DIGITAL HEALTH SERVICES IN MANAGING PEOPLE LIVING WITH DIABETES

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In the recent world, more than 450 million people have diabetes. There are several types of diabetes and among them common are Type 1 DM in which the body cannot produce Insulin, Type 2 DM in which body cannot properly use insulin and Gestational Pregnancy related Diabetes. For diabetic patients, failure to treat or manage it can lead a serious complications like blindness, renal failure, heart attack and lower limb amputation. The burden of diabetes in patients are more acute in low middle income countries where nearly 80% people lived with diabetes.

Digital health is a methodology that uses ICT to more efficiently personalize, and precisely address, the various problems people face with health¹. In addition to healthcare, experts and stakeholders from various fields such as engineering, public health, and the economy are also involved in the digital health arena. In general, the provision of digital health services facilitates the collection of data related to an individual’s condition, analyzes data to evaluate clinical or pre-clinical conditions, and provides the personalized intervention or monitoring for an area of interest². These services not only include traditional interfaces such as e-mail, text messages, and web, but also new technology-based services such as smartphones, applications, and wearable devices³. Furthermore, the digital health field incorporates advanced and specialized services directly utilized by doctors and healthcare professionals.

Development of digital health implies that in dealing with diabetes there is a demand to establish a standard as guidance. Standard of digital health technology should fulfill aspects of functionality, contextually, effectiveness, and economic efficiency⁴. Level of evidence in functional aspects divided into three levels⁵:

a. Level 1 is noticed when there is no direct user benefit such as electronic health records that can be connected to the wards and emergency room.

b. Level 2 is noticed when the information related to healthy living and illness prevention behaviors is provided. At this level, digital health service may provide information; do monitoring, and conduct two ways communication.

c. Level 3
   • 3A refers to the use of digital health service in preventing and managing diseases by self-management behavior with measurable patient’s outcome.
   • 3B, which the most advanced medical device takes role in treating, activating, monitoring, calculating and diagnosing the patient.

The contextual and functional aspects have to be contemplated among the vulnerable populations who have limited digital literation. Adding to that, digital health service should provide factual information and clinical judgment to prevent misdiagnosis. This approach could support health
care professional deliver their practical treatment5. In spite of the patient having low digital skill, the national government of the concerned countries should declared the legal and ethical consideration of digital health service which will be used. It also relates to economic consideration when the higher level functional digital health service the higher cost should be spent to cover the budget impact, cost utility, and cost consequences6.

Validating digital health products requires a complex domain which is time-consuming during its development process. There are 4 domains to construct the rigor of digital health known as digital health scorecard7.

a. 1st domain is technical to ensure the precision of the device of the digital product as valid as the gold standard of clinical examination. Technical validation was also constructed by security and interoperability aspects. The examples of technical validation of CGM in diabetes management that the device could check the blood glucose accurately, easily transfer to the health care provider, safely encrypted and provide data privacy for the patient8.

b. 2nd domain is clinical aspect to make sure the digital health product feasible in real-world settings. In this stage, there will be critical appraisal of the simulation to determine a true clinical judgment9. An example of clinical validation in diabetes mobile apps using Mobile App Rating Scale (MARS) scoring to determine whether the application is good acceptable or poor acceptable10.

c. 3rd domain is usability, to define when the feature of digital health met the needs of consumers (diabetes patients or health care providers). The best example of usability validation in CGM is calculation of high and low glucose scores, user’s experiences, and patch attachment adherence11.

d. 4th domain is about the cost or amount of price that consumers should pay to get access to a digital health service or product. In some diabetes apps, it is low cost and somehow it is free of charge. In the beginning, advanced technology such as CGM devices will be quite expensive. In future, this cost will be paid congruence with a better quality of care12.

Table 1: Representative digital health-related factors that can be used in diabetes and metabolic diseases

| Classification                  | Example                                                                 |
|---------------------------------|-------------------------------------------------------------------------|
| Pre-clinical condition          |                                                                         |
| Assessment of daily activity    | Activity tracker, heart rate, electrocardiogram, sleep quality          |
| Evaluation of eating habits     | Evaluation of meal time, frequency, total food intake, and calorie pursuing automation with the “food lens” function |
Digital health services in managing people living with diabetes mellitus

### Digital health services in managing people living with diabetes mellitus

| Weight reduction/diabetes prevention | Obesity management applications, online diabetes prevention program interventions |
|--------------------------------------|----------------------------------------------------------------------------------|

**Digital health for people with diabetes mellitus**

| Patient education | Evidence-based reference materials, Chatbot service |
|--------------------|-----------------------------------------------------|
| Advanced blood glucose measurement | Continuous glucose monitoring systems |
| Improvement of medication adherence | Oral medication with biosensor, insulin dose calculator, digital insulin pen |
| Evaluation and management of complications | Screening of retinopathy, and foot ulcer, detection and/or prediction of fall, hypertension management, home urinalysis |

**Direct involvement from healthcare professionals**

| Remote blood glucose monitoring, human coaching |
|--------------------------------------------------|

| Remote clinical trial | ‘ResearchKit’, mSToPs study |

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Various successful activities already been running in many countries. The recent study shows a comprehensive diabetes healthcare center in south India has been efficiently exploiting the Diabetes Tele-Management System (DTMS®), a telemedicine-based intervention and follow-up program for diabetes management since 1998. The DTMS® team uses telephone/email/secure website to educate patients/caregivers on insulin injection technique, diet, exercise, use of a glucometer, hypoglycemia, and compliance to medications as well as to titrate insulin and oral drug dosages according to personalized glycemic targets. Telemedicine follow-up through DTMS® produced a significant reduction in HbA1c and hypoglycemia frequency in a cohort of 1000 patients with T2D. This approach ensures appropriate glycemic control, reduction in micro- and macrovascular complications, and multidrug compliance among the patients.

Digitally facilitated interactions between people living with Diabetes and healthcare professionals can allow enhanced access to care and prevent avoidable complications. This was demonstrated by the Be He@lthy Be Mobile (BHBM) initiative, run jointly by the WHO and the international Telecommunication Union (ITU), which works with governments and other partners to improve the prevention and control of NCD including diabetes with mobile technology. One BHBM program helped people living with diabetes in low- and middle-income countries to reduce diabetes-related complications through simple SMS interventions.

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