Technology

Diabetes apps: The agony of choice

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Healthcare apps are being seen as a novel way of helping people with self-management of their medical conditions, and more than 1100 smartphone apps for diabetes care have now been identified (Garabedian et al, 2015). This is reflected by the three publications regarding apps summarised in these pages.

The scale of the challenge for healthcare professionals trying to assess what apps are available and how useful and reliable they are, in order to advise interested patients appropriately, is emphasised by the analysis performed by Basilico and colleagues. Searching Apple's US App store with the keyword diabetes returned 952 results! Of these, 67 apps were to support diabetes self-management. All of the latter had a glucose log, but 88% of them required the user to input the data manually. Medication and nutrition logs were common features, but advanced features such as a bolus calculator (present in 17% of apps) were rare.

Another recent publication has highlighted that app-based bolus calculators may have potentially flawed algorithms underpinning the bolus doses recommended (Huckvale et al, 2015). In their paper, Basilico and colleagues focussed on how trustworthy the apps are, describing a "Pictorial Identification Schema" that users could complete to report how useful and reliable they found an app. Such a review system is a more advanced version of rating systems commonly used for apps and other online services, such as TripAdvisor. However, the authors acknowledge that an app rating system from a reputable healthcare body such as NICE or Diabetes UK would be the preferred way of flagging up which apps are likely to be most useful. The best apps are likely to be those that minimise data input and so capture glucose readings directly from a meter, record activity data using in-built accelerometers or other exercise logging apps and, perhaps one day, determining nutritional data from meal screenshots.

De Ridder and colleagues reviewed incentive-driven mobile health technology used in diabetes management. Nineteen publications involved the use of apps, and these were the dominant technology in publications from 2014, the last year considered in the review. The incentives included goal reminders; alerts when a health parameter was out of range; feedback where the user is provided with automated or manually inputted advice on the basis of the data provided; discussion with peers; education, where information is provided to the user on the basis of the inputted data or issues identified; financial, where rewards such as iTunes vouchers are offered when targets are achieved; and "gamification", in which social competition is used to make self-management more fun. The latter is an increasingly common phenomenon and appears to be particularly attractive to adolescents and young adults with diabetes. Older people, in contrast, are more likely to favour simpler incentive-driven technologies such as SMS messaging – although our experience with using diabetes technologies such as pump therapy and continuous glucose monitoring is a caution against such age-based stereotyping!

We are left with an ever-increasing number of apps which people with diabetes may access to support them in self-management, but with little information as to the utility or reliability of a particular app, and with limited evidence that such interventions are effective in motivating or improving outcomes for users. However, it is encouraging that steps are being taken to try and assist users by providing app evaluation from other users. In describing their app to support women with gestational diabetes, Jo and Park provide an alternative means by which we might be able to evaluate individual apps.

Garabedian LF, Ross-Degnan D, Wharam JF (2015) Mobile phone and smartphone technologies for diabetes care and self-management. *Curr Diab Rep* **15**: 109

Huckvale K, Adomaviciute S, Prieto JT et al (2015) Smartphone apps for calculating insulin dose: a systematic assessment. *BMC Med* **13**: 106

Comput Biol Med

Identifying the best apps for diabetes self-care

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! Factor	✓✓✓✓

1 These authors propose a new tool, an adaptation of the "Pictorial Identification Schema" (PIS), to evaluate smartphone applications that aim to assist self-care in people with diabetes.

2 The PIS is designed to be used by any user (e.g. developer, patient or healthcare professional) and uses a traffic-light colour system to rate the various attributes of an app.

3 Attributes are divided into six families, including the services and functions offered, envisaged users (e.g. patients or professionals) and qualifiers and quantifiers (e.g. user ratings and download numbers).

4 In evaluating this new tool, the authors searched Apple's US app store using the keyword diabetes. Of the 952 apps revealed in this search, only 67 (7%) were actually for diabetes care, of which 41 were selected after applying exclusion criteria.

5 While most apps allowed logging of data on blood glucose levels and medication, advanced features such as bolus calculators were much more rare.

6 Two users – a developer and a person with diabetes – evaluated these apps using the PIS. Both users identified weaknesses in the functionality and interface of the apps; however, the patient focussed on usability while the developer focussed on technical implementation.

7 The authors conclude that the majority of apps available at present offer limited functionality and that more advanced functions still need to be implemented. The PIS appears to be a simple and intuitive tool to inform choice.

Basilico A, Marceglia S, Bonacina S, Pinciroli F (2016) Advising patients on selecting trustful apps for diabetes self-care. *Comput Biol Med* **71**: 86–96

J Telemed Telecare

Incentive-driven mHealth technology: Systematic review

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! Factor	✓✓✓✓

1 These authors conducted a systematic review to identify the incentive-based mobile health (mHealth) technologies available for diabetes care and to categorise the different incentive mechanisms used.

2 Overall, 42 articles were included in the final review. A number of different media were used, including smartphone apps, the internet, glucometers and text messages.

3 The authors were able to classify incentives into seven categories. Education (presenting instructional and informational content) was the most common mechanism, used in 21 tools.

4 Reminders (e.g. regular notifications of personal goals) was the next most common (used in 11 tools), followed by feedback (e.g. a practitioner or a software algorithm messaging users to let them know their management had been good or bad; used in 10 tools).

5 Social media (connecting users with one another for support) was the next most common incentive, used in eight tools, often in combination with other methods. Alerts (similar to reminders, but usually targeted at the practitioner rather than the user) were used in five tools.

6 Finally, gamification (using game-like systems such as levelling up and unlocking digital rewards) was used in three tools, and financial rewards (e.g. earning iTunes vouchers) in two.

7 These core incentive mechanisms have remained largely unchanged over the 7-year study period, even though the technology platforms on which they are delivered have evolved.

de Ridder M, Kim J, Jing Y et al (2016) A systematic review on incentive-driven mobile health technology: As used in diabetes management. *J Telemed Telecare* 16 Feb [Epub ahead of print]

Healthc Inform Res

Development of a smartphone app for managing GDM

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! Factor	✓✓✓

1 In this article, the authors describe the development process and feedback on a new app for Android phones to assist women with gestational diabetes (GDM).

2 The information and functions required for the app were determined using clinical practice guidelines and expert review.

3 In addition to educational resources relevant to all women with GDM, the authors produced a total of 49 tailored recommendations on diet, blood glucose and ketone management, physical activity and body weight, and an algorithm was created to link these to users' data.

4 The app was piloted in 60 women with GDM, who used a 7-point Likert scale to describe behavioural intention to use (BI; their intention to use the app in the future), intrinsic motivation (IM; willingness to use the app without any compensation), perceived ease of use (PEoU) and perceived usefulness (PU; belief that the app would improve their GDM management).

5 Overall, 36 of the pilots gave feedback on the app; after exclusion criteria were applied, 22 responses were analysed. The average scores for BI, IM, PEoU, and PU were 5.5, 4.3, 4.6, and 5.0 out of 7, respectively.

6 User acceptability of this new app appears to be high. This systematic method to develop and evaluate the app could easily be extended to others. As the next step, the authors recommend evaluating the effect of their app on GDM outcomes.

Jo S, Park HA (2016) Development and evaluation of a smartphone application for managing gestational diabetes mellitus. *Healthc Inform Res* **22**: 11–21

ADA 2016

RT-CGM improves HbA_{1c} irrespective of treatment modality

76th scientific sessions, American Diabetes Association, New Orleans, LA, June 10–14, 2016

1 The aim of this study was to determine the effect on glycaemic control of switching from multiple daily insulin injections (MDI), guided by traditional self-monitoring of blood glucose (SMBG), to therapies guided by real-time continuous glucose monitoring (RT-CGM).

2 People with T1D were assigned to switch to sensor-augmented pump (SAP) therapy (n=11), MDI with RT-CGM (n=8) or insulin pump therapy guided by SMBG (n=18), or to stay on MDI with SMBG (n=17).

3 After 1 year of treatment, mean HbA_{1c} fell significantly by 12 mmol/mol (1.1%) in the SAP group and by 14 mmol/mol (1.3%) in the MDI/RT-CGM group, with no significant difference between the two groups.

4 HbA_{1c} also fell significantly, but to a lesser extent, in the insulin pump/SMBG group (by 5 mmol/mol [0.5%]). There was no significant reduction in the MDI/SMBG group.

5 Use of RT-CGM resulted in significantly greater HbA_{1c} reductions than SMBG, either with MDI or pump therapy.

6 Glycaemic variability was significantly lower with both RT-CGM and pump therapy compared to MDI/SMBG. A reduction in the amount of time spent in hypoglycaemia occurred only with RT-CGM (8% at baseline vs 6% at 1 year; $P<0.01$).

7 The authors conclude that RT-CGM significantly improves HbA_{1c}, and that RT-CGM-supported MDI is a valid alternative to SAP.

Šoupal J, Petruželková L, Flekac M et al (2016) Continuous glucose monitoring improved glycemic control in patients with type 1 diabetes in a 52-week period, either with insulin pump therapy or with a basal–bolus insulin regimen. *American Diabetes Association 76th Scientific Sessions*: abstract 869-P

"The authors conclude that the majority of apps available at present offer limited functionality and that more advanced functions still need to be implemented."