2024 APRU Virtual Global Health Case Competition

"Improving Diabetes Care Management through Technological Innovation"

INTRODUCTION

Thank you for participating in the 9th annual APRU Global Health Case Competition. We hope that you will have a challenging and rewarding educational experience. Please remember that this case represents a complex scenario and that there is no single "right" plan. Your challenge is to develop and justify a strategy to respond to the challenge. We encourage teams to consider a balance of innovative yet realistic, evidence-based solutions. Note that this challenge is hypothetical but many economies around the world are currently considering how to address this problem.

OVERVIEW

The number of people with diabetes around the world is rising, especially in low- and middle-income countries (LMICs). Diabetes can be treated and its complications avoided or delayed with regular screening and treatment. In this challenge, teams will create a technology-based solution to improve diabetes care for patients in one economy in the Asia-Pacific with an APRU member

institution[1]. The overall challenge is to address the low rates of adherence to treatment about people with diabetes. If your proposal is selected by the local city government, your team would work closely with the Ministry of Health over the next three years. The plan must address either individual-level ***or*** systems-level barriers to treatment using technology with a total budget of US$1 million.

BACKGROUND

Introduction

Diabetes is a chronic metabolic disease characterized by elevated levels of blood glucose (or blood sugar). Type 2 diabetes is the most common form, usually found in adults, in which the body either becomes resistant to insulin or doesn't make enough insulin (WHO, 2023).

The number of people with diabetes has nearly quadrupled since 1980, causing serious negative economic and social implications worldwide. The International Diabetes Federation reports that as of 2021, 540 million adults are living with diabetes worldwide. By 2045, this number is expected to reach 783 million, an increase of 46% (IDF, 2024). Over 80% of people with diabetes live in low- and middle-income countries (LMICs) (GBD 2021 Diabetes Collaborators, 2023). The global diabetes prevalence is estimated to be close to 10% and will rise above 10% by 2030. The prevalence is higher in urban areas and it also differs by age; for example, it is about 5% for people 35-39 but close to 20% for people 65-69 years. Furthermore, there has been a concerning rise in youth-onset type 2 diabetes, particularly in recent years. Studies have highlighted the increasing prevalence of type 2 diabetes among children and adolescents, indicating a shift in the demographics affected by this disease (Perng et al., 2023). Notably, youth-onset type 2 diabetes often presents a more aggressive clinical course and is associated with higher rates of complications compared to adult-onset type 2 diabetes. This awakening epidemic among the younger population underscores the urgency of addressing diabetes as a global health priority. In addition, diabetes affects especially LMICs, as 77% of all people with diabetes worldwide live in those countries. In addition, an estimated 352.1 million people worldwide are pre-diabetic and this number is expected to rise to 531.6 million by 2045 (Standl et al., 2019; Saeedi et al., 2019).

Every five seconds someone dies due to diabetes. Diabetes is responsible for 6.7 million deaths each year, making it one of the top 10 causes of death and disability globally. Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation (WHO,

[1] Please see the APRU website for list of eligible economies.

2023). A healthy diet, regular physical activity, maintaining a normal body weight, and avoiding tobacco use are ways to prevent or delay the onset of type 2 diabetes. Alarmingly, one-half of people living with diabetes are unaware that they have it (Saeedi et al., 2019; IDF, 2023).

Treatment Issues

Treatment in terms of diabetes means not only medications, monitoring of blood glucose levels, and regular medical visits but also many other self-care behaviors, such as weight reduction and regular physical exercise (Sapkota et al., 2015). Diabetes differs from many other chronic conditions in that it requires frequent monitoring and continuous management, by the patient and the healthcare provider (Al-Badi & Hamdy, 2021; Baryakova et al., 2023). The self-management of diabetes is crucial to improving outcomes and quality of life. But it can be difficult due to many factors, such as lifelong medication requirements and the need for changes in lifestyle, along with factors such health disparities and psychological distress that may occur.

Non-adherence to diabetes treatment is a problem in LMICs as well as high-income settings (Delamater, 2006; Morello & Hirsch, 2017). Studies show that more than one-half of patients with diabetes fail to reach their glycemic goals (Morello & Hirsch, 2017). The progressive nature of diabetes and the resulting lifelong dependence on medications pose serious challenges for both patients and the healthcare system (Morello & Hirsch, 2017). Non-adherence to treatment can be related to both systemic- and individual-level barriers. For example, individual barriers may include financial problems, occupational factors, low education/lack of knowledge, cultural beliefs, co-morbidities, and personal feelings of helplessness or fear (Delamater, 2006; Bussell et al., 2017; Morello & Hirsch, 2017). Systems barriers include inadequate equipment and facilities, lack of time and training among providers, supply chain issues, lack of health workforce, cold chain problems in the case of insulin, and poor inter-sectional coordination (Morello & Hirsch, 2017; Hashemi & Bouya, 2018). Research has suggested strategies to increase treatment adherence at the individual level may include improvement of patients' knowledge about the disease, better access test results, and the enhancement of the patient performance and motivation in adherence to treatment (Hashemi & Bouya, 2018). Studies have also shown that health systems strengthening and a more coordinated and systematic approach to medication management and treatment compliance across providers and health systems has the potential to improve patient adherence and clinical outcomes on a wide scale (Delamater, 2006; Morello & Hirsch, 2017; Hashemi & Bouya, 2018; Ong et al., 2018).

Technology for Diabetes

Technological innovations have the power to improve the health and well-being of people with diabetes. "Diabetes technology" is the term used to describe the hardware, devices, and software that people with diabetes use to help manage their condition, from lifestyle to blood glucose levels.

Technology for diabetes treatment and management could improve diabetes adherence to treatment. Empowering people to take control over their health could lead to better health outcomes and improved quality of life. Technology can also be used by providers or at the health systems level to support provider decision-making to provide a higher quality of care, meet gaps in access to specialist care, and lower healthcare costs and the burden to the healthcare systems (Daly & Havorka, 2021; Elbert et al., 2023; Baryakova et al., 2023).

New technologies have largely focused on improving patients' self-management of diabetes through improved insulin administration tools and continuous blood glucose monitoring systems. For example, wearable minimally-invasive continuous glucose monitoring sensors are revolutionizing diabetes management, and are increasingly adopted technology especially for diabetics (Cappon et al., 2019). The use of remote, personal tools such as apps, sensors, watches, and other devices has increased globally. More recently, diabetes technology has expanded to include other tools that provide support for diabetes care at the health systems level as well. Some examples include:

- **Telehealth** may increase access to care for people with diabetes who are not otherwise able to see a specialist, particularly in rural settings (Al-Badri & Hamdry, 2021; Klonoff et al., 2023).
- **The incorporation of diabetes digital data into electronic health records** could provide improved patient and provider on-demand access to medical record data, such as clinical notes, test results, and medications. These systems could help provide clinical decision support for providers, as well as facilitate the exchange of information through different health systems for various members of a diabetes care team (Klonoff et al., 2023).
- **Artificial-intelligence (AI)** and the development of algorithms that can learn over time to recognize patterns and make predictions without being explicitly programmed could help optimize treatments for people with diabetes, and diagnose diabetic complications in their early, treatable stages (Klonoff et al., 2023). Predictive analytics algorithms can also analyze large datasets of patient health records, lifestyle factors, and genetic predispositions to identify individuals at high risk of developing diabetes or its complications. Early

identification of at-risk individuals allows for targeted interventions and preventive measures to mitigate the progression of the disease (Contreras & Vehi, 2018; Ellahham, 2020;

- **Better diabetes registries** could be a valuable source of data to inform real-world decisions and shape national policies. The incorporation of data collected from electronic health records (EHRs), insurance claims, pharmacy records, social media, and sensor outputs from devices form real-world evidence that can supplement electronic health records. For example, registries could include information usually missing from EHRs, such as data on the social determinants of health which have a major impact on diabetes outcomes, or patient-reported outcomes that can be used to measure quality of life (Klonoff et al., 2023). Blockchain technology can enhance the security and interoperability of EHRs by providing a decentralized and tamper-resistant platform for storing and sharing patient data. This can improve data integrity, privacy, and accessibility, facilitating better coordination of care among healthcare providers and ensuring continuity of diabetes management (Han et al., 2022; Schmeelk et al., 2022).
- **Chatbots and virtual assistants powered by natural language processing (NLP) algorithms** can provide personalized education, support, and guidance to individuals with diabetes. These virtual agents can answer questions, offer lifestyle recommendations, and provide reminders for medication adherence and healthcare appointments, enhancing patient engagement and self-management skills (Nayak et al., 2023).
- **SMS and Mobile health (mHealth) applications** can empower individuals with diabetes to manage their condition more effectively by providing tools for tracking blood glucose levels, medication adherence, diet, and physical activity. These apps can also offer personalized recommendations and reminders to help users maintain healthy habits (Kassavou et al., 2020; Unnikrishnan et al., 2022; Lauffenburger et al., 2024).
- **Remote patient monitoring systems** can also enable healthcare providers to remotely monitor patients' health data, including blood glucose levels, blood pressure, and weight, in real-time. This technology allows for early detection of fluctuations or abnormalities, facilitating timely interventions and reducing the risk of complications (Ellahham, 2020; Johnson & Miller, 2022).

However, the complexity and rapid change of the diabetes technology landscape can create a multitude of barriers to the use of technology-based tools for patients, including lack of digital literacy, concerns about privacy, lack of insurance coverage for new devices, and the digital divide (Huang et al., 2023). At the systems level, barriers may include providers' lack of time for patients, lack of knowledge or comfort with technology, and trouble keeping up with newly released technology (Elbert et al., 2023; ADA, 2022). To be successful, the technology must be accessible, affordable, and people must be willing to use it (Klonoff et al., 2023).

The Challenge

Your team, acting as consultants, has been asked to provide an innovative plan to improve adherence to treatment among people with diabetes. In this challenge, teams are tasked with build on existing technology to create a program to improve adherence to treatment for diabetes in one economy in the Asia-Pacific region. While information to raise awareness about diabetes is important for prevention and control of this disease, another grant is being offered for the development of educational programs so your proposal does not need to focus on this. In addition, behaviors around physical activity and healthy eating are crucial to preventing and managing diabetes, but the focus of this proposal should be self-management of specific diabetes-related behaviors not related to exercise of nutrition. Therefore, your team should focus on other barriers to treatment adherence. You can choose to target either patient-level **or** systems-level issues. For example, a program for patients might target using technology to improve self-management through empowering patients to better monitor their blood glucose levels, or with ways to better monitor their health data over time while a program focused on the health systems might improve diabetic patient data in electronic health records through digitization or to improve access to follow-up care through telemedicine. You will be given a budget of US$1 million for a three-year program.

The plan should include the following:

- An analysis of the problem of diabetes in the chosen country/economy, especially focused on the contextual factors that contribute to the risk of diabetes in this population (please make sure your chosen economy is one of the 19 listed on the APRU website)
- A detailed description of the main program objectives and activities, including a detailed description of the technological tool or solution and how your program will adapt/use it

(please note that you do not need to use one of the examples listed in the background; you are free to use anything technology-related). Keep in mind that any digital projects (apps or software or devices) should be designed on open-source, interoperable technology platforms that are compliant with (like FHIR or HL7 and ICD-11 taxonomy)

- Explanation of the main benefits of this technological solution, and how this solution may be more effective than non technology-based options and/or the technology currently being offered
- Potential strategies to address barriers to overcome the technological solution's use, especially considering the population least likely to use it
- Plan on how to integrate this solution into overall diabetes management activities

The video should also include:

- A justification for this approach including a theoretical model, if appropriate
- Consideration of the sustainability of this program after the initial three years
- Appropriate references
- Brief timeline of activities over three years
- Very basic budget for US$1 million

Other Important Information

- Provide a link to your video on YouTube, Vimeo, Bilibili or similar site by June 7, 2024 at 11:59pm pacific time by emailing mwithers@usc.edu
- Video MUST be no more than 10 mins or it will not be eligible.
- At the beginning or end of the video, please provide a slide with full name, discipline of study, affiliated department and institution, and academic status (e.g. undergraduate, graduate, medical, etc.) for each team member. Please make sure to clearly identify your team name and university name.
- Teams are encouraged to develop engaging and creative visual materials for the presentation. All team members must be physically shown in the videos at least once. However, just as in a live presentation, you can include video clips, slides, animations, and other media/props. Teams should begin with an introduction as in any presentation to an audience. Following the introduction, the format is open. The team can choose to 'zoom in', showing videos, photos, maps, diagrams, interviews, etc.

- We highly recommend that teams use microphones when filming. Please do not speed up the video to make it difficult to understand, especially for non-native speakers. We also encourage the use of subtitles.
- Outside video clips or b-rolls (developed by other people or agencies) are allowed but they should not last for more than 180 seconds total (all clips combined).
- Any use of AI or generative technology should be explicitly acknowledged.
- All teams automatically grant permission for APRU to screen their videos at the workshop and to post their videos on our website for an unlimited time.

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