with screenless, numberless scale as a proposed solution to prevent or delay development of type 2 diabetes and support sustainable weight reduction within a prediabetic population. This study was conducted in conjunction with a large HMO provider. A retrospective analysis was done using data from 222 participants who were randomly screened and assigned by dietitians.

Overall, the participants lost on an average of 5% of their body weight, from their starting weight at 6 months after starting their Shapa program. Highly engaged participants lost ≥10% of their body weight at 6 months. Additionally, 42% of the participants moved down at least one BMI category at 6 months. Furthermore, 96% of the participants using Shapa made progress towards their weight and health goals. This study presents evidence that a screenless, numberless scale, along with a personalized digital behavior change program focusing on weight reduction, increasing physical activity, stress reduction, and lifestyle behavior modification can mitigate the risk factors associated with diabetes and obesity.

INTRODUCTION

According to WHO, about 422 million people worldwide have diabetes and 1 in 11 people have diabetes. The majority of people live in low-and middle-income countries. About 1.6 million deaths are directly attributed to diabetes each year. The cause for diabetes is complex, but the rise is partly due to the 1) increases in the number of people who are overweight (1 in 3), including an increase in obesity (1 in 10), and 2) lack of physical activity. Over the past three decades, the prevalence of type 2 diabetes has risen dramatically in countries of all income levels. The risk factors for type 2 diabetes in which an individual has control over to effect change include diet and physical activity. A large proportion of diabetes and its complications can be prevented by adapting to healthier eating patterns, regular physical activity, maintaining a normal body weight and avoiding tobacco use.[1]

Another significant health and social problem which has reached epidemic levels is obesity. There is a need for an effective and accessible weight reduction program to reverse the increasing prevalence of obesity. There are various remedies proposed for such epidemic problems, one of them being digital health programs. There is a significant growth of internet and mobile interventions promoting healthy behaviors and lifestyle. These practices have also gained a great deal of attention. The growth in digital health can be due to the following factors: 1) scalability, 2) accessibility, 3) low costs, 4) privacy and user control and 5) applicability to real-time modifications. But a definite problem exists with providing sustainable long-term behavior modification solutions. This is due to the lack of focus on behavior change and not addressing the motivation for developing healthy behaviors.[2]

Apart from obesity and diabetes, mental health problems are also increasing worldwide. APA suggests that as much as we care about our body, it is important that we take care of our mind as well. People with diabetes are 2 to 3 times more likely to have depression than people without diabetes. A 12-year longitudinal study suggests that moderate/high stress levels were associated with a 2.3-fold increase in the odds of diabetes three years later, for the total estimated effect.[3]

Furthermore, due to the rise of an obesogenic environment, ultra processed foods contribute the majority of calories consumed, which when coupled with a more sedentary lifestyle, are causative factors for weight gain. Some types of foods have become progressively cheaper and fewer meals are being prepared at home. Additionally, changes in occupation and industrialization have made it challenging to be active throughout the day.[4]

There are various digital health programs such as Noom and Omada providing accessible digital health in a variety of languages in addition to English. But, there is no evidence from research pointing to the cultural competence of digital health–supported lifestyle change programs. Additionally, research studies point to the need to deliver nutrition-based content to increase and sustain weight loss for DPP.[5]

Given the increase in obesity, diabetes, mental health conditions and an ever growing obesogenic environment, there is a need for a digital intervention to address the gap between our long-term interests and short-term temptation of unhealthy choices.

Shapa builds and delivers digital tools that are founded on important principles from behavioral science to create a behavior change program that sets its members up for sustained engagement and improved health outcomes. Shapa, with a digital program that can be localized and paired with a device in the home, makes it an accessible and effective solution for addressing the cultural competence of digital health and provide good intentions to engage in developing long-term healthier behaviors.

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The Science Behind Shapa

There is a lack of longitudinally-focused programs that support weight reduction in a sustainable manner. With Shapa, the focus was developing a program that brought behavioral science principles to life to support health and disease management focused goals. The Shapa digital tools developed to translate behavioral science into an effective weight loss system. A few of the behavior science principles behind Shapa include:

1) Stepping on the scale in the morning time sets a health intention

Numerous studies confirm that frequent weigh-ins help maintain weight loss and act as an effective reminder for weight management.[6] The process of weight reduction, as we know, is not a one-time behavior, rather a culmination of many small behaviors every day, such as, walking to work, choosing to drink water instead of a soda, reducing sugar intake etc. Drawing from the concepts of behavior science, reminders or cues can help people engage in the behaviors periodically, especially when they are in the appropriate context.[7][8][9] This basic principle further strengthens the correlation between the morning ritual of weigh-in, not only for weight loss, but also for the development of healthier self-regulatory behavior choices for the next few hours. In other words, it acts as a drive towards positive behavior change and sets a health intention for the entire day. Little did we know that this "small reminder" of weigh-in and the presence of a scale can signal unconscious cues for developing healthy behaviors and drive towards a healthy mindset.

The Shapa scale pairs the morning ritual of stepping on the scale with familiar habits and existing routines. This process of assessment is crucial for the development of habits and can act as a cue or reminder to reinforce the behavior of weigh-in. By using this scientific method of "habit pairing", stepping on a scale and weighing ourselves in the morning starts becoming a non-binding commitment and reminds us of our health goals we are trying to achieve.[10]
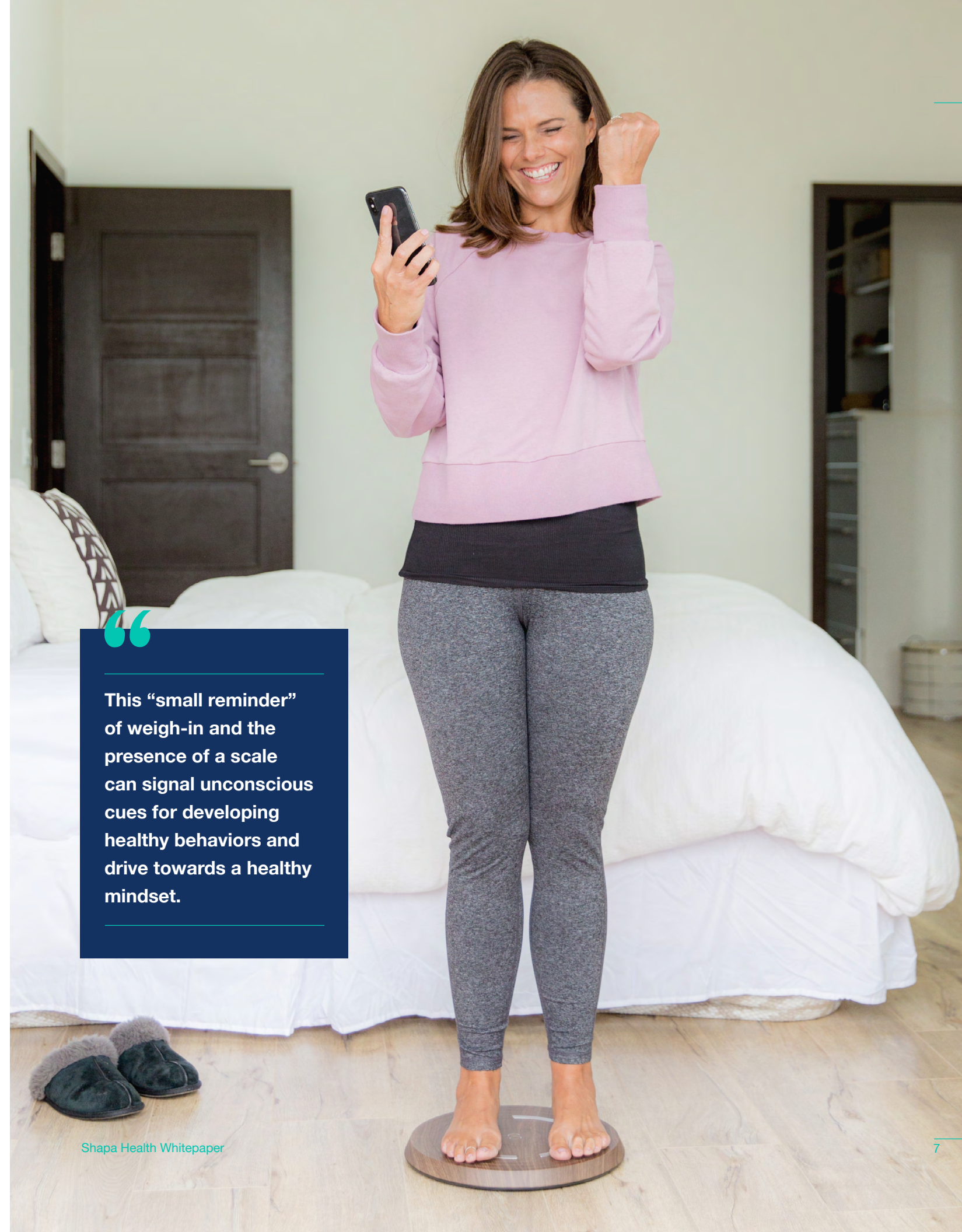
> **This "small reminder" of weigh-in and the presence of a scale can signal unconscious cues for developing healthy behaviors and drive towards a healthy mindset.**

2) Feedback and fluctuations

The traditional digital bathroom scale user interface hasn't changed for over 100 years,[11] it is still considered as a "state-of-art" in weight reduction. The digital scale gives a single value as a representation of one's weight at the moment of measurement. Over the years, we can see an analog needle, body fat percentage, offline progress review, still the main point however is the singular data point. The digital scales seem to only answer only one question, "what do I weigh right now?" But we know that weight fluctuations can be due to various reasons like salt intake, hormonal changes, etc. These small differences create unnecessary "noises" and we tend to get hypersensitive to the decimal difference of being 156.7 or 156.9. This sort of unrealistic level of precision negatively affects the user's perception of weight and creates a "marked aversion" to stepping on the scale.

At Shapa we re-imagined the 100-year-old user interface, from understanding the best practice in weight management research and behavioral science to understanding of weight fluctuation. Shapa is based on the principle of "loss of aversion". As humans we always remember the losses compared to the gains. For example, the emotional intensity equated to losing $1000 is compared in our brains in the same magnitude as the emotional intensity of gaining $2000. In the content of weight loss, loss aversion causes people to feel intense negative emotions of weight gain at a higher degree than appreciating weight loss. This negative experience does not allow people to appreciate the "good days" and the emotions on the "bad days" take over. On the days people gain weight, they start developing aversion and feel miserable. As this loop continues, it becomes one of the reasons that people stop weighing themselves, in turn losing the advantages of "the scale as a health intention and reminder".

This unnecessary noise or daily fluctuations can create confusion in the weight loss journey. It can be hard to figure out the link between the actions we take and the consequences. For example, imagine that we had a good day, completed a run for 30 minutes, ate a salad for lunch, but when we measure ourselves the next day, we notice a gain in weight. On the other hand, imagine we had a late night snack like a cheesecake, but the scale reflects a loss of weight by 3 pounds. The digital feedback is inconsistent with our actions and behaviors of the previous day. This "unexplained fluctuation" ends up causing friction and confusion leading to feelings of demotivation and aversion. We all expect to have an experience that is consistent with our behaviors and actions. The traditional digital scale although provides a good reminder for the day, the factors of fluctuations, aversion, demotivation and confusion signals a negative experience with the scale and affects the healthier behaviors.

3) Building habits for long-term results

In recent decades, there has been an overflow of evidence based research and advances in the field of behavior science. A key research innovation studied the factors that impact people's behavior. The findings suggest that, not one, but many factors can significantly impact people's behavior, yet bypass their conscious decision-making, attitudes, goals, and awareness.[12 13 14 15]

Hence it is important to consider more than one factor while designing a behavior change model. The three building blocks model applied at Shapa for creating a positive behavior change are: **Routine, Nudges, and Knowledge**.

ROUTINE HABITS

NUDGES

KNOWLEDGE
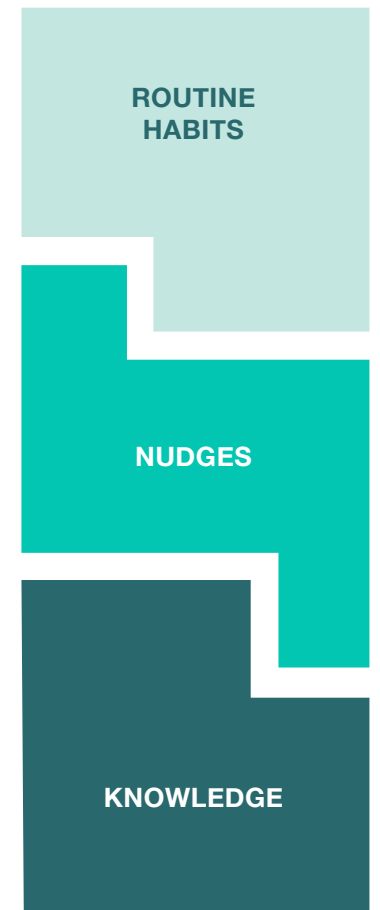
Figure 1

The Three Building Blocks of Behavior Change

ROUTINE HABITS

Routine habits are defined as, "frequent, learned behavioral responses that are cued automatically by context cues, such as physical settings and preceding actions in a sequence" (e.g., morning bathing sequence, food preparation habits). Habits, as confirmed by researchers, are more likely to be formed when people not only repeat frequently, but repeat in the same setting, at the same time of day and/or in the same action sequence.[16]

Research also suggests that if people intend to engage in a behavior, it is important to remind them of the behavior periodically, especially when they are in the appropriate context. When we receive cues and behaviors that are already well established in people's daily practices can be linked to the new, desired behavior. This increases the likelihood that the new behavior is performed and is often more effective than trying to insert a new behavior in isolation from existing practices.

Instead of creating a new, desired behavior "from nothing," it can be more effective to attach the behavior to an existing physical cue in the environment, or an existing behavior, that is already established in people's daily practice. This is where nudges come into play.

NUDGES

Nudges are the environmental cues that signal a desired response from the end user or channel their decision making (e.g., placing fruit at eye level to encourage consumption, changing defaults so that people have to deliberately opt-out of healthy behaviors). These simple daily changes help in making progress towards healthier choices.

KNOWLEDGE

Knowledge is information about evidence based practices, that can improve overall health.

A meta-analysis study investigated the various behavior patterns around habits and intentions. The study compared behaviors that people perform infrequently or in different settings. Intentions signify to be stronger predictors of their future behavior.[17]

However, behaviors that are performed frequently in the same setting are better predicted by habit strength.

Things we do rarely *or* in different environments

Intentions / Attitudes → 0.62 → Future Behavior

Habit Strength → 0.12 → Future Behavior
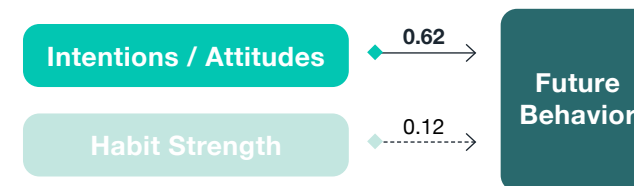
Things we do often *or* in the same environments

Intentions / Attitudes → 0.27 → Future Behavior
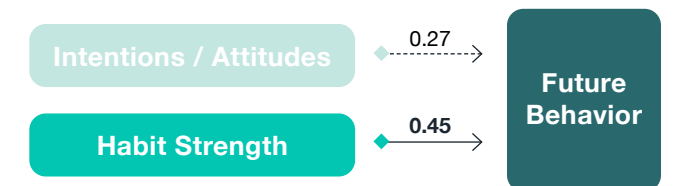
Habit Strength → 0.45 → Future Behavior

Figure 2

Intentions/attitudes indicate future preference. Habit strength indicates the frequency of past behavior. The numbers represent the correlation coefficients.

This principle is clearly applied within the Shapa experience. The numberless weigh-in experience along with the personalized program not only nudges the habit formation in a familiar environment, but also helps in setting the health intentions when people are in different environments.

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The Proposed Solution

Shapa provides a screenless, numberless scale that seamlessly integrates with a mobile app.

The traditional digital display from the scale is replaced with a 5-point visual color feedback model, as an indicator for weight change. The Shapa color feedback model assesses the weight trend over the past few days compared to the past few weeks.

The color feedback mechanism is personalized such that Shapa will follow weight trends and confirm it's a true weight change vs natural weight fluctuation. The goal is to help a member understand if the daily behaviors and actions they have been taking over the past few weeks are getting them closer to their goal.

Positive feedback, or weight loss, signifies a color range of teal and blue. The negative feedback is denoted by light grey and dark grey as an indicator for weight gain. The weight maintenance is also an important phase that needs celebration, so it is denoted by the color green. All color feedback provided is paired with additional guidance and support, particularly if a member received negative feedback to better enable them to make changes and stay motivated. With a traditional digital scale, it can be very challenging to understand the principle of weight maintenance.

This simple, yet effective color feedback mechanism reduces the aversion and confusion associated with daily fluctuations in weight. The Shapa AI goes through training to calibrate to each individual so it can understand the natural fluctuations such as shifts in hydration, salt intake, or hormonal changes that are unique to that individual. When trying to understand these fluctuations with a traditional scale the small decimal changes do not have any statistical significance and just create additional noise and confusion about one's weight trend and behaviors that support weight loss efforts.

The Shapa Color feedback model helps individuals understand how the changes made recently influence the progress towards health goals. The feedback model along with the health goals serves as a guide on the path to success.

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Personalized Lifestyle Program

With Shapa personalized lifestyle program, we create an environment that focuses on building long-term sustainable health. The revolutionary system is built on the 3 building blocks of behavior change: 1) knowledge, 2) nudges, and 3) routine. The combination of these 3 building blocks creates an environment that is favorable for long-term success. The Shapa AI carefully learns about the user's behaviors and activities and provides the right knowledge, nudges that seamlessly integrate with the routine.

Based on the onboarding responses given by the user, Shapa sends daily missions that are designed to build new habits and behaviors to drive the user's closer towards personal goals. These missions are personalized and seamlessly integrate into the user's circumstances and daily life. The missions help the user's make small, positive changes that, overtime, lead to big results in health and wellness. The missions are designed to target the 5 main facets including healthy eating, drinking water, physical activity, space and environment and stress management. Whether focusing on sleep, nighttime snacking, or not reaching for the sweets when bored just to name a few, Shapa's missions are designed to help you build new habits and behaviors to drive you towards your personal goals.

Additionally, a health age and longer term feedback model is utilized within all Shapa programs. The Shapa Age algorithm assesses weight, user-driven goals and progress towards those goals, as well as, member feedback for what age they felt the healthiest. Rewarding engagement in the program and progress towards set goals, the Shapa Age will change over time from starting at one's chronological age to subtracting, or adding, years. A member is rewarded for the healthy habits they are building and progress they're making in the program.

The Shapa system is built on a holistic approach that creates sustainable, long term behavior changes that transform the body and health.

The purpose of this study is to investigate the impact of Shapa, a personalized behavior change program paired with screenless, numberless scale as a proposed solution to prevent or delay development of type 2 diabetes and support sustainable weight reduction within a prediabetic population. This study was conducted in conjunction with a large HMO provider. The two main research questions that we aimed to address through this study are:

Research Question 1: To understand participants' engagement with Shapa as predictors to improved behaviors towards personal health goals.

Research Question 2: To evaluate the impact of Shapa as a digital tool for sustainable weight reduction within a prediabetic population.

METHODOLOGY

Study Design

This study was conducted in conjunction with a large HMO provider. A retrospective analysis was done and participants were screened and randomly assigned to the dietitians. The participants' percentage weight change, movement across BMI categories, weigh-in frequency and program engagement were assessed at 6 months. All the participants received a monthly in-person coaching session with their assigned dietitians along with Shapa, a numberless scale and program. The results were then analyzed and presented at the end of 6 months. The study lasted for 12 months in the spring of 2019 and the members actively participated in the program.

Participants

The participants were screened and recruited by the dietitians who worked for the large HMO provider. The eligibility criteria considered for this pilot is as follows: 1) participants who are at least 18 years of age, 2) overweight with a BMI >25, and 3) no previous diagnosis of diabetes, specifically type 2.
Once the screening was completed, 222 participants were chosen for the study. The HMO provider sent the participants an option to sign up via a landing page and were randomly assigned to a registered dietitian.

In addition to their monthly in-person coaching sessions, each of the recruited participants were provided with a Shapa numberless, wireless bluetooth scale, personalized web-based dashboard, and a mobile phone application for recording their daily weigh-ins, educational content and health tips, reviewing progress and completing daily missions. The Shapa mobile phone application also documented and connected to a fitness tracker, if the participant provided access.

The dietitians received weekly reports of mission engagement, weigh-in frequency and percentage weight change of their assigned patients. The dietitians closely tracked the user's engagement and discussed the results during their monthly in-person coaching sessions.

For the purpose of a comparative analysis, a control group was chosen with a similar study design and participants had enrolled in the Livongo Diabetes Prevention Program (DPP).[18]

The next section of the paper presents the comparison table between both the groups, the results at the end 6 months as compared to the control group and further discussions.

Table 1

Comparative Experience between the Study Group and Control Group

Shapa DPP (Study Group)	Livongo DPP (Control Group)
Numberless Scale with a 5-color feedback mechanism	Traditional digital scale with weight in numbers
Expected daily app engagement: weigh-in and two personalized missions recommended by Shapa	Expected daily app engagement: Food logging and weigh-in
In-person coaching session with dietitians	Video conferencing coaching sessions
Health tips and motivational quotes that follow an approved diabetes prevention program curriculum focusing on diet, exercise, stress management, food buying/choices, and mindfulness.	No nutrition based content was delivered within the app experience.
As a reward of healthier behavior choices, reinforcement or incentive was provided through earning badges, weigh-in streaks and Shapa Age.	No model of reinforcement or incentives were provided

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RESULTS

The findings of the present study are presented in this section. The section includes descriptive statistics for the demographic details of the participants as the first section. The second section highlights the main outcomes of the study including the weight change, BMI and engagement analysis. The final section highlights the Shapa age and subjective assessment analysis.

Table 2

Descriptive Statistics of the Demographic Details of Age (N = 222)

Variables	M	(±) *SD*
Age	47.5	11.17

As seen from Table 2, the total sample size of the present study was 222 with a mean age of 47.5 (SD = 11.17) for the participants.

Table 3

Descriptive Statistics of the Demographic Details of Gender (N=222)

Variables		Frequency	Percent
Gender	Male	66	30%
	Female	156	70%

As indicated in Table 3, the sample consisted of 66 males (30%) and 156 females (70%).

Main Outcomes

1) Weight Change Analysis

The participants who had the Shapa experience (numberless scale and app) were able to achieve an average weight loss of 5% in the first 6 months. As compared to the control group, the participants who were part of the Livongo Diabetes Prevention Program (DPP) who weighed on the digital scale had lost an average weight loss of 5% only at the end of 12 months.

The participants weight change percentage was analysed month by month. The results indicated a steady decrease in weight at 30 (2.33%) 60 (3.06%), 90 (3.83%), 120 (4.65%), 150 (4.73%) and 180 days (5%).

Figure 3
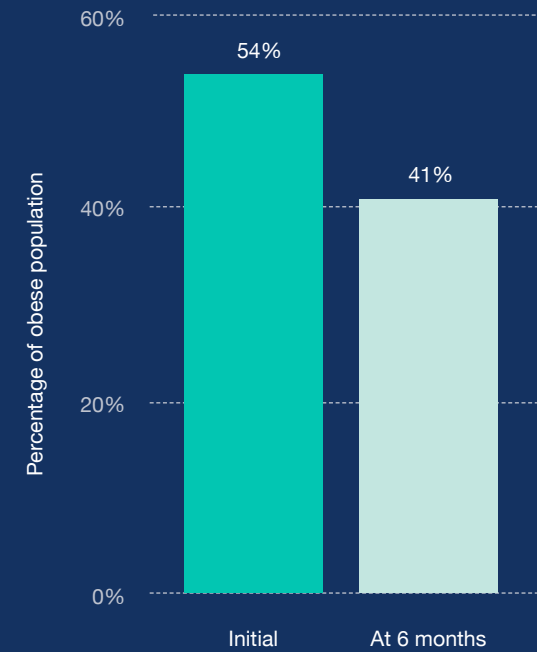
Average Percentage Weight Change
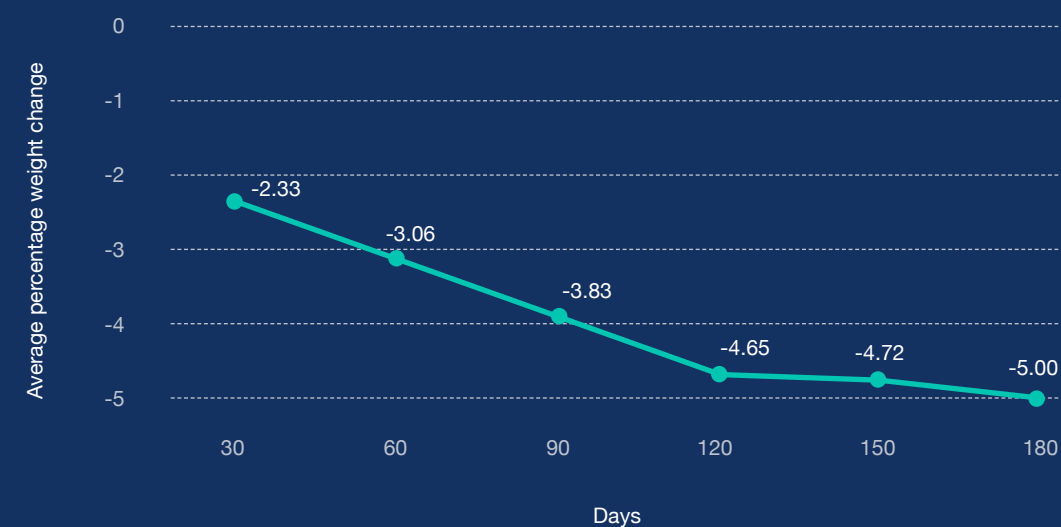
Overall, more than half of the participants, 54.28% of the participants had achieved an average weight loss of 5% of their body weight from their initial weight in the first 6 months.

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2) BMI Analysis

Of the 222 participants, 119 (54%) were obese at the beginning of the program, and 91 (41%) were obese at the end of 6 months.

Overall, 42% moved from obese to overweight BMI category and 19% moved from overweight to normal BMI category, achieving a significant reduction in weight and resulting lower BMI within the first 6 months of their Shapa program.

Figure 4

Initial and Final Percentage of Obese Population
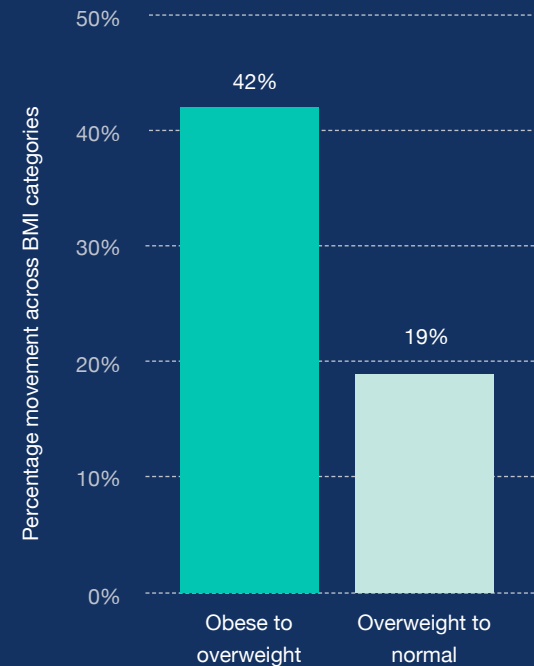
Figure 5

Percentage Movement Across BMI Categories at 6 months

3) Engagement Analysis

The change in body weight is related to the participant's level of engagement within the Shapa program. Overall the engagement with the scale and the program was high, with 61.2% of participants stepping on the scale and weigh-in five or more times per week.

In addition to the weigh-in results, correlation analysis with weight loss and weigh-in (measurements) showed higher weight loss with higher frequency of weigh-in ($r = -0.34$, $p = 0.09$)

Of the 222 participants, we considered users who step on the scale and weigh-in more than 4 times a week as highly engaged participants (N=68). In the first 6 months, highly engaged participants lost 5% of starting body weight, with 11% losing ≥10% of their body weight in the first 6 months. Strong daily engagement is an indicator of sustainable long-term behavior change and weight loss. ($r = -0.24$, $p = 0.11$)

Other Results

1) Shapa Age analysis

Considering the high level of engagement in the Shapa program, rewarding engagement metrics strongly indicated the participants to progress towards set goals. 96% of the participants within the Shapa program made progress towards their weight and health goals, and see a decreased Shapa Age. The Shapa Age will change over time from starting at one's chronological age. The participant's level of engagement is recognized and rewarded for the healthy habits they are building and progress in the program.

2) Subjective assessment analysis

Finally, participants were sent an assessment to survey the effectiveness of the Shapa program. This was a subjective assessment. 52% reported that they review the progress history within the Shapa app 1-3 times a week. 59% reported that the Shapa program was influential in their daily decisions and increased the desire for change around engaging in a healthy lifestyle.

DISCUSSION

Obesity has emerged to be a leading global concern over the last century for individuals, medical professionals, healthcare and companies. In accordance with the WHO, overweight and obesity account for 44% of the diabetes cases and type 2 diabetes is most strongly associated with obesity. The prevalence of obesity-related diabetes is expected to double to 300 million by 2025. This strong association led to the emergence of the connotation 'diabesity'. Furthermore, the healthcare expense for management of diabetes alone is estimated to be $1.3 trillion dollars. Those living with type 2 diabetes account for 90-95% of the overall disease burden.[19]

As a part of Shapa's commitment to reduce the prevalence of obesity and diabetes, we propose a research-based, highly structured and sustainable lifestyle change program as a solution to prevent or delay onset of type 2 diabetes.

By integrating the principles of behavioral science, Shapa provides a personalized behavior change program paired with screenless, numberless scale as a proposed solution to prevent or delay development of type 2 diabetes and support sustainable weight reduction within a prediabetic population.

The key components for a successful and effective DPP within the Shapa model include a Shapa numberless, wireless bluetooth scale, personalized web-based dashboard, and a mobile phone application for recording their daily weigh-ins, educational content and health tips, reviewing progress and completing daily missions. The Shapa mobile phone application also documented and connected to a fitness tracker, if the participant provided access. The positive 5-color feedback model and incentives within the app experience breaks the frustrations and fluctuations caused by a traditional digital scale. Additionally, it creates a rewarding experience through fostering the building of new habits and behaviors that in turn drive towards sustainable, long term behavior changes.

This study leverages the scalability of digital health solutions with DPP programs. While several studies support the importance of digital health, there is a clear need for cost-effective solutions. Furthermore, there is a need for the application of health economic principles to drive medical decisions by health systems to improve the health care costs and resources. Additionally, research also highlights the direct correlation between lifestyle interventions as a factor that can improve the quality-of-life, reduce costs, and complications associated with type 2 diabetes.[20]

Compared to the traditional digital scales and other DPP programs, the use of behavioral science principles with the personalized lifestyle program reveals opportunities for Shapa as a solution for various health conditions. The use of personalized feedback, nutritional education and technology provides effective health reminders leading to sustainable long-term behavior changes and health outcomes.

The numberless scale, paired with the personalized program and 1:1 coaching bridges technology with healthcare. This increases the scalability and creates successful health outcomes. Within the first 6 months of the program participants achieved an average weight loss of 5%. The progessive change in body weight coincided with participant's level of engagement within the Shapa program, with 61.2% of participants stepping on the scale and weigh-in five or more times per week. As confirmed by similar studies, the adherence to daily weigh-in acts as a reminder and increases the motivation for behavior change, and ultimately leading to greater weight loss. Furthermore, 42% of participants moved from obese to overweight BMI category. Within the first 6 months, 96% of the participants continued to make progress towards health goals. This clearly addresses the 'diabesity' epidemic by providing a rewarding solution by achieving improved health outcomes.[21]

This study provides a new revolutionary dimension of a numberless scale by creating an evidence-based digital platform. The study

highlights the core strengths by achieving real-world outcomes in weight loss and insight into the holistic lifestyle program that drives participant engagement. The rewarding experience within the Shapa program was the only incentive for the participants. No participatory incentives were provided.

Future studies can be conducted with a larger sample size and use of advanced statistical methods (regression) to better understand the applicability and representativeness of the population at large. Furthermore, it is important to gather information from the other variables tracked by the participants including practices outside Shapa or use of other digital self-monitoring tools that can create noise in the results.

In conclusion, the Shapa numberless scale along with a personalized lifestyle program was successful in delivering accessible digital health, and for the purposes of this study focused on diabetes prevention. Through a focus on mitigating the risk factors such as weight reduction, increasing in physical activity, stress reduction, and lifestyle behavior modification; Shapa provides a scalable solution for tackling a number of different chronic diseases where prevention and management benefit greatly for improvements in an individual's daily behaviors and actions.

> " Compared to the traditional digital scales and other DPP programs, the use of behavioral science principles with the personalized lifestyle program reveals opportunities for Shapa as a solution for various health conditions. The use of personalized feedback, nutritional education and technology provides effective health reminders leading to sustainable long-term behavior changes and health outcomes.

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