


Research Article

Knowledge, Attitude, and Practice of Diabetic Patients Following Up In King Khalid University Hospital about Insulin Use; a Cross-Sectional Study

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Abstract

Objectives: There are not many studies evaluating the knowledge, attitudes, and practices of insulin self-administration in Saudi Arabia; therefore, we conducted this study aiming to determine the level of knowledge diabetic patients have on insulin use. and also to establish the most common mistakes, most patients do.

Methods: This cross-sectional study was performed in the Outpatient setting at King Khalid University Hospital, Riyadh, Saudi Arabia. Patients who are following up in Diabetes Outpatient Clinics at King Khalid University Hospital and taking Subcutaneous insulin injections. Ethical approval for the study was sought from the Institutional Review Board at King Saud University, College of Medicine. The “insulin self-administration” questionnaire was used.

Results: A total of 378 participants responded to our questionnaire. We found an overall fair level of knowledge among participants. 87.83% acknowledged the presence of high blood sugar levels as indicative of diabetes. A significant majority of 89.68% recognized the outer thigh area as appropriate, and a significant majority of 92.06% (348 individuals) affirmed their ability to inject themselves in the right places. 60.05% were females, and 39.95% were males. We found a significant correlation between "Understanding Diabetes Management and Insulin Administration" and "Insulin Injection Techniques and Site Rotation in Diabetes Management" ($r = 0.104$, $p = 0.044$). However, A weak positive correlation was found between "Understanding Diabetes Management and Insulin Administration" and "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" ($r = 0.019$, $p = 0.706$) and between "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" and "Insulin Injection Techniques and Site Rotation in Diabetes Management" ($r = 0.025$, $p = 0.626$).

Conclusions: Patients with diabetes in the current research had fair awareness of and practices regarding insulin storage and delivery. Patients lacked proficiency in the crucial and key procedures of administration

Keywords: Diabetes mellitus; Insulin

Introduction

Diabetes mellitus (DM) is a metabolic condition caused by insufficient insulin production, resistance to the action of insulin, or both [1,2]. It is characterized by persistent hyperglycemia and impaired carbohydrate, lipid, and protein metabolism. The International Diabetes Federation estimates that 592 million people will have diabetes by the year 2035, up from 382 million in 2013. Similar to Ethiopia, where there were more than 1.8 million

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diabetics and a nationwide prevalence of 4.36% among adults [3]. In the majority of poor countries, DM is regarded as the biggest killer [4,5]. This might be attributable to poorly managed hyperglycemia, which is linked to a number of fatal consequences, including cardiovascular disease and renal failure [6]. To minimize DM morbidity and mortality by preventing or delaying complications, optimal glycemic management is essential [7]. Only when patients stick to self-management practices such as a balanced diet, regular exercise, blood glucose monitoring, taking medicines as prescribed, the capacity to manage their diabetes, and good coping are they able to attain optimal glycemic control [7–11]. The mainstay of treatment for both type 1 and some type 2 diabetes cases is insulin therapy. Despite this, 20% of individuals willfully skip doses, and at least one-third of patients fail to take their insulin as directed [12].

Due to the complexity of its sophisticated application, insulin treatment is fraught with difficulties. If used properly, problems, negative patient outcomes, poor treatment adherence, and inevitably poor glucose control may be avoided [13]. However, individuals with diabetes mellitus did not get adequate knowledge and practice ratings (14). Patients who are taught how to self-administer insulin are more self-assured and proud of their role in their care [15]. Additionally, a good injection method is crucial for effective distribution to subcutaneous tissues as well as to avoid lipohypertrophy and intramuscular injury [16]. The American Diabetic Association developed a set of recommendations for the safe handling of insulin syringes, mixing insulin, and other factors [17]. Due to poor socioeconomic issues, patients, particularly those in developing nations, could not adhere to the recommendation. Although insulin is known as the best medicine for diabetes, Regarding the proper administration of insulin, there is a documented lack of understanding and cooperation between doctors and patients [18,19]. Furthermore, several research revealed that insulin injection techniques fell short of the necessary quality [20–22]. There are not many studies evaluating the knowledge, attitudes, and practices of insulin self-administration in Saudi Arabia; therefore, we conducted this study aiming to provide clear evidence representative of the Saudi population.

Methods

Study Design

Quantitative, Cross-Sectional study.

Study Duration

24 months

Study Setting

The study took place in the Outpatient setting at King Khalid University Hospital, Riyadh, Saudi Arabia.

Sample size

The sample size was calculated according to the literature using standard equations.

Target Population/Sample Size

Patients who are following up in Diabetes Outpatient Clinics at King Khalid University Hospital and taking Subcutaneous insulin injections.

❖ Inclusion Criteria

- Patients older than 18 years of age.
- Outpatient cases
- Currently on or previously were on subcutaneous insulin

❖ Exclusion Criteria

- Patients with an incompletely filled questionnaire.
- DKA and ER cases.

Study Variables

Knowledge, Attitude, Practice, Diabetes Mellitus, Insulin, Injection, Lipohypertrophy.

Ethical Considerations

Ethical approval for the study was sought from the Institutional Review Board at King Saud University, College of Medicine, Riyadh, Saudi Arabia. A web link was created and shared with the chosen sample. The nature and purpose of the study, the primary investigator's contact information, and an explanation of the confidentiality and data anonymity policy were provided. Consent to participate was obtained by clicking on the informed-consent link. After reading the informed consent statement, the participants must click on "agree" to access the study's survey. The survey takes approximately 3 minutes to complete.

Data Collection

The "insulin self-administration" questionnaire was used. It's a questionnaire developed based on some studies about insulin administration with [16–18] minor modifications. The questionnaire has four parts (sociodemographic, knowledge, attitude, and practice with 9, 13, 5, and 6 structured questions, respectively). The Knowledge part was a Yes or No question that assesses the general information on diabetes mellitus and insulin self-administration.

Results

Demographic characteristics

The demographic landscape among the 378 participants was done, and gender distribution revealed a nuanced composition, with 60.05% (227 individuals) identifying as female and 39.95% (151 individuals) as male. The

age spectrum showcased notable variance: 37.04% (140 individuals) fell within the 30-55-year bracket, 22.75% (86 individuals) were below 30 years old, and 40.21% (152 individuals) transcended 55 years. Religious affiliation remained uniformly represented, with all participants (100%) identifying as Muslim. Educational attainment featured a gamut of diversity, wherein 39.95% (151 individuals) had collegiate education, while 11.64% (44 individuals) were confined to illiteracy. Occupationally, participants exhibited intriguing distribution; 34.92% (132 individuals) assumed the role of housewives, 29.37% (111 individuals) were engaged in the government sector, and 16.93% (64 individuals) navigated the realm of academia as students.

Geographical residence trends were dominated by the Central Region (Riyadh, Qassim), accounting for 94.18% (356 individuals), while the remaining regions exhibited more modest representations. Marital status unveiled a

Table 1: Demographic characteristics

Sex	
F	227 (60.05%)
M	151 (39.95%)
Total	378 (100%)
age	
30-55yo	140 (37.04%)
Less_than_30yo	86 (22.75%)
More_than_50yo	152 (40.21%)
Total	378 (100%)
religion	
Muslim	378 (100%)
Educational level	
Cannot read or write	44 (11.64%)
collegiate	151 (39.95%)
Preparatory	32 (8.47%)
primary	32 (8.47%)
Secondary	96 (25.4%)
Without education (can read and write)	23 (6.08%)
Total	378 (100%)
job	
Freelancing	26 (6.88%)
government sector	111 (29.37%)
Housewife	132 (34.92%)
military sector	12 (3.17%)
private sector	33 (8.73%)
Student	64 (16.93%)
Total	378 (100%)
residence	
Central Region (Riyadh, Qassim)	356 (94.18%)

Eastern Province	1 (0.26%)
Northern Region (Northern Borders, Tabuk, Al Jawf, Hail)	3 (0.79%)
Southern Region (Najran, Jazan, Asir, Al-Baha)	13 (3.44%)
Western Region (Makkah Al-Mukarramah, Madinah Al Munawwarah)	5 (1.32%)
Total	378 (100%)
marital status	
divorced	20 (5.29%)
married	209 (55.29%)
Single	105 (27.78%)
widow	44 (11.64%)
Total	378 (100%)
Diabetes period	
Above10years	265 (70.11%)
From5-10years	72 (19.05%)
LessThan5year	41 (10.85%)
Total	378 (100%)
No	52 (13.76%)
Yes	326 (86.24%)
Total	378 (100%)

spectrum: 55.29% (209 individuals) were married, 27.78% (105 individuals) were single, 11.64% (44 individuals) were widowed, and 5.29% (20 individuals) were divorced. Remarkably, diabetes cast a substantial footprint, with 86.24% (326 individuals) of participants affirming its presence; within this, 70.11% (265 individuals) reported a diabetes period exceeding a decade, 19.05% (72 individuals) spanned 5-10 years, and 10.85% (41 individuals) endured it for less than 5 years. Additionally, 13.76% (52 individuals) declared their exemption from diabetes. (Table. 1)

Public knowledge and practice regarding insulin

Among the 378 participants, 87.83% (332 individuals) acknowledged the presence of high blood sugar levels as indicative of diabetes, whereas 12.17% (46 individuals) did not correlate it with elevated blood sugar. Pertaining to insulin needles and their understanding, 88.1% (333 individuals) possessed adequate knowledge, while 11.9% (45 individuals) revealed gaps in their understanding. Impressively, 95.77% (362 individuals) demonstrated awareness that insulin needles are typically stored within cooling devices, with a minority of 4.23% (16 individuals) being unaware of this practice.

Insulin administration in relation to meals illuminated intriguing trends; 64.55% (244 individuals) comprehended that insulin wasn't exclusively administered with food, while 35.45% (134 individuals) held the misconception that it was. Also, results revealed that the participants' understanding of insulin injection practices and associated concepts. Regarding

injection sites, a majority of 82.8% (313 individuals) correctly identified the abdomen (farther than 1 cm from the navel) as a suitable site, with 15.87% (60 individuals) answering negatively. Similarly, 17.72% (67 individuals) acknowledged the appropriateness of the abdominal area closer to the navel, while 74.6% (282 individuals) responded negatively. Moreover, the shoulder area was considered suitable by 69.05% (261 individuals), while 29.37% (111 individuals) answered negatively.

A significant majority of 89.68% (339 individuals) recognized the outer thigh area as appropriate, with 9.52% (36 individuals) responding negatively. Conversely, 31.22% (118 individuals) found the inner thigh suitable, while 67.2% (254 individuals) responded negatively. In terms of insulin injection angles, 51.59% (195 individuals) confirmed awareness of the 45-degree angle practice, while 48.41% (183 individuals) were unaware. Interestingly, 92.06% (348 individuals) recognized the importance of varying injection sites to mitigate complications, and 97.35% (368 individuals) understood that massaging the injected area can enhance insulin absorption. Participants also showed diverse views on insulin's effects and associated stigma.

Finally, a significant majority of 92.06% (348 individuals) affirmed their ability to inject themselves in the right places, and 54.76% (207 individuals) confirmed using a 45-degree angle for injection. The examination of insulin injection practices of participants' choices of injection sites. Regarding the abdomen, a significant majority of 83.07% (314 individuals) confirmed injecting insulin in this region, with 13.49% (51 individuals) abstaining from it. Meanwhile, the shoulder was found to be a less popular choice, with 62.17% (235 individuals) indicating its use, while 33.86% (128 individuals) opted against it. The buttocks were another varied site, chosen by 23.54% (89 individuals), while 71.69% (271 individuals) refrained from injecting insulin there.

In contrast, the thigh was a favored option, with 89.95% (340 individuals) utilizing it for injections and only 6.88% (26 individuals) choosing otherwise. Similarly, the leg saw minimal use as an injection site, selected by 3.17% (12 individuals), while 93.12% (352 individuals) declined its usage. Interestingly, the chest/breast region was infrequently employed, as only 1.32% (5 individuals) utilized it, while the vast majority of 94.97% (359 individuals) abstained. (Table. 2)

Correlations among the combined scores

The current data analysis revolves around conducting correlations dataset comprised of responses from participants. The primary objective of this analysis was to explore potential relationships between three distinct variables, namely "Understanding Diabetes Management and Insulin Administration," "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care," and

Table 2: Showing answers to questions about insulin among survey respondents

Diabetes means a high blood sugar level.	
No	46 (12.17%)
Yes	332 (87.83%)
Total	378 (100%)
Do you have enough information about insulin needles?	
No	45 (11.9%)
Yes	333 (88.1%)
Total	378 (100%)
Insulin needles are stored inside cooling devices.	
No	16 (4.23%)
Yes	362 (95.77%)
Total	378 (100%)
Is insulin taken with food only?	
No	244 (64.55%)
Yes	134 (35.45%)
Total	378 (100%)
Can you inject insulin in the following places?	
Abdomen (farther than 1 cm from the navel)	
Didn't Vote	5 (1.32%)
No	60 (15.87%)
Yes	313 (82.8%)
Total	378 (100%)
Abdominal area (closer than 1 cm to the navel)	
Didn't Vote	29 (7.67%)
No	282 (74.6%)
Yes	67 (17.72%)
Total	378 (100%)
shoulder area	
Didn't Vote	6 (1.59%)
No	111 (29.37%)
Yes	261 (69.05%)
Total	378 (100%)
thigh area (outer part)	
Didn't Vote	3 (0.79%)
No	36 (9.52%)
Yes	339 (89.68%)
Total	378 (100%)
thigh area (inner part)	
Didn't Vote	6 (1.59%)
No	254 (67.2%)
Yes	118 (31.22%)
Total	378 (100%)
buttocks	

Didn't Vote	9 (2.38%)
No	231 (61.11%)
Yes	138 (36.51%)
Total	378 (100%)
chest/breast	
Didn't Vote	6 (1.59%)
No	368 (97.35%)
Yes	4 (1.06%)
Total	378 (100%)
the leg	
Didn't Vote	8 (2.12%)
No	357 (94.44%)
Yes	13 (3.44%)
Total	378 (100%)
The angle of insulin injection is 45 degrees.	
No	183 (48.41%)
Yes	195 (51.59%)
Total	378 (100%)
Is insulin always injected into the same area?	
No	348 (92.06%)
Yes	30 (7.94%)
Total	378 (100%)
Complications of insulin use are low blood sugar levels, body resistance to insulin, and atrophy of the injected area.	
No	91 (24.07%)
Yes	287 (75.93%)
Total	378 (100%)
Changing injection sites helps reduce pain and prevent atrophy of the injected area.	
No	10 (2.65%)
Yes	368 (97.35%)
Total	378 (100%)
Massaging the injected area helps speed up the absorption and action of insulin.	
No	126 (33.33%)
Yes	252 (66.67%)
Total	378 (100%)
Insulin causes other health problems.	
Didn't Vote	2 (0.53%)
Agree	84 (22.22%)
Disagree	159 (42.06%)
Neutral	133 (35.19%)
Total	378 (100%)
Insulin taken by the patient reduces the level of sugar in the blood.	
Agree	328 (86.77%)
Disagree	14 (3.7%)
Neutral	33 (8.73%)

Total	378 (100%)
Insulin taken by the patient is not irritating.	
Didn't Vote	3 (0.79%)
Agree	227 (60.05%)
Disagree	83 (21.96%)
Neutral	65 (17.2%)
Total	378 (100%)
No Insulin taken by the patient is a stigma.	
Didn't Vote	4 (1.06%)
Agree	274 (72.49%)
Disagree	65 (17.2%)
Neutral	35 (9.26%)
Total	378 (100%)
Can you inject yourself in the right places?	
Didn't Vote	13 (3.44%)
No	17 (4.5%)
Yes	348 (92.06%)
Total	378 (100%)
Do you inject yourself and the needle at a 45-degree angle?	
Didn't Vote	15 (3.97%)
No	156 (41.27%)
Yes	207 (54.76%)
Total	378 (100%)
Do you store insulin in the refrigerator or in cool places?	
Didn't Vote	11 (2.91%)
No	4 (1.06%)
Yes	363 (96.03%)
Total	378 (100%)
Do you inject insulin at the same site frequently?	
Didn't Vote	11 (2.91%)
No	309 (81.75%)
Yes	58 (15.34%)
Total	378 (100%)
Should short-acting insulin be taken with meals?	
Didn't Vote	17 (4.5%)
No	81 (21.43%)
Yes	280 (74.07%)
Total	378 (100%)
Should long-acting insulin be taken with meals?	
Didn't Vote	13 (3.44%)
No	274 (72.49%)
Yes	91 (24.07%)
Total	378 (100%)

Can you inject insulin in the following places?	
Do you inject insulin in the abdomen?	
Didn't Vote	13 (3.44%)
No	51 (13.49%)
Yes	314 (83.07%)
Total	378 (100%)
Do you inject insulin in the shoulder?	
Didn't Vote	15 (3.97%)
No	128 (33.86%)
Yes	235 (62.17%)
Total	378 (100%)
Do you inject insulin in the buttocks?	
Didn't Vote	18 (4.76%)
No	271 (71.69%)
Yes	89 (23.54%)
Total	378 (100%)
Do you inject insulin in the thigh?	
Didn't Vote	12 (3.17%)
No	26 (6.88%)
Yes	340 (89.95%)
Total	378 (100%)
Do you inject insulin into the leg?	
Didn't Vote	14 (3.7%)
No	352 (93.12%)
Yes	12 (3.17%)
Total	378 (100%)
Do you inject insulin into the chest/breast?	
Didn't Vote	14 (3.7%)
No	359 (94.97%)
Yes	5 (1.32%)
Total	378 (100%)

"Insulin Injection Techniques and Site Rotation in Diabetes Management." The aim was to ascertain whether these variables demonstrated any substantial correlations or associations. The initial phase of the analysis involved performing correlation analysis using Pearson correlation coefficients. These coefficients, which indicate the strength and direction of linear relationships, were computed among the variables. The findings revealed the following:

- A weak positive correlation was found between "Understanding Diabetes Management and Insulin Administration" and "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" ($r = 0.019$, $p = 0.706$).
- A weak positive correlation was observed between "Understanding Diabetes Management and Insulin Administration" and "Insulin Injection Techniques and

Site Rotation in Diabetes Management" ($r = 0.104$, $p = 0.044$).

- Similarly, a weak positive correlation was identified between "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" and "Insulin Injection Techniques and Site Rotation in Diabetes Management" ($r = 0.025$, $p = 0.626$).

Additionally, a nonparametric correlation analysis utilizing Spearman's rank correlation coefficient (ρ) was executed. Spearman's ρ evaluates monotonic relationships that may not strictly adhere to linearity. The Spearman's ρ outcomes were as follows:

- No statistically significant correlation was found between "Understanding Diabetes Management and Insulin Administration" and "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" ($\rho = 0.010$, $p = 0.842$).
- Similarly, no statistically significant correlation was observed between "Understanding Diabetes Management and Insulin Administration" and "Insulin Injection Techniques and Site Rotation in Diabetes Management" ($\rho = 0.087$, $p = 0.092$).
- Likewise, no statistically significant correlation was identified between "Understanding Misconceptions and Realities of Insulin Usage in Diabetes Care" and "Insulin Injection Techniques and Site Rotation in Diabetes Management" ($\rho = 0.024$, $p = 0.647$).

Discussion

Our research, which evaluated patients' knowledge and practice levels, found that, on average, study samples' knowledge of insulin storage and handling practices was only fairly sufficient, whilst their levels of practice were only fair. By adding the scores of each patient, the total knowledge and practice scores are calculated as the median of all knowledge and practice levels. An essential step in preventing the acute and chronic problems of diabetes mellitus connected to insulin delivery has been the development of correct understanding and excellent practice in relation to insulin storage and administration.

The majority of diabetes patients lack understanding and often do not consider the effects of improper handling of insulin and inadequate management techniques. The knowledge levels found in our research were greater than reported knowledge levels (57.55%) from India [23] and Nepal [24] but almost equivalent to reports (62.13%) from another study done in Ethiopia [25]. The levels of practice, however, were lower than what was recorded for Nepal (73.98%) [24]. The patients in the research locations may be less devoted and unconfident in their practitioners, which might account for some of the variance. Additionally, the

actions of patients may not have received much support from healthcare professionals (HCPs). Patients should follow directions to the letter, but they still need additional professional interventions to properly explain the guidelines in order to improve their knowledge and practice levels.

Previous research has shown that people with DM have little understanding of how to manage their illness and take care of themselves [26,27, 25]. In the current research, the patients' knowledge levels were influenced by residence, payment status for insulin, mock injection technique demonstrations at the initial visit, education levels, the length of insulin therapy, and the length of illness. Similar to the research conducted in Nepal, educated patients are much more likely to comprehend and put into practice storage and administration instructions and orders (24). In a similar vein, people who had the condition for longer and those who used insulin for longer had higher knowledge levels and could thus carry out the advised practices. This demonstrates how more frequent insulin self-administration may enhance patient understanding and proficiency. It is evident that as the amount of time spent on insulin treatment grows, so does their exposure to knowledge.

Additionally, patients may have had the chance to benefit from the negative effects of improper insulin management techniques. The results of this investigation were consistent with those of Surendranath A. et al., who found that patients' levels of knowledge had a significant impact on how long they used insulin self-administration strategies (P 0.05) [23]. Numerous pieces of advice about insulin injections and storage had sufficient logical and scientific backing, according to research, and were instead focused on local customs and habits(28,29). Patients' knowledge, practice, and abilities related to managing insulin may be greatly enhanced if they get both verbal and hands-on training. This is because combining verbal and physical instruction might be complementary, facilitating patient understanding and memory.

The first visit's practical mock administration method demonstration had a good impact on the respondents' level of understanding of insulin storage and administration procedures. Allowing patients to practice fake injections in a separate training room for diabetes injections on their first visit may help boost their confidence in the diabetic self-care procedure. Regular evaluations of patients' storage and injection habits may be beneficial. Additionally, repeating these practices during future follow-up visits may help them become more knowledgeable and more proficient practitioners than their competitors. Students had higher levels of practice than other groups from the standpoint of their employment. Students may be able to read and search the provided suggestions and directions. Additionally, they could ask for clarification on advice and directions they don't comprehend.

The correlation coefficient test revealed a linear positive link between insulin injection knowledge and practice levels. These findings suggest that increased patient understanding of insulin handling practices may lead to an improvement in the amount of injection practice among patients. This suggests that the majority of patients were aware of the benefits of rotating injection sites on a regular basis, including the prevention of painful injections, lipodystrophy, and the preservation of healthy tissue for appropriate absorption. A number of papers [29–31] corroborate this. In the current research, mixing insulin before administration seems to be more common than what was found in India (66.3%).

Additionally, more patients (97%) in India [31] tipped or rolled the vial less than ten times. The smaller sample size of the current research may be the cause of the outcomes being different between our study and those from India. Generally speaking, around 50% of responders either misperformed or omitted highly crucial practical knowledge and essential elements of insulin administration guidelines. Despite the fact that the patient's knowledge and practice levels were reasonably good and fair, respectively, the study's findings showed that their practical abilities were noticeably lacking. Here, patients may be reluctant to put into practice what they previously knew and had been advised by experts, or they may have forgotten and be having trouble remembering all necessary actions. Additionally, diabetes patients often experience frustration and embarrassment associated with the necessity for needle injections; this may encourage patients to look for alternatives to injections for the administration of insulin.

This is yet additional difficulty for the patients and can make them less motivated to adopt the recommended insulin delivery and handling techniques. Therefore, another objective of experts should be to inform patients with DM about incorrect perceptions, beliefs, and attitudes about storage and administration methods [32].

Limitation

There are several limitations to the current investigation. Not all prospective respondents may have been taken into account as we only included patients who went to the hospitals that were chosen at random throughout the data collecting period. It could be challenging to generalize the results to Ethiopia's multiracial and very diversified population due to the small sample size and the few hospitals. Additionally, since the research was carried out in hospitals, where medical experts were always on hand, patients can feel under pressure because they may believe they would be held accountable for their subpar behavior.

Conclusion

Patients with diabetes in the current research had fair

awareness of and practices regarding insulin storage and delivery. Patients lacked proficiency in the crucial and key procedures of administration. In order to permanently improve patients' knowledge, practice, and insulin administration skills and eventually allow patient self-care, this research emphasizes the necessity for routine public health education, ideally provided by healthcare professionals as well as other stakeholders.

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