Analysis of Development Status and Function Features of Diabetes Health Medical Management Apps

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Research Article

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Abstract

Background

Using Diabetes-related Apps can effectively reduce the patients’ level of glucose and rehospitalization rate. However, due to the serious homogeneity of diabetes apps content and uneven function quality, medical staffs and patients do not know how to choose. This study aimed to understand the development status of diabetes health management Apps, analyze their functions and characteristics, and provide recommendations for further improvement or development of diabetes-related Apps.

Methods

In May 2022, diabetes-related apps were screened in ten major App markets, including Android and iOS system by using the keywords either Chinese or English. Then, we searched the literature to supplement the APP. The apps that met the criteria were downloaded and their functions and characteristics were analyzed. Silberg scale was used to assess their information accountability.

Results

105 diabetes-related apps were included, including 69 Chinese apps and 36 English apps. Almost all (97.8%) of which were developed by companies and commercial teams. Most of the apps (96.2%) were targeted at people with diabetes, and only 3.8% were for type 1 and gestational diabetes. The total mean score of Silberg scale was 3.60 ± 0.81. Among 28 functions, individual customized function and social support function are rare.

Conclusion

Nowadays, the overall accountability quality of diabetes-related apps is low. The functions are insufficient, and the individual customized functions need to be further explored. In the future, it should be strengthen the diversity and individualization of diabetes-related apps, and encourage medical staffs and patients to participate in the designment and development of Apps.

Introduction

According to the data from The Global Diabetes Overview (Tenth Edition) of the International Diabetes Federation (IDF), up to December 2021, there were about 537 million diabetics in the global population aged 20–79, and the number of diabetics is expected to reach 643 million by 2030, direct medical costs from diabetes are already approaching 1 trillion [1]. China has the largest number of diabetics in the world, and the total number of diabetics has exceeded 116.4 million, equivalent to 1 in 9 diabetics [2]. Due to the characteristics of insidious onset, long courses and incurable, patients need long-term treatment
and management to control the disease, preventing and delaying acute or chronic complications [3]. Poor management can easily lead to diabetic microangiopathy and complications of diabetes, seriously affecting the patients’ quality of life and life span, and bringing great economic and psychological burden to families and society [4].

Mobile Health applications (mHealth Apps), as one of the main forms of mHealth management, refers to smartphones, tablets or other mobile devices as terminals and mobile internet technology as the support, providing services for patients and medical staffs [5]. With the popularity of mobile devices, more than 500 million smartphone users worldwide use mobile health apps for health management [6]. Medical staffs can develop individualized health guidance plans for users through mobile health apps, give instant feedback through the Apps, and provide online consultation for patients, which bringing great convenience to users [7].

With the rapid increase of diabetics and the shortage of medical resources, it is difficult to meet the individual needs of the patients [8, 9]. A number of studies have shown that applications are a feasible tool to improve diabetes self-management [10]. diabetes patients who use mobile phone APP for self-management can improve their cognitive level and self-efficacy of disease, effectively reduce postprandial blood glucose, glycosylated hemoglobin level and readmission rate [11–17]. Medical staffs can use apps to provide immediate support and help patients improving their compliance with self-management, so as to improve management efficiency [18, 19]. At present, mobile health apps have been widely used in the prevention and health management of patients with diabetes [20]. With the development of mobile medicine, a large number of chronic disease management apps have been launched into the app market. Recently, there are more than 320000 health applications available in major app stores, of which diabetes applications account for about 30% [21]. "Homogenization" describes the state of an industry at a specific stage of development, which is manifested in the infinite integration of products, brands, marketing, services, etc., making consumers face almost the same choices. Due to the serious homogenization of the content of diabetes applications and the imbalance of the functional quality, medical staff and patients do not know how to choose [22–24]. Diabetes app can not effectively meet the actual needs of diabetes patients, which reduces their willingness to use [25]. Therefore, the purpose of this study is to understand the development status of diabetes related applications in China's mobile application market, analyze their functions and characteristics, provide help for medical personnel to reasonably select applications, and provide reference for subsequent development of diabetes related applications.

Methods

1.1 Searching Platform We used two search strategies. First, we searched the app market for "diabetes, blood glucose, blood sugar, type 1 diabetes, type 2 diabetes, hyperglyceamia, gestational diabetes, GDM" in the app market corresponding to Apple iOS 14.2, iPad 14.4.2 and Android Huawei Mate 20 Pro mobile terminals. The selection of the app market and the keywords were discussed between the two researchers. Among the many application markets for Android, "PeaPod", "360 Mobile Assistant", "Huawei
App Market", "Anzhi Market" "App Store" "91 Assistant" "Xiaomi App Store" "Mobile Baidu Assistant" "Top eight application market; Apple system choose "Apple iOS Mall" "iPad APP Store" to search. Then, we used the search terms "diabetes app, mobile medical, GDM app, blood glucose monitoring APP, Mobile applications, Mobile health, e-health, mobile phone, mHealth, mobile health applications, mobile health apps" to search PubMed, China Journal Full Text Database (CNKI) and Wanfang database, and summarized the retrieved APPs.

1.2 Screening Criteria The inclusion criteria of app are as follows: The user’s interface is either Chinese or English; All type of diabetes medical management apps can be used normally after registration. Exclusion criteria: Only Diet or Complication management apps; Medical Version apps; Medical consultation apps.

1.3 Screening Methods The two researchers used different mobile phones and entered keywords in the two systems to search. Record search results in Excel for data de-duplication. Download and register the included applications one by one, test and use the corresponding functions. A total of 1029 APPs were retrieved, and duplicate and unusable APPs were deleted. Finally, 105 applications related to diabetes management were included in the study.

1.4 Extracting Information Extract the functions from the incorporated app. Eventually extraction " Risk prediction and assessment function, Personalized customized function, Blood glucose recording, Trend analysis, Diet recording, Calorie calculation, Food storage, Exercise recording, Reminding function, Weight recording, Blood pressure recording, Sleep monitoring, Heart rate monitoring, Blood oxygen monitoring, Cholesterol recording, Uric-acid recording, HbA1c recording, Health information, Moments, Rewarding, Sharing data, Consulting services, Live function, Medication recording, Insulin recording, Book store, Mall service, Upload medical records ", a total of 28 functions.

1.5 Evaluation of information accountability Silberg Scale was used to evaluate the accountability of the included Apps. Silberg scale is a validated scale originally designed to determine online health information quality, which was initially developed by Griffiths and Christensen [26]. This scale has recently been used in evaluating the accountability aspect of apps information. The scale includes 4 dimensions, Authorship, Attribution, Disclosure and Currency, with 9 items in total. One point for each item, a total of 9 points, the higher the score, the better the quality of the APP. This scale has been applied to evaluate the information quality of cardiovascular, postpartum depression and other disease applications [27]. Two researchers (Beibei Duan, Mengdi Liu) independently used the Silberg scale to evaluate the included APP, and checked the results after evaluation. For the inconsistency after check, discuss with the third researcher Weiwei Liu to determine.

1.6 Statistical Analysis SPSS 25.0 software was used to analysis the data. Counting data by frequency and percentages, and measurement data by mean ± standard deviation.

Results
2.1 Screening process By May 2022, a total of 721 applications have been found in the Android system, 268 applications have been found in the Apple system, and 40 applications have been retrieved from the literature, 1029 apps in total. Through browsing the tabs, exclude apps that are unrelated to the theme, duplicate, or can't be used properly after downloading. Finally, 105 diabetes-related apps were included. Among them, there are 69 apps in Chinese, 36 apps in English. See Fig. 1 for the specific process.

2.2 General Characteristics of diabetes health management Apps See Table 1. Among them, the average cost of the paid APP is 19.8 Yuan, and the cost of the free APP is 60 to 800 Yuan, which include some charges such as consultation and physical examination package.

<table>
<thead>
<tr>
<th>Items</th>
<th>Chinese apps</th>
<th>English apps</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 69</td>
<td>n = 36</td>
<td>n = 105</td>
</tr>
<tr>
<td>Applicable population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1 diabetes</td>
<td>1(1.4)</td>
<td>1(2.8)</td>
<td>2(1.9)</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>2(2.9)</td>
<td>0(0.0)</td>
<td>2(1.9)</td>
</tr>
<tr>
<td>All types of diabetes</td>
<td>66(95.7)</td>
<td>35(97.2)</td>
<td>101(96.2)</td>
</tr>
<tr>
<td>Research and development organization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The institute which collaborated with medical institutions</td>
<td>2(2.9)</td>
<td>0(0.0)</td>
<td>2(1.9)</td>
</tr>
<tr>
<td>Company or business group</td>
<td>67(97.1)</td>
<td>36(100)</td>
<td>103(98.1)</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid</td>
<td>4(5.8)</td>
<td>1(2.8)</td>
<td>5(4.8)</td>
</tr>
<tr>
<td>Free</td>
<td>65(94.2)</td>
<td>35(97.2)</td>
<td>100(95.2)</td>
</tr>
</tbody>
</table>

2.3 Analysis Of The Function Characteristics Of Diabetes Management Apps

Number of Diabetes Health Management Apps Functions A total of 28 functions were abstracted in the apps in this study. The numbers of Chinese and English diabetes management apps as shown in Table 2.
Table 2
Classification of the number of diabetes management APP functions (n/%)

<table>
<thead>
<tr>
<th>numbers of functions</th>
<th>Chinese apps n = 69</th>
<th>English apps n = 36</th>
<th>Total n = 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>15(21.7)</td>
<td>0(0.0)</td>
<td>13(12.4)</td>
</tr>
<tr>
<td>Level 2</td>
<td>17(24.6)</td>
<td>3(8.3)</td>
<td>20(19)</td>
</tr>
<tr>
<td>Level 3</td>
<td>29(42.0)</td>
<td>14(38.9)</td>
<td>43(40.1)</td>
</tr>
<tr>
<td>Level 4</td>
<td>8(11.6)</td>
<td>19(52.8)</td>
<td>27(25.7)</td>
</tr>
</tbody>
</table>

Note: the number of functions > 15 is level 1; The number of functions between 11 and 15 is level 2; The number of functions between 6–10 is level 3; Less than 5 is level 4

2.4 Ranking of Functions about the Diabetes Management Apps

Ranked by the number of diabetes management apps feature from most to least, the top five functions are Blood-glucose recording and Trend Analysis, Blood Pressure recording, Exercise recording, Health information and Consulting services. The last five functions are Heart Rate monitoring, Live function, Sleep monitoring, Book store and blood Oxygen monitoring. As shown in Fig. 2.

2.5 Function Comparison of Diabetes Management Apps

Diabetes related apps features can be divided into six functions, including Prevention Function (Risk prediction and assessment Function), Auxiliary Self-management Functions (Diet recording, Exercise recording, Medication recording, Insulin recording, Blood Glucose recording, HbA1c recording, Blood pressure recording, Weight recording, Sleep monitoring, Heart rate monitoring, Blood oxygen monitoring, Uric-acid recording, Cholesterol recording, Health information, Live function, Book store), Developing Individual Blood Glucose Program; Social support function (Consulting services, Moments, Sharing data), Reminding function; Service function (Calorie calculation, Food storage, Trend analysis, Mall services, Rewarding, Upload medical records). The comparison of the number of diabetes management apps in different mobile phone systems is shown in Table 3.
Table 3
Comparison of functions of diabetes health management apps (n/%)

<table>
<thead>
<tr>
<th>Function</th>
<th>The secondary function</th>
<th>Chinese apps n = 69</th>
<th>English apps n = 36</th>
<th>Total n = 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary self-management functions</td>
<td>Blood Glucose Recording</td>
<td>68(98.6)</td>
<td>35(97.2)</td>
<td>103(98.1)</td>
</tr>
<tr>
<td></td>
<td>Diet Recording</td>
<td>33(47.8)</td>
<td>22(61.1)</td>
<td>55(52.4)</td>
</tr>
<tr>
<td></td>
<td>Exercise Recording</td>
<td>39(56.5)</td>
<td>16(44.4)</td>
<td>55(52.4)</td>
</tr>
<tr>
<td></td>
<td>Medication Recording</td>
<td>33(47.8)</td>
<td>18(50.0)</td>
<td>51(48.6)</td>
</tr>
<tr>
<td></td>
<td>Insulin recording</td>
<td>26(37.7)</td>
<td>15(41.7)</td>
<td>41(39.0)</td>
</tr>
<tr>
<td></td>
<td>Health Information</td>
<td>41(59.4)</td>
<td>7(19.4)</td>
<td>48(45.7)</td>
</tr>
<tr>
<td></td>
<td>Live function</td>
<td>9(13.0)</td>
<td>0(0.0)</td>
<td>9(8.6)</td>
</tr>
<tr>
<td></td>
<td>Book Storage</td>
<td>2(2.9)</td>
<td>3(8.3)</td>
<td>5(4.8)</td>
</tr>
<tr>
<td></td>
<td>Blood Pressure Recording</td>
<td>49(71.0)</td>
<td>11(30.6)</td>
<td>60(57.1)</td>
</tr>
<tr>
<td></td>
<td>Weight Recording</td>
<td>37(53.6)</td>
<td>6(16.7)</td>
<td>43(41.0)</td>
</tr>
<tr>
<td></td>
<td>HbAlc Recording</td>
<td>21(30.4)</td>
<td>11(30.6)</td>
<td>32(30.5)</td>
</tr>
<tr>
<td></td>
<td>Heart Rate Recording</td>
<td>14(20.3)</td>
<td>1(2.8)</td>
<td>15(14.3)</td>
</tr>
<tr>
<td></td>
<td>Blood Oxygen Recording</td>
<td>5(7.2)</td>
<td>0(0.0)</td>
<td>5(4.8)</td>
</tr>
<tr>
<td></td>
<td>Uric-acid Recording</td>
<td>16(23.2)</td>
<td>0(0.0)</td>
<td>16(15.2)</td>
</tr>
<tr>
<td></td>
<td>Cholesterol Recording</td>
<td>21(30.4)</td>
<td>5(13.9)</td>
<td>26(24.8)</td>
</tr>
<tr>
<td></td>
<td>Sleep Monitoring</td>
<td>7(10.1)</td>
<td>1(2.8)</td>
<td>8(7.6)</td>
</tr>
<tr>
<td>Individual blood sugar program</td>
<td>Developing Individual Blood Sugar Program</td>
<td>14(20.3)</td>
<td>1(2.8)</td>
<td>15(14.3)</td>
</tr>
<tr>
<td>Prevention</td>
<td>Risk Prediction and Assessment</td>
<td>18(26.1)</td>
<td>0(0.0)</td>
<td>18(17.1)</td>
</tr>
<tr>
<td>Reminding</td>
<td>Reminding</td>
<td>30(43.5)</td>
<td>1(2.8)</td>
<td>31(29.5)</td>
</tr>
<tr>
<td>Social Support Function</td>
<td>Consulting Services</td>
<td>43(62.3)</td>
<td>3(8.3)</td>
<td>46(43.8)</td>
</tr>
<tr>
<td></td>
<td>Moments</td>
<td>18(26.1)</td>
<td>2(5.6)</td>
<td>20(19.0)</td>
</tr>
<tr>
<td></td>
<td>Sharing Data</td>
<td>24(34.8)</td>
<td>8(22.2)</td>
<td>32(30.5)</td>
</tr>
<tr>
<td>Service Function</td>
<td>Trend Analysis</td>
<td>68(98.6)</td>
<td>27(75.0)</td>
<td>95(88.0)</td>
</tr>
<tr>
<td></td>
<td>Mall Service</td>
<td>31(44.9)</td>
<td>2(5.6)</td>
<td>33(31.4)</td>
</tr>
<tr>
<td>Function</td>
<td>The secondary function</td>
<td>Chinese apps n = 69</td>
<td>English apps n = 36</td>
<td>Total n = 105</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Calorie Calculation</td>
<td>28 (40.6)</td>
<td>7 (19.4)</td>
<td>35 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Food Storage</td>
<td>27 (39.1)</td>
<td>4 (11.1)</td>
<td>31 (29.5)</td>
<td></td>
</tr>
<tr>
<td>Upload Medical Records</td>
<td>22 (31.9)</td>
<td>1 (2.8)</td>
<td>23 (21.9)</td>
<td></td>
</tr>
<tr>
<td>Rewarding Points</td>
<td>15 (21.7)</td>
<td>0 (0.0)</td>
<td>15 (14.3)</td>
<td></td>
</tr>
</tbody>
</table>

2.6 Information Quality Analysis Among the 105 apps included in this study, the highest score was 6 and the lowest score was 2. The majority of apps (91, 86.7%) scored no more than 4, and just (3, 2.8%) of apps reached above 5. For the authorship, 7.6% Apps identified the authors, although all the applications (100%) identified the author’s affiliations, none of them furnished the credentials of authors. In respect of attribution, 30.5% applications given the source, 3.8% had the references or hyperlinked. As for disclosure, all of the apps have disclosed the ownership of the applications, but none of them disclosed the sponsorship. With regard to currency, 96.2% of apps included the last modification date, 19.0% of the apps were updated within the past month. The mean score of each of four domains was very low, ranging from 0.34 out of 2 for attribution and 1.15 out of 2 for currency. The mean score of each dimension of the Silberg scale for diabetes-related apps is presented in Fig. 3.

Discussion

Among all the diabetes management apps in the Chinese mobile App market, only 46.2 percent English or Chinese apps are available for use. The vast majority of apps were developed by commercial teams or companies, with little involvement from medical staffs. Apps related to type 1 diabetes mellitus or gestational diabetes mellitus were rare. The overall information quality of diabetes health management apps is low. More than half of the apps have a small number of functions, and lack of personalized customization functions and social support functions, which are difficult to effectively assist patients with diabetes self-management.

Previous studies have pointed out that technical and quality problems are the main problems existing in health management apps [28]. Currently, there are 195 apps related to diabetes health management in China’s mobile App market, but only 53.8% can be used normally. Most apps have technical problems such as failure to register, login and flash back. Therefore, the operation and technical maintenance of mobile health applications should be strengthened in the future to ensure the usability of App market. From the perspective of development teams, the vast majority of apps are developed by commercial teams or companies, with little participation of the medical staff, and uncertain accuracy of push content, which is consistent with the research of Jimenez et al [29]. Secondly, apps fee will affect patients’ intention to use apps [30]. This study shows that 95.2% of apps are free software, but nearly half
(36.7%-50%) of apps have built-in charging items, such as consultation and mall functions, which will affect the use of apps by patients. Finally, at present, most apps are suitable for all types of diabetic patients, while few apps are designed for the characteristics of type 1 diabetes and gestational diabetes. Due to the different characteristics of various types of diabetes, their health management is also different. It is suggested that medical staff should participate in the design and development of the APP and push evidence-based content to ensure the accuracy and authority of the push content.

In this study, the average information quality score of the 105 apps was 3.60 ± 0.81 (the highest score was 9), which indicates that the overall quality of diabetes-related apps is low and has not yet reached the average level. This result is basically consistent with that of Zhang et al [31], but slightly higher than that of Zhang et al [32] and Xiao et al [33]. This may be related to the fact that 19.0% of diabetes health management apps updated their content within the last month, which is the reason why the average score of information quality of diabetes health management apps was higher than that of other studies. However, this study showed that in all 105 apps, the author's certificate was not provided, and the sponsor of the apps was not disclosed. This is the direction for future improvement.

Research shows that the more problems apps can help users solve, the higher the stickiness of users to medical apps, and the stronger their willingness to use apps in the future [34]. This study shows that more than half of the apps have less than 10 functions, and some of them are only designed for one function, such as blood sugar recording app, diet recording app and exercise recording app, etc. These apps can solve limited problems for patients, so their use is limited. In addition, only about half of all diabetes management apps can provide the function of diet and exercise recording and monitoring, and 39% of them provide the function of Insulin Recording, indicating that most apps lack the core function of assisting self-management and monitoring, which is difficult to meet the needs of assisting patients in self-management [35]. Therefore, it is suggested that when developing diabetes management apps in the future, sufficient research should be carried out to understand the needs of patients, and the comprehensiveness and diversity of functions should be considered on the basis of the development of core functions to assist self-management, so as to meet the diversified needs of patients as much as possible.

Research shows that 17.1% of diabetes management apps have the risk prediction function of diabetes risk or diabetes complications. However, it is uncertain whether the risk prediction function of these apps is developed based on the diabetes risk prediction model. Therefore, the accuracy of their prediction is uncertain. In addition, only 14.3% of diabetes management apps have the function of developing personalized management plans for patients, and most apps cannot develop personalized management plans for patients based on their characteristics. Therefore, these apps are difficult to effectively assist patients to improve their self-management ability. It is suggested that a risk prediction module should be developed based on the diabetes risk prediction model in the future to identify people with different risk levels and give hierarchical management, so as to improve the quality and efficiency of diabetes prevention management. At the same time, personalized management plans should be formulated based
on the patient-centered risk factors and evidence-based evidence, combined with the characteristics and needs of patients, so as to better prevent and delay the occurrence and development of the disease.

The function of social support is one of the most important factors affecting patients' behavior change and health status. Professional support from medical staff plays an important role in patients' self-management and blood glucose control [36]. The health guidance carried out by nursing staff can improve the compliance of patients with medication and make them actively cooperate with treatment [37, 38]. This study shows that almost half of apps (43.8%) have expert consultation function. Diabetics can communicate with doctors anytime and anywhere through mobile apps, which can better help patients to manage themselves; Studies have shown that peer support has a good effect on improving patients' behavioral compliance and psychological and emotional management, and patients' real-time sharing and communication in the app can strengthen the role of peer support [39]. However, in this study, apps with communication functions between diabetics such as Moments function account for only 19.0%, and there is no core function for peer support such as group interaction and regular sharing of experience. This suggests that peer support for these apps is limited. As an important part of social support, family support plays an important role in promoting patients' self-management. This study found that no app has the interconnection function with family members. It is suggested that when developing diabetes management apps in the future, attention should be paid to the development of family and social support functions, so as to comprehensively improve patients' self-efficacy and self-management ability.

Timely reminding can help users improve the compliance of self-management and develop good living habits, when the user's laboratory value exceeds the normal limit, it can give an early warning and reminding to help patients better control their blood sugar. In this study, less than half of the apps have reminders (only 29.5%), indicating that existing apps have insufficient auxiliary functions for patient self-management. Studies show that if the push frequency is too low, users will not be able to arouse the activity of the APP, while if the push frequency is too high, users may feel antipathy and even uninstall the apps [40]. Therefore, it is suggested that in the future development of APP, customized reminder functions should be set so that patients can choose the time, frequency and form of reminder to help users improve compliance.

**Limitations**

This study has certain limitations. Due to the wide range of Android mobile application markets, this study only searches the top eight Android application markets, which may be incomplete. Secondly, for the charging items of the APP, the consulting function that needs to be bound to the doctor, and the recording function that needs to be connected to the glucose meter and other instruments, we failed to test whether it is available.

**Conclusion**
At present, diabetes-related APPs have been rapidly developed in the field of mobile health, but there is still some room for improvement. For example, the integration of diabetes management App and medical system has not been achieved online and offline, and the participation of medical institutions and medical staff is low, which easily causes the daily monitoring data not to be effectively utilised and fails to achieve the purpose of extending medical services by using mobile internet technology; the core function of assisting diabetes self-management behaviour monitoring is still insufficient, and the overall quality of APP development is low. It is recommended that the development of future APPs should strengthen the participation of medical staff and users, and develop APPs for different types of diabetes. In addition, the development of diabetes-related APPs should fully consider the needs of patients, focus on behavioural changes of diabetes patients, and give patients adequate family and social support, supplemented by means of behavioural monitoring, in order to better help patients improve their Self-management skills.

**Declarations**

**Ethics approval and consent to participate:** Not applicable.

**Consent for publication**

Agree to publish.

**Availability of data and materials**

Data and materials are allowed to be used.

**Competing interests**

The authors declare that there is no conflict of interest.

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**Authors' contributions:** BB Duan and MD Liu studied the literature and conceived this study. BB Duan and MD Liu contributed equally to this study. BB Duan wrote the first draft and data analysis; CH Ma assisted in the investigation; Liu Weiwei conceptualized this research and gained ethical recognition. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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Figures
Figure 1

Flow chart of APP screening in two major application markets

Android system: 721
360 mobile Assistant: 99;
Wandoujia: 70;
Huawei App Store: 191;
Xiaomi App Store: 234;
Tencent My App Store: 53;
Mobile Baidu Assistant: 45;
91 Assistant: 20; Anzhi Market: 9

Apple system: 268
iOS: 199;
iPad: 69

App appears in the literature: 40

Total 1029

Use repetition in the market: 87;
Do not tally with the subject: 611;
Medical version: 39;
Non-Chinese or English interface: 57

245 were incorporated for the first time

Recipes, drugs, complications-related app: 96;
Can't use normally: 34

105 apps were included
(69 in Chinese
36 in English)
Figure 2

Distribution of the functions of diabetes health management APPs
Figure 3

The mean score of each dimension of the Silberg scale for diabetes-related apps