

The Health Bank (THB) Connected Care Program: A Pilot Study of Remote Monitoring for the Management of Chronic Conditions: Focusing on Diabetes

Reem Saad, Senior Nutritionist & Care Coach, The Health Bank

Alizeh Ahmad, Strategy Analyst, The Health Bank

Sana Khalid, Nutritionist & Diabetes Educator, The Health Bank

Abstract:- Globally, noncommunicable diseases (NCDs), also termed as chronic conditions, account for a disproportionate number of deaths annually. The main types of NCDs are cardiovascular, cancers, chronic respiratory conditions, and diabetes. These diseases kill approximately 41 million individuals annually and account for 71% of overall deaths. Despite amounting evidence showing the socio-economic impact of these manageable conditions, the global call to action remains less than adequate [1]. Chronic diseases are defined as health conditions lasting for over one year or more. Chronic diseases such as diabetes are associated with repeated hospitalizations and pose a grave public health challenge [2]. During the COVID-19 pandemic, reducing hospitalizations due to chronic diseases became necessary, which led to the emergence of non-invasive remote monitoring. Research has consistently shown that remote monitoring helps in achieving better glycemic control in patients with diabetes [3].

The Health Bank (THB), a global healthcare company, conducted a pilot study “THB Connected Care Program” to examine the relationship between remote monitoring and patient outcomes in patients with chronic conditions, focusing on diabetes. Patients were remotely monitored using a variety of devices (iHealth glucometer, Freestyle Libre, and Medtronic – Guardian Connect) for a period of three months. The results of our study suggest that remote monitoring helps in achieving improved patient engagement and better parameter outcomes. This pilot serves as a foundation for further studies that can help in the wider adoption of remote monitoring in persons with chronic conditions.

I. INTRODUCTION

At THB, our mission is to provide excellence in healthcare services, powered by technology to enhance patient outcomes. Our compassionate, personalized approach to care ensures a seamless patient journey in chronic conditions, such as diabetes.

Chronic diseases or conditions that last over a year can lead to a considerable socioeconomic burden. Globally, one in every three adults are living with more than one chronic condition, amassing huge health and economic burdens [4].

A US study indicated that, as compared to non-diabetics, patients with diabetes have direct medical costs 2.3 times higher at an annual per capita excess cost of \$7,888 due to their condition [5]. Recent global estimates suggest that 537 million adults in the age group 20-79 years are currently living with diabetes. Since 541 million adults already have Impaired Glucose Tolerance (IGT), indicating a high risk of type 2 diabetes, it is predicted that the number of persons with diabetes will rise to 643 million by 2030 and 783 million by 2045 [6].

According to the International Diabetes Foundation, it is estimated that the Middle Eastern and Northern Africa (MENA) region spent approximately 13.6 billion USD on diabetes care in 2013 alone. Under this trend, it is evident that the burden of such chronic diseases will continue to rise in the MENA region, thus overloading already burdened healthcare budgets. In 2012, 4 GCC countries (Kuwait, Saudi Arabia, Qatar, and Bahrain) were flagged within the top 10 countries to have the highest diabetic prevalence globally, within the 20–79-year-old population demographic [6]. Such statistics highlight the need for preventative care programs, low-cost programs, and remote monitoring of patients [6]. By conducting this pilot, we at THB believe it is imperative to test a remote monitoring program to meet the future needs of our patients not just with diabetes, but also any other chronic conditions.

II. OBJECTIVE AND STUDY RATIONALE

THB’s Connected Care Program aims to increase not only the awareness around diabetes but also provide patient centered avenues of management. We hypothesized that patient involvement in monitoring increases patient compliance. The program focused on implementing self-management of chronic conditions with continuous monitoring by a multidisciplinary team. Although the main objective was to follow care plans continuously along with remote monitoring, the research also aimed at reducing the burden on an overburdened healthcare industry and improving outcomes with potential cost savings.

In this paper, we evaluate the implementation of the THB Connected Care Program and the use of the PERS rating system in improving clinical outcomes. Our aim is to introduce a new level of care management to help reduce

hospitalizations and emergency visits where possible, through a proactive and preventative patient centric approach. As a long-term goal, we aim to reduce the global burden of care associated with chronic conditions at large.

III. METHODS

A. Intervention

The Connected Care program is designed for people with chronic conditions such as obesity/overweight, hypertension, or diabetes. In this program, participants were given a Continuous Glucose Monitoring device (Medtronic – Guardian Connect) or a Flash Monitoring Device (Abbott - Freestyle Libre) or a regular glucose monitoring device (iHealth BG5 glucometer) and asked to measure their readings daily for a 3-month period.

Additionally, depending on their condition, participants improved their lifestyle and self-monitored their health, by tracking blood parameters such as HbA1c and, fasting blood sugar. Participants were also advised to achieve weight loss (if required), improve their body composition analysis, and enhance levels of physical activity.

We used complementary smart technology devices to support the remote monitoring of the patient, where all their data was recorded and shared with our team in real-time. The continuous monitoring (data history) supported patients with long-term management and provided their endocrinologist a detailed insight into their condition, allowing for enhanced accuracy of care delivery and treatment. In cases where the patient did not have an endocrinologist, the THB care team referred them to a physician.

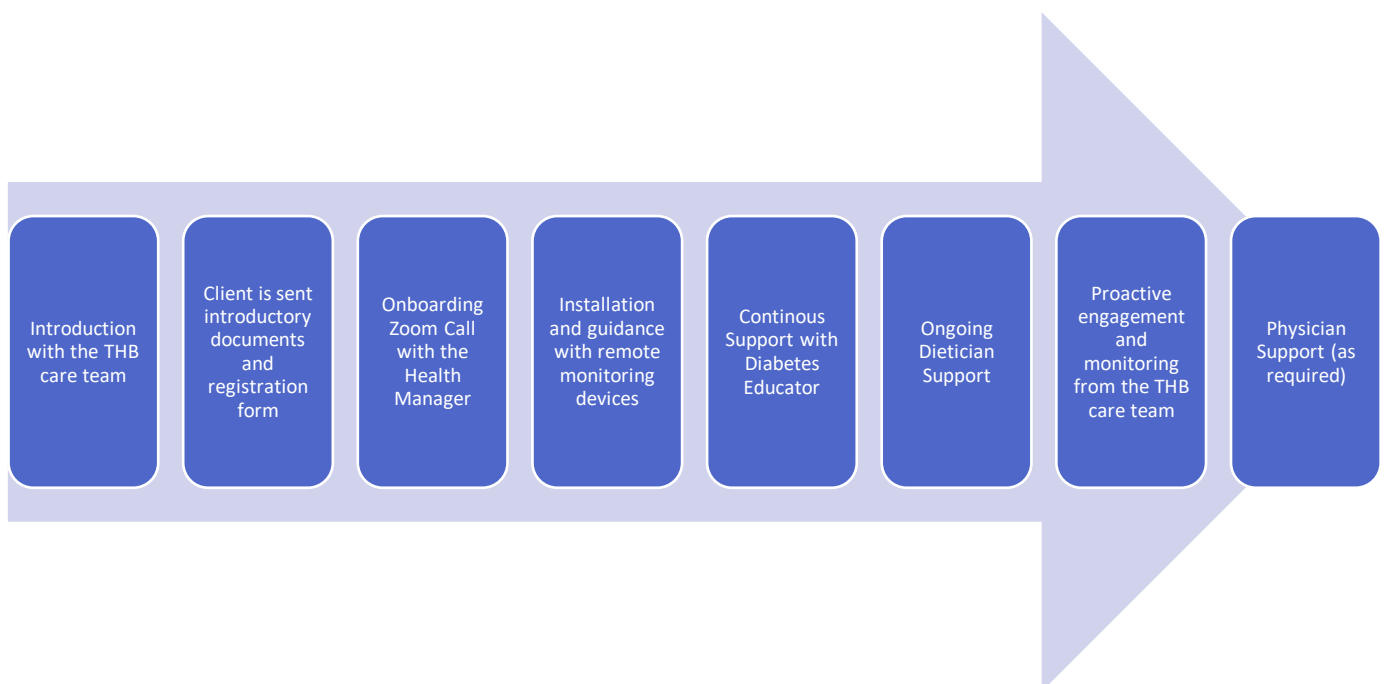


Fig 1. Flow chart of the patient journey in THB Connected Care Program

B. Outcome Measures

- THB has developed a unique 5-Star Patient Engagement Rating System (PERS) to drive the following outcomes:
- Motivate patients to improve their health care and subsequently involve them in their care plan
- Quantified initiatives towards health improvement
- Track and quantify progress through wearable connectivity with the portal
- Monitor readings, trends, and engagement, allowing for personalized nudges and reminders

The PERS is a scoring system assigned for each participant that rates their progress in terms of 1) readings, 2) whether they've reached their targets which are pre-set upon onboarding 3) the effort they've put in towards reaching their goals through certain activities, like drinking water, logging their readings, achieving daily step targets or, using healthy cooking techniques, 4) going to their doctor's appointments,

5) checking their HbA1c, 6) advised activities, and 7) the number of wearables used to monitor their progress. Each activity has a specific score, and all these scores are compiled together to give a cumulative score that represents patient participation in the program. That average score will identify the degree of success that participant has achieved towards reaching their targets and improving the outcomes for their specific condition.

Every patient was provided a specific care team that included a dietician, a health manager, and a diabetes educator (for diabetic patients in particular). The care team was responsible for overall patient handling and coordination, monitoring and sending reminders for patient readings, and guiding patients through high or low disease episodes so that they could identify triggers and manage their symptoms better. The care teams were also responsible for understanding the patients' lifestyle (i.e., work patterns,

habits, hobbies, food preferences) and creating a tailored program for each patient. The Connected Care program ensured that patients felt supported, engaged, and empowered to improve their own health, by being masters of their own healthcare journey.

C. Participants (Demographics)

The study recruited 32 patients (14 female, 18 male), from ages 22 to 81.

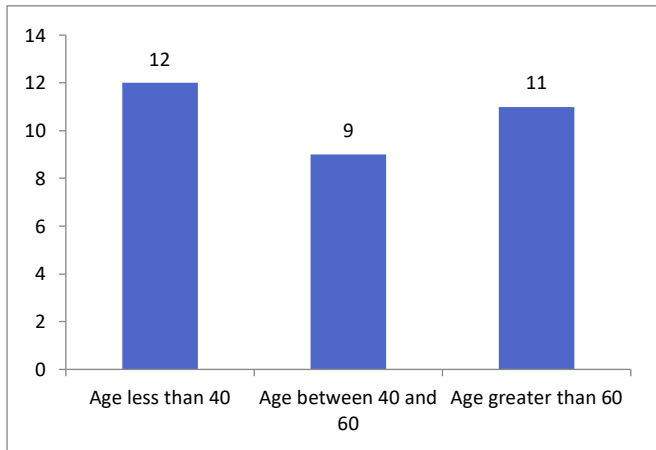


Fig 2: Participant age-groups

21 patients had diabetes and their blood sugar ranged from 150 to 500 mg/dl. 11 patients had metabolic disorders such as hypertension and weight loss.

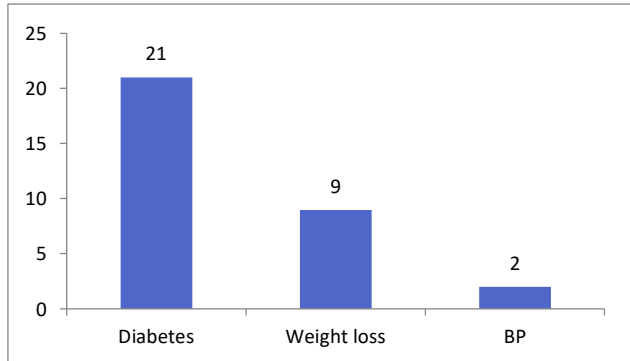


Fig 3: Diagnosis of Patients

Patients were provided with monitoring devices and followed for three months. 22 participants adhered to the program for more than 2 months.

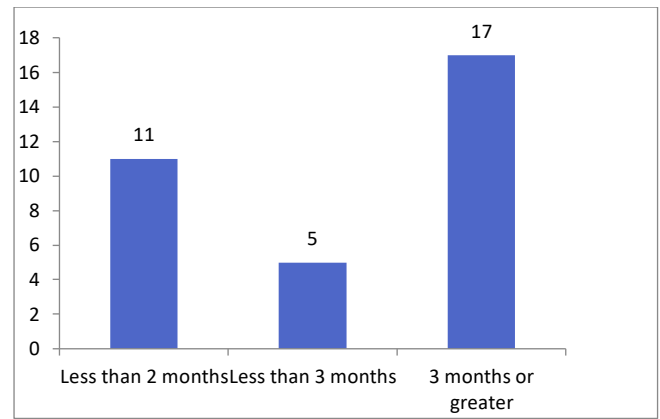


Fig 4: Program duration and the number of patients

IV. RESULTS

A correlation analysis of the data revealed that our results were in alignment with our primary hypothesis. It is to be noted, correlation values range from 1 to -1. The higher the correlation value, the higher the relationship between the variables. Also, it is to be noted that p-values must be less than 0.05 for the result to be considered statistically significant.

A. Statistical Analysis

➤ **Patient Engagement Rating Score (PERS)**

A 5-Star Patient Engagement Rating Score (PERS) was developed, based on the engagement efforts made by patients as well as the outcomes achieved. Specific weights were given to engagement parameters (such as doctor check-ins, taking of readings, exercise, as well as outcomes attained i.e., whether patients were able to reduce their parameter readings according to targets set at the beginning of this program). Because of the quantitative nature of the PERS score, it was also helpful in monitoring trends, alerting the care team in case there was a lack of overall progress and providing interventions accordingly. A correlation analysis was conducted to understand the relationship between PERS scores and factors such as age, duration, and chronic conditions.

➤ **Patient engagement leads to improved patient outcomes**

We found a definite positive correlation, $r(32)=.52$, $p=.002$, between patient engagement and patient outcomes as the trendline below shows (See Figure 5).

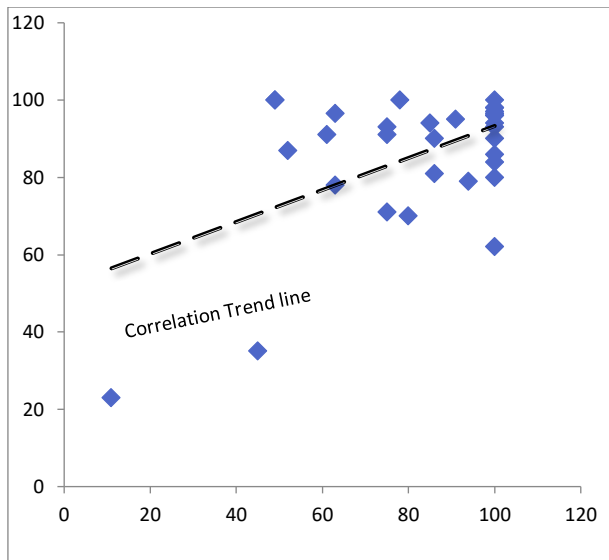


Fig 5: Correlation between Patient Engagement (x axis) and Outcome (y axis)

➤ *The duration of engagement influences improved patient outcomes*

A positive correlation was found between engagement and patient outcomes for patients who had spent at least 3 months in the program, $r(17)=.62, p=.007$. Average scores at 2 months were 92 and showed a slight decline to 89.9 at 3 months.

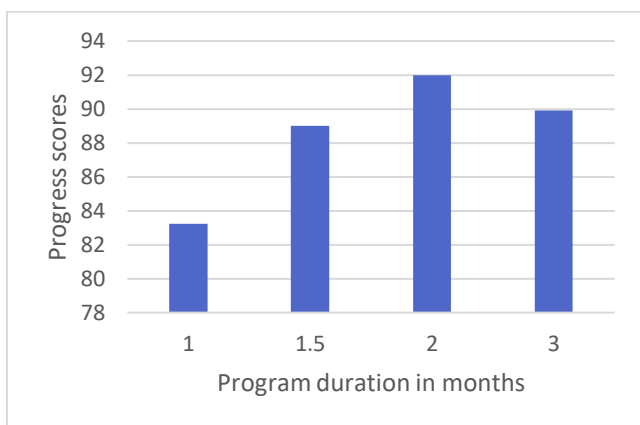


Fig 6: Average progress scores over the duration of engagement

We believe that it is imperative for healthcare service providers to spend sufficient time engaging with their patients to derive the best results.

➤ *Patients with diabetes show increased program engagement and improved outcomes.*

A positive correlation was found between engagement and patient outcomes for patients who were treated for only diabetes rather than other conditions ($r(21)=.62, p=.002$). It is not to say that engagement is not needed for other conditions, but instead that diabetes patients are likely to be more driven to improve given the nature of the disease. Our participation was the highest for diabetes patients and the least for hypertensive patients.

➤ *The effect of age on patient engagement and outcomes*

Patients across all the age groups were able to participate in the program. Although patients between age 40-60 years showed high scores, no significant effects of age were observed on patient engagement and outcomes.

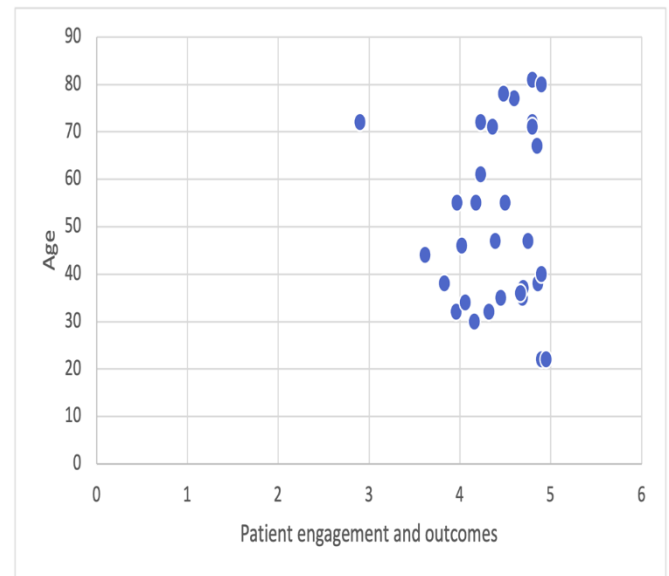


Fig 7: Patient age does not affect patient engagement and outcomes

V. DISCUSSION

This pilot study was conducted to understand the relationship between remote monitoring and patient outcomes in chronic conditions, focusing on diabetes. We observed that patient engagement played a pivotal role in improving patient outcomes insofar as the higher the level of patient engagement there was, the greater the improvement in patient outcomes also was. Our findings indicated that the higher the level of patient engagement, the better the glycemic control and vice versa.

During the COVID-19 pandemic, the overall use of remote monitoring devices (e.g., mobile phones) has greatly increased. In this era of rapid development and globalization, chronic conditions such as cancer, diabetes, and hypertension are monitored using apps or other measuring devices [7]. Our results were similar to the findings of the meta-analysis conducted looking at the impact of telehealth remote patient monitoring on glycemic control in type 2 diabetes [3]. Our study provides supplementary evidence that remote monitoring for patients with diabetes is a cost-effective, easily implementable, and low-resource tool that can work at enhancing patient outcomes.

Engagement increased patients' knowledge of their condition and facilitated them in being active members of their own decision-making. This in turn helped them take control of their condition, thus having a positive impact on their engagement and subsequently their performance. It is important for healthcare service providers to set up engagement processes with their patients including timely interventions to gain significant, measurable outcomes.

Similar findings were reported by studies that examined diabetes self-management by facilitating lifestyle management. Patients with diabetes were shown to improve glycemic control by weight loss and an increase in physical activity [8].

Diabetes alone led to 6.7 million deaths in 2021 and caused at least USD 966 billion dollars in health expenditure. This was a 316% increase over the last 15 years [4]. In the next decades, the burden of chronic diseases, specifically diabetes, is expected to skyrocket. The Middle East will face its highest ever increase in the frequency of type 2 diabetics globally, touching approximately 60 million diabetes by the year 2030 [9].

We hope to reduce this economic burden by developing a low-cost program and providing it to all patients with diabetes and other chronic conditions. Our key success lies in those who were compliant with the program, achieved targets, improved their readings, and focused on their general wellbeing. We've had multiple success stories of patients reversing their diabetes while others achieved a reduction in medication and, a large percentage ended up with a manageable controlled condition. This is a testament to how low-cost programs can be successful at managing chronic conditions.

One of the main limitations of the study was the small sample size, which meant that generalizing the results to a larger population is not entirely feasible. However, our results allow us to plan for a larger test and transition study that we believe will yield the same findings. The study experienced a few challenges that were mostly related to connectivity issues. Some patients were not as familiar and comfortable with using technology and required physical support relatively often to resolve connectivity problems. Another challenge would be the incompletion of clients to the care plan set by the care team; those patients were unable to achieve goals and therefore didn't benefit from the program. Patients continuously needed to be reminded to take their readings, which invariably was demanding on the care team, as frequent interventions were required on their end to encourage patients to self-monitor. However, it should be noted that this is the first study in the MENA region that used a structured remote program and an electronic engagement rate system.

VI. CONCLUSION

THB follows a preventative, out-come driven, personalized, team-based care approach, that is focused on delivering care proactively, rather than reactively. By promoting a patient-centered approach, we involve our patients in the decision making, education and awareness along with guiding them through their care program. This leads to the patient being engaged and empowered in their own care. Understanding the patients' environment factors, work patterns, habits, hobbies, food preferences and other similar factors, helps us in developing a tailored program that will work for that specific individual. In addition to managing the patients' chronic conditions, we focus on educating and

supporting our patients to feel empowered thus helping them make better lifestyle choices and improve their self-management abilities.

As patients with chronic conditions become more engaged in their care journey, they see themselves as active masters of their health rather than just being passive onlookers. Patients typically show greater levels of preventive care, as well as increased self-management of health conditions. Greater patient engagement not only results in improved patient outcomes, but also reduced hospital admission rates, and costs while enhancing medication adherence. For patients diagnosed with chronic conditions, remote monitoring leads to a plethora of positives, ranging from increasing knowledge of the disease, earlier clinical assessment and treatment options, greater sense of self-management and overall improved decision making.

REFERENCES

- [1]. GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*, 2016; 388(10053):1659-1724
- [2]. Van Cleave, J.H., et al., Multiple Chronic Conditions and Hospitalizations Among Recipients of Long-Term Services and Supports. *Nursing Research*, 2016. 65(6): p. 425-434.
- [3]. Lee, P.A., G. Greenfield, and Y. Pappas, The impact of telehealth remote patient monitoring on glycemic control in type 2 diabetes: a systematic review and meta-analysis of systematic reviews of randomised controlled trials. *BMC Health Services*
- [4]. Marengoni A., Angleman S., Melis R. Aging with multimorbidity: a systematic review of the literature. *Ageing Res. Rev.* 2011;10:430–439.
- [5]. McEwen, L.N. and W.H. Herman, Health Care Utilization and Costs of Diabetes, in Diabetes in America, C.C. Cowie, et al., Editors. 2018, National Institute of Diabetes and Digestive and Kidney Diseases (US): Bethesda (MD)
- [6]. International Diabetes Federation. IDF Diabetes Atlas, 10th edn. Brussels, Belgium: 2021. Available at: <https://www.diabetesatlas.org>. Available from: http://www.idf.org/sites/default/files/5E_IDFAtlasPoster_2012_EN.pdf
- [7]. Muli, E., et al., Leveraging technology for health services continuity in times of COVID-19 pandemic: Patient follow-up, and mitigation of worse patient outcomes. *J Glob Health*, 2021. 11: p. 05024.
- [8]. Koenigsberg, M.R. and J. Corliss, Diabetes Self-Management: Facilitating Lifestyle Change. *Am Fam Physician*, 2017. 96(6): p. 362-370.
- [9]. Habibzadeh F. Diabetes in the Middle East. *Lancet*. 2012;380:1. [[Google Scholar](#)]