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The Practicality of Mobile Applications in Healthcare Administration and COVID-19 Pandemic

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Abstract

Mobile health (mHealth) applications (apps) aid healthcare administration through monitoring health issues and virtually achieving personal well-being goals. There are numerous mHealth apps available; however, their usefulness is unclear. Furthermore, older age groups may be unfamiliar with mHealth apps. Therefore, the purpose of this literature review is to provide an overview of the practicality of mHealth apps in healthcare administration. mHealth apps carry important roles for non-communicable and infectious diseases, primarily during the COVID-19 pandemic. Hence, people with different backgrounds or ages need to understand to utilise mHealth apps, particularly the 'MySejahtera' app. Thus, the classifications, functions, advantages, and disadvantages of mHealth apps are addressed. The information was obtained from a variety of electronic databases, including PUBMED, Google Scholar, UpToDate, and web sources. Several journals, books, articles, and reports were retrieved and analysed based on their relevance from May 2011 to November 2020. Non-communicable diseases, particularly chronic diseases, can be assisted by mHealth as the unique

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interaction via mHealth apps assist patients in executing optimistic behaviours towards a healthy lifestyle. In the case of COVID-19, this review emphasises the importance of the 'MySejahtera' app, which is actively being used in Malaysia to handle the COVID-19 pandemic. This article also discusses mHealth apps' effectiveness and how Malaysians used the 'MySejahtera' app during the COVID-19 pandemic. More secure apps, comparable to the 'MySejahtera' app are required to manage infectious diseases like COVID-19 and non-communicable diseases such as diabetes mellitus since the number of mobile app users will continue to grow worldwide.

Keywords: *mHealth apps, MySejahtera, COVID-19, Healthcare Management, Mobile Apps.*

1. Introduction

Mobile health or m-health uses wireless communication applications on devices such as smartphones, mobile phones, personal digital assistants (PDAs), and tablets. This promotes public health services to the community and facilitates clinical practice for patients (Benferdia & Zakaria, n.d.). This software also benefits health care practitioners as a quick reference for diagnosing and managing patients (Morse et al., 2018). According to mHealth apps Economics 2017/2018, there are 325,000 mHealth apps available in both the Android and iOS systems in 2017 (Pohl, 2017). However, the study also shows that there are decreasing downloads of such apps and declining adherence by the users. This is probably because of in-app charges and frequent advertisements (Liew et al., 2019).

Moreover, a study by Lee et al. in Malaysia, published in 2019 found that more than half of respondents (62%) did not know about mHealth apps and the services offered by mHealth. This study was done among Malaysians, in the town area in Klang and Petaling district in Selangor, with participants aged between 41 to 50 years old. This study also mentioned that the services provided by mHealth apps include remote monitoring and online support groups, which benefit those with chronic diseases. However, elderlies born from 1946 to 1964 are not familiar with mHealth apps. They prefer to communicate with doctors face to face. In contrast, the younger age group, less than 39 years old, prefer to use mHealth apps. This shows that the acceptance of mHealth apps in Malaysia is low among the elderly. Thus, familiarising the elderly with mHealth apps is vital to overcome this problem (Lee et al., 2020). Moreover, the Ministry of Health Malaysia has started online appointments for patients, thus elderly will have to book an appointment before they can consult a doctor in future.

In December 2019, the Coronavirus disease 2019 (COVID-19) pandemic first appeared in Wuhan, China. The causative organism is the *Severe Acute Respiratory Syndrome Coronavirus-2 (SARS CoV-2),* transmitted through respiratory droplets, aerosol and contaminated fomites (*Aerosol Transmission of Covid-19: A Room, a Bar and a Classroom: How the Coronavirus Is Spread through the Air | Society | EL PAÍS in English*, n.d.). Due to the difficulty in controlling this novel virus, cases keep increasing worldwide and cause high mortality, particularly among the elderly. In Malaysia, there are various strategies enforced by the government in handling the outbreak. One of the measures is implementing "Movement Control Order 2020" under the Prevention and Control of Infectious Disease Act 1988 and the Police Act 1967, and this was first implemented on 18th March 2020 (Lim et al., 2020). Moreover, the government also developed the 'MySejahtera' app to help prevent virus transmission, whereby the primary function of this app is for contact tracing.

Therefore, this literature review is aimed to provide information on the efficacy of the mHealth apps and further discussion on the 'MySejahtera' app. This effort is hoped to disseminate knowledge and create awareness on mHealth apps, their risks, and benefits, hence encourage the safe use of mHealth apps, particularly at this time of rapid technology development and COVID-19 pandemic.

2. Methodology

The literature reviews were carried out using the following electronic databases: PUBMED and Google Scholar, UpToDate, and web sources. Several journals, books, articles, and reports were read and retrieved based on their relevance from the search. Furthermore, we searched the references of the retrieved materials to find related studies. We also explored the articles which were published between May 2011 and January 2021. Keywords used to search were "mHealth apps" and "effectiveness" or "quality" or "uses" or "risk" or "benefits" or "diabetes mellitus" or "obesity" or "MySejahtera" or "COVID-19". The search strategy was by combining multiple keywords as stated above, following the study's objective accordingly.

Study selection

Two investigators separately reviewed the title first then analysed the abstracts. One reviewer performed data extraction, and another reviewer rechecked to validate the accuracy. The same investigators read and screened the full texts to make the final decision. The reason for inclusion and exclusion were as follows. We included articles with the following characteristics:1) published in English, 2) published between 2000 to 2021, 3) the use of mHealth applications whether from cellular phones, computer devices, or other wireless devices, 4) the study design had to be either a randomized controlled trial (RCT), systematic review or cohort studies. Also excluded from this review were studies other than in the English language. The studies that were not related to this literature, such as cancer or cardiovascular diseases, were also excluded.

3. Results & Discussion

Classifications and usefulness of Mobile Apps

All mobile applications are built based on three different basic concepts of technologies applied to build an app. These are the native apps, web-based apps, and hybrid apps. As for the mHealth apps, there are many types available online. Most researchers classified mHealth based on the technology used to build them and based on the functions of the mHealth.

As for the technology used to build them, there are three types of mobile apps (Goel et al., 2018):

1) Native apps:
These applications are developed specifically for a designed platform. Native mobile apps are designed exclusively for a specific operating system type. However, apps developed on one kind of operating system cannot be used on another operating system. Native apps are usually fast, efficient, and can access all hardware on a device like a camera, compass, etc. The mobile game is a typical example of native apps. Examples of native medical apps are Apple's Health apps for the iOS system and Samsung Health for the Android system, Kardia, BlueStar Diabetes.

2) Web-based apps:
Web-based applications need internet access to use them. Mobile web apps usually use HTML, JavaScript, and other web technologies. Among the advantages of web-based applications is a low cost, not installed in devices; therefore, there is no issue with space limitations and reduce software piracy. Examples of web-based medical apps are IU Health, Rest Assured *(*8 Examples of Great Healthcare Website Designs | DBS Interactive*, n.d.)* and, Epocrates.

3) Hybrid apps:
These apps have features of both web-based and native apps. A hybrid app is designed using web technologies and then enclosed in a platform-specific shell that enables it to be downloaded in the same way as a native app. Hence, users can obtain it via app stores. Examples of hybrid medical apps are Sworkit *(*11 Hybrid App Examples That Redefined Cross-Platform Mobile Apps*, n.d.)* and Koreo.

mHealth apps are also classified based on their function, as follows *(Larson, 2018)* :

a. Information apps give general health information to the public, such as WebMD, HealthCentral, and WrongDiagnosis.com.
b. Diagnostic apps that require doctors to enter a patient's information. These will then assist the doctor in diagnosis, such as Sony's mSafety Mobile Health (Williams Lauren, 2020).
c. Control apps enable, control and access to the function of medical gadgets. For instance, insulin pumps access from a distance. This enables continuous control of blood sugar levels in patients.
d. Adapter apps will potentially turn the smartphone into a portable medical device like Schosche my Trek and iHealth BP3 (Roth, 2014).

The developers of the apps consider ways to build apps as to fulfil mHealth apps' function. This is because the native apps, web-based apps, and hybrid apps have their advantages and disadvantages. The method these apps were developed impact on its usefulness by identifying their efficacy and reliability.

Although app store repositories have more than 160,000 mHealth applications, very few were tested for their efficacy and reliability. Hence, this results in clinicians' hesitation to recommend mHealth apps to their patients. Moreover, patients may have enquiries regarding these mHealth apps, which will be difficult for the clinicians to answer. As it was built by an online apps' developer. Besides, the content accuracy of mHealth apps is questionable since many of the apps are poorly regulated or managed by their developer (Stec et al., 2019).

Therefore, the Federal Drug Administration (FDA) makes efforts to monitor the policy regarding this matter to ensure mHealth apps' quality. mHealth apps are classified into three classes based on their risk of being regulated by the FDA. Class I are apps that constitute a low risk to the patient. For example, apps that help patients self-manage their condition without providing recommendations for specific treatment. Class II has a moderate level of risk of injury to the people. And, class III devices are high-risk devices. The apps that fall under class III, may threaten patients' safety and may cause harm to them. From the latest policy, the FDA only regulates certain device software functions that fall under moderate risk (class II) and high risk (class III). This includes "mobile apps that control medical devices," such as blood pressure cuffs and insulin delivery (Cber, 2019).

Hence, several methods are proposed to assess the reliability of mHealth apps. In 2015, Stoyanov et al. developed the Mobile App Rating Scale (MARS), a checklist or guideline in designing and assessing mHealth apps' quality. It is accurate, precise, and objectively assesses the quality of mHealth apps. MARS considers six broad classifications of mHealth apps (Stoyanov et al., 2015). One classification determines app grouping, four categories focused on the app's characteristics, and one category for subjective app quality [16]. Both clinicians and patients can utilise MARS as a systematic rating of mHealth apps. Clinicians also can assess the accuracy of the information provided within the apps. Many studies used MARS, such as pain-related apps (Salazar et al., 2018) and health and wellness apps (McKay et al., 2019).

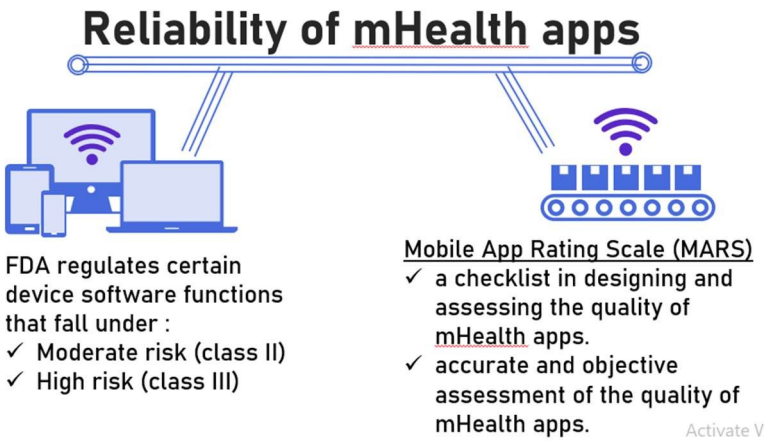

Figure 1: Methods to assess the reliability of mHealth apps

Uses and Effectiveness of mHealth Apps.

The mHealth apps' users are healthcare providers, medical students, patients, and the public (Seabrook et al., 2014). A person might use patient's apps under healthcare provider follow-up, and they may be under long-term conditions that may require mHealth support as an adjunct to their medical management. In comparison, apps for the public are self-care apps without clinician oversight. Table 1 below shows a summary of the mHealth apps used.

Table 1: The use of mHealth apps.

Authors	Year	Types of study	Findings (Uses)
Heather J Seabrook et al. (Seabrook et al., 2014)	2014	Cross-sectional study	● For references like guides for health care worker (HCW) ● For patient education ● For patient tracking/ diary ● For monitoring such as glucose monitoring. ● For conferences for HCW ● To assist in the diagnosis ● As a reminder setting. ● As a nutrition and dietary guide ● As a source of motivation ● As a calculator ● As an alternative medicine reference
Youcef Benferdia & NorHidayati Zakaria (Benferdia & Zakaria, n.d.)	2014	Systematic review	● For chronic disease management ● For personal wellness and healthy living ● For medication adherence ● For teaching or training ● To access health information ● As a diagnostic tool ● As a remote monitoring ● For communication
Eskinder Eshetu Ali &Lita Chew Kevin Yi-Lwern Yap (Ali et al., 2016)	2017	Systematic review	● For patient monitoring ● As support for health services ● For diagnosis-related issues ● For treatment reference ● For health promotion

According to the mHealth economic 2017/2018 study, diabetes and obesity are the two top diseases that utilise mHealth apps (Pohl, 2017). Therefore, mHealth apps' effectiveness in managing diabetes mellitus and obesity needs an evaluation since these diseases are highly prevalent in Malaysia.

Diabetes mellitus is a chronic illness that has a high impact on a patient's quality of life. It is a significant public health problem with an increased risk of morbidity and mortality (Yang et al., 2013). mHealth apps delivered via mobile phones or tablets can support patients with their diabetes

management. However, Fu et al. found insufficient evidence to support the efficacy of diabetes apps since only four out of ten studies showed a significant reduction of HbA1c, ranging from 0.4%-1.9%. These four studies show the great interactive features of mHealth apps, such as feedback messages from a primary care provider and alert reminders that keep the patients motivated in adopting positive behavioural changes (Fu et al., 2017).

Meanwhile, in a systematic review and meta-analysis by Bonoto et al., which includes 13 studies out of 1236 publications. In 6 RCTs, it is found that there is a statistically significant reduction of HbA1c at the end of the studies in the intervention group. Thus, Bonoto et al. conclude that the use of mHealth apps to communicate with healthcare practitioners has a positive influence in controlling HbA1c (Bonoto et al., 2017). From both studies, there was a significant decrease in the HbA1c level. This is also supported by Spyros et al. on a review of 15 systematic reviews published from 2008 to 2014. Spyros et al. conclude that mHealth intervention improves glycemic control (HbA1c) compared to standard care or other non-mHealth approaches by as much as 0.8% for patients with type 2 diabetes and 0.3% for patients with type 1 diabetes, at least in the short-term (≤12 months) (Kitsiou et al., 2017). The reduction of HBA1c indicates better diabetic control and reduces the risk of diabetes complications. Therefore, mHealth apps appear to be an effective method in improving patients' outcomes in diabetes mellitus. However, further improvement of mHealth features is needed to optimize its use for diabetes management. This will sustain patients' engagement in using the apps (Liu et al., 2019).

Similarly, apps for obesity have proven a significant reduction in weight loss. Chin et al. reported in a retrospective study on mHealth apps' effect on weight loss for obese or overweight people. 77.9% recorded a reduction in body weight when using the app, with 22.7% encountering weight loss of more than 10% compared with baseline (Chin et al., 2016).

In a systematic review, Wang et al. reported a positive result with an average weight loss of -1.97 kg in 16 weeks to -7.1 kilograms in 5 weeks among obese (Wang et al., 2017). However, Apiñaniz et al. reported no significant differences in weight in intervention groups at six months. This may be due to most of the participants in the studies having higher BMI (more than 30 kg/m2). They hypothesised that the patients were chronically obese (BMI > 30 kg / m2), therefore challenging to lose weight, although they use various treatment strategies (Apiñaniz et al., 2019). In conclusion, mHealth apps for obesity may be useful for short-term use compared to long term (more than six months) use, particularly for patients who are not chronically obese.

Benefits and Risks of mHealth Apps

The mHealth apps' users benefited from the applications available, particularly via mobile devices. The apps allow healthcare professionals to make decisions quickly with a lesser error rate, improving medical data processing consistency and usability and improving productivity and expertise in practice (Miller, 2018). The use of mHealth apps is very convenient since users can access various applications to achieve different commitments (Boulos et al., 2011). Social networking was another essential factor that impacts participants' views of mHealth and diabetes. It could boost self-esteem, especially when they share experiences with others who are in the same situation.

Moreover, engaging with mHealth encourages contact between patient and healthcare providers. Diabetic patients learn to control their disease by applying newly gained knowledge regarding

diabetes and monitor their disease by self-empowerment. They get the opportunity to participate in their treatment and make more informed choices (Kayyali et al., 2017). Besides, text message reminders assist patients to comply with appointments and improve clinic attendance rates. Although text reminders were not as good as phone call reminders, they were considered more cost-effective (McCallum et al., 2018).

Despite the benefits of mHealth, there are some risks for users. The risks can be divided into three broad categories related to privacy, security, and safety concerns upon using mHealth, as in Figure 2.

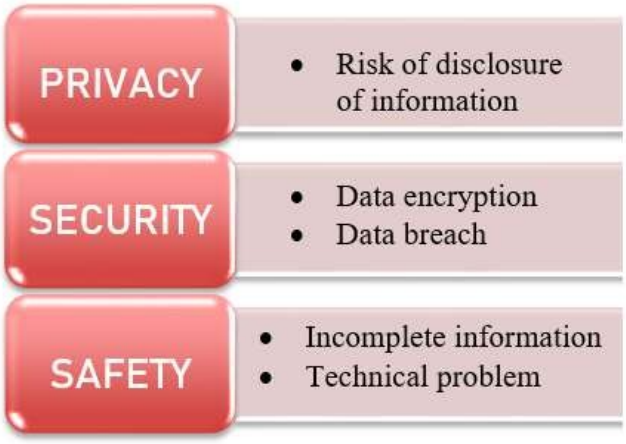

Figure 2: The risks and safety concerns upon using mHealth

In the Information System (IS) aspect, privacy is explained as an individual's right to control information about themselves (Li, 2011). One of the critical privacy issues is the possibility of disclosure of an individual's data. The data collected without the user's consent may be sent to the third-party such as advertisers (Sampat & Prabhakar, 2017). Nasiri et al. reported that researchers carried out a survey of 20 out of 23 most popular free mobile health apps and found out that 50 % of 20 apps in the survey deliver personal data to the third party (advertisers) (Adhikari et al., 2014). Moreover, internet connections can be used to breach the activity of users. The hackers can view the user's action in the current time through sensors in their devices. This act may cause additional risks since these data provide comprehensive details on the user's routines and locations (Sampat & Prabhakar, 2017).

Security is defined as physical, technical, or administrative protection to prevent illegal access to health data (Sampat & Prabhakar, 2017). There are two subcategories under security: data encryption and data breach (Sampat & Prabhakar, 2017). Encryption is the act of transforming texts into a format that is difficult to understand or interpret. Encryption is required as apps that do not use data encryption have a risk of being hacked or accessed by an unauthorised user. Furthermore, these unlawful users may expose the data and place it in an inappropriate location for their benefit. McCarthy reported that from 43 free and paid health and fitness apps, 26% of free apps and, shockingly, 40% of paid apps did not have a privacy policy. On top of that, only 57% of paid apps

and 15% of free apps notified users that information they made public by sharing in chat groups or with online friends was not protected (Adhikari et al., 2014). Thus, it is apparent that data encryption is vital in mobile health apps.

Data breaches or data leaks do occur among healthcare professionals. They need to explore patients' health records for treatment purposes, even without the patient's knowledge at times for the benefit of patients' health. However, healthcare professionals are subject to medical ethics and physician oath. The main aim of healthcare professionals is to treat diseases that the patient is suffering from. Moreover, accessing patients' data usually occurs as healthcare professionals may need to discuss further a patient's management. Particularly in the case of patients having multiple comorbidities, which may need different specialty input for managing the patient. However, irrelevant information not related to a patient's medical problem, such as patients' names, personal identification numbers, or addresses, will be kept confidential. Yet, anyone else who inquiries about a patient's data without consent can be considered a data breach. As it can lead the offender to use another person's identity without the person's permission. Apart from that, the offender may sell the patient's record or change the document's data, which further harms the user's security (Adhikari et al., 2014).

Finally, for safety, mobile apps may cause danger to the user when the apps' content is incomplete or when a technical problem arises. Incorrect information and faulty alarms may harm patients (Akbar et al., 2020). For example, it is found out that there are apps for bipolar disorder (BD) that incorrectly differentiated BD types and wrongly recommended that patients should "take a shot of hard liquor an hour before bed." Some of the apps also suggested that BD is contagious. This incorrect information of the apps will cause more harm to patients. Hence, developing a proper guideline on mHealth apps use is vital to ensure the users' safety and privacy are well secured.

Roles of 'MySejahtera' in managing COVID-19 pandemic

'MySejahtera' app is a native app launched on 20th April 2020 to help the government in combating pandemic COVID-19. Despite its multifunction, the crucial role of the 'MySejahtera' app is to prevent transmission of COVID-19. It is a collaboration between the National Security Council (NSC), Minister of Health Malaysia (MOH), the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) and Malaysian Communicates and Multimedia Commission (MCMC), and Ministry of Science, Technology, and Innovation (MOSTI) (*Soalan Lazim App MySejahtera Covid-19 | My Sejahtera*, n.d.).

One of the main functions of the 'MySejahtera' app is for contact tracing. The data for the 'MySejahtera' app is collected by users scanning the QR code using smartphones, which is available in over 1 million premises in Malaysia. The data recorded will be identified and directed to the local District Health Office for contact tracing activity. As of 19th November 2020, 9,167 cases were detected through the 'MySejahtera' app, and 7,606 cases were detected through contact tracing (*MySejahtera Bantu KKM Kesan Hampir 10,000 Kes Positif*, n.d.).

'MySejahtera' app also offers a self-health assessment. About 1,561 cases were detected through self-health assessment by the users (*MySejahtera Bantu KKM Kesan Hampir 10,000 Kes Positif*, n.d.). Users can perform health self-assessment for themselves or their families to know whether they are at low or high risk of getting infected. The 'MySejahtera' app also provides the latest

updates on daily cases of COVID-19 both in Malaysia and globally. This helps keep people aware of the latest cases, cured cases in Malaysia, and current global situations.

'MySejahtera' app also assists users to determine whether their current location is a hotspot area for COVID-19. This creates awareness for users to keep themselves safe by avoiding crowded places near their home like the supermarket, always wearing the mask when they are out, practicing frequent handwashing, and cleaning themselves once they return home.

'MySejahtera' app aids users locate the nearest health screening centres, treatment facilities available, and a list of private clinics that provide walk-in, drive-thru, or home visit services for the public *Soalan Lazim App MySejahtera COVID-19 | MySejahtera, n.d.)* This eases the users at this stressful time of the COVID-19 pandemic. Moreover, there is a 'Helpdesk' in the app that will answer the users' questions.

Interestingly, there are 'Things to know' and 'Things to do' as part of the app. 'Things to know' provides information on the daily updates regarding the COVID-19 pandemic in the country. The current status and statistics about the pandemic from MOH are readily available for view. Whereas, 'Things to do' is a reminder for the app user on the activities to be done related to this pandemic.

Most importantly, the 'MySejahtera' app plays a key role in the prevention of COVID-19 infection by providing information about the vaccines and the vaccination process. The 'MySejahtera' app aids the users to book dates for their vaccination online. Likewise, the app will notify the users regarding their vaccination date via the 'MySejahtera' app. Subsequently, steps are provided to aid the users till the end of the vaccination process. After the user has completed the second dose of the vaccination, a digital certificate will be issued. Hence, the users have to provide all important information regarding themselves.

However, the data in the 'MySejahtera' app is protected under the Personal Data Protection Act 2010 (PDPA). If the Health District Officers need to obtain the data for contact tracing purposes, their request will be processed according to the PDPA procedure. The request will be evaluated and will go through several stages by Crisis Preparedness and Response Centre (CPRC) and National Cyber Security Agency (NACSA) within 24 hours. The data include patients' identities, the name of the reporting physicians and the health centre involved. However, all these will remain confidential following what is stated in the Act *(Annex_42_MySejahtera (1), n.d.)*. Therefore, the 'MySejahtera' is a safe app and is compulsory for all Malaysian to record and use this application regardless of age.

This limitation of this literature review is that there was no assessment of risk bias of the studies reviewed. Therefore, there may be bias in selecting the studies in this review. This is because most of the studies were conducted in developed countries. Hence, more studies need to be undertaken in developing Asian countries. Moreover, most of the studies included in this review have a small sample size, conducted in a short period, which is less than six months. One of the reason is because of the participants' poor adherence. Hence, further studies need to be done, involving a larger sample size and longer duration for a more accurate result.

4. Conclusion

The mHealth apps are not only useful in the management of non-communicable diseases like diabetes mellitus and obesity but also to control infectious diseases like COVID-19. More reliable and effective apps like 'MySejahtera' are necessary for the prevention of infectious diseases like COVID-19. Further research is necessary to improve the usability, safety and feasibility of mHealth apps for the benefit of optimizing healthcare, particularly at the time of pandemics like COVID-19.

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