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DIABETIC Medicine

RESEARCH ARTICLE

Continuing the quality improvement of an electronic personal health record and interactive website for people with diabetes in Scotland (*My Diabetes My Way*)

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Abstract

Aims: eHealth applications have the potential to enable patients to take more control over managing their own health, helping to delay and prevent complications. My Diabetes My Way (MDMW) is an electronic personal health record/educational platform available to people with diabetes in Scotland. This study aims to assess user experience with respect to demographic subgroups, examine effectiveness of previous improvements made to the platform and inform its ongoing development.

Methods: All active MDMW users (22,665) were invited to take part in a questionnaire combining Likert scale and free-response items relating to system utility. Likert responses were used to generate a 'utility score'. This was used in regression analyses to determine predictors of system utility scoring. Free-response answers were analysed thematically and themes were generated.

Results: A total of 4713 (21%) MDMW users responded to the questionnaire. Most agreed that MDMW helps them to track changes over time, prepare for face-to-face consultations, remember information discussed in consultations and reduced the need to contact their general practitioner. Free-response answers showed that users valued earlier enhancements made to the site (e.g. linking Fitbit data), and highlighted areas needing further improvement. Evidence of the 'digital divide' was seen in respondent demographics, and some users mentioned 'lack of digital skills' as a barrier to engaging with the platform.

Conclusions: User experience of MDMW was positive. Users agreed with statements that MDMW facilitates diabetes self management. Several areas of potential improvement were identified, including linking more wearable device data, and assisting/directing users to gain the digital skills required to engage fully with MDMW.

KEYWORDS

diabetes mellitus, digital skills, eHealth, electronic personal health record, patient portal, self management

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1 | INTRODUCTION

Diabetes is one of the most common chronic medical conditions, affecting approximately 4.7 million individuals in the United Kingdom and accounting for 10% of UK healthcare spending.[1] Eighty percent of costs are due to complications.[2] eHealth applications have the potential to enable patients to take more control over managing their own health,[3–6] with the potential to delay or prevent the onset of complications and reduce the burden on healthcare systems.[7,8] Such applications will become ever more important as diabetes prevalence increases.[9,10] The COVID-19 pandemic has further intensified the demand for effective digital solutions that can supplement face-to-face clinical care.[11] The increasing pervasiveness of digital technologies could help to facilitate the widespread delivery of such solutions, although disparities still exist in society in terms of access to and engagement with digital technology.[12]

My Diabetes My Way (MDMW)[13,14] is an interactive website that provides self management support and diabetes education for people with diabetes (PWD). A previous (2015) user questionnaire,[15] relating to an earlier version of the platform, highlighted potential areas for improvement. This feedback has since informed several changes to MDMW. The platform, and its evolution since the previous questionnaire, are described below.

Conceived in Scotland in 2008, with health records access commencing in 2010, MDMW has approximately 60,000 registered users in Scotland. At the time of the survey, MDMW had 22,665 'active users'—those who have registered and logged in at least once (this number has since grown to 32,000 at the time of writing). Since 2018, MyWay Diabetes (a commercial derivative of MDMW) has been deployed in several large NHS regions in England. In Scotland, MDMW is linked to SCI-Diabetes—a national diabetes electronic record containing data on all >300,000 PWD in the country.[16] MDMW takes a subset of data from primary and secondary care, including key diabetes indicators (HbA_{1c}, blood pressure [BP] and body mass index [BMI]), eye and foot screening results, medications and clinical correspondence. The platform provides users access to these records, as well as to advice and resources (information, structured education and videos, curated web links) tailored to each user through data characteristics and the implementation of rules and algorithms.[17]

Users can view their retrospective data through history graphs (Figure 1). A bullseye-style 'target chart' (Figure 2) displays key diabetes indicators, encouraging the user to bring their HbA_{1c}, BP, BMI and cholesterol into the central green region. MDMW also contains a checklist of care targets achieved for each user, based on the Diabetes UK '15 Healthcare Essentials',[18] highlighting any overdue assessments.

What's new?

- eHealth applications can enable patients to manage their own health, but barriers exist to some users engaging fully. eHealth tools should not exacerbate the digital divide in society. User needs should be considered when making changes/improvements.
- My Diabetes My Way, an electronic personal health record/education platform, helps users to track their progress and plan for (and retain information from) face-to-face consultations. Users pinpointed areas of the platform that could be improved. Users lacking digital skills struggled to engage with the platform.
- Understanding user perceptions/needs can target improvements where these are needed most. Ways will be found to include users/groups who are less engaged with digital technologies.

Users can enter home-recorded data (e.g. weight, BP) into MDMW, and can also use the site to set health and lifestyle goals for themselves. In response to previous user feedback from 2015,[15] additional functionality was introduced in 2016 allowing users to upload home blood glucose readings (either manually or through integration with a third-party product—DIASEND[19]). Additionally, since July 2019, MDMW has been able to link to users' Fitbit activity data. User feedback from 2015 surfaced some site navigation issues.[15] The front end of the MDMW platform was therefore updated in 2018 in an effort to provide an improved user experience (Figures 1 and 2).

In response to MDMW user feedback from 2015, the registration process has since been simplified. Patients can now register for the platform in two ways:

1. Self-registration: PWD can self-register for MDMW via an online web form. This process is explained in our patient information leaflets which are distributed to diabetes clinics and general practitioner (GP) surgeries across Scotland. People are also encouraged to register whenever they reach the website. The person's identity is verified by traditional post, and when the workflow process is complete, login details are sent via a verified email address.
2. Healthcare professional referral: Users of SCI-Diabetes can refer a patient to the service by initiating an invitation link to the patient's email address. Awareness for this process is circulated regularly to healthcare professionals via the regional diabetes networks in Scotland. Once the individual confirms their demographics (in

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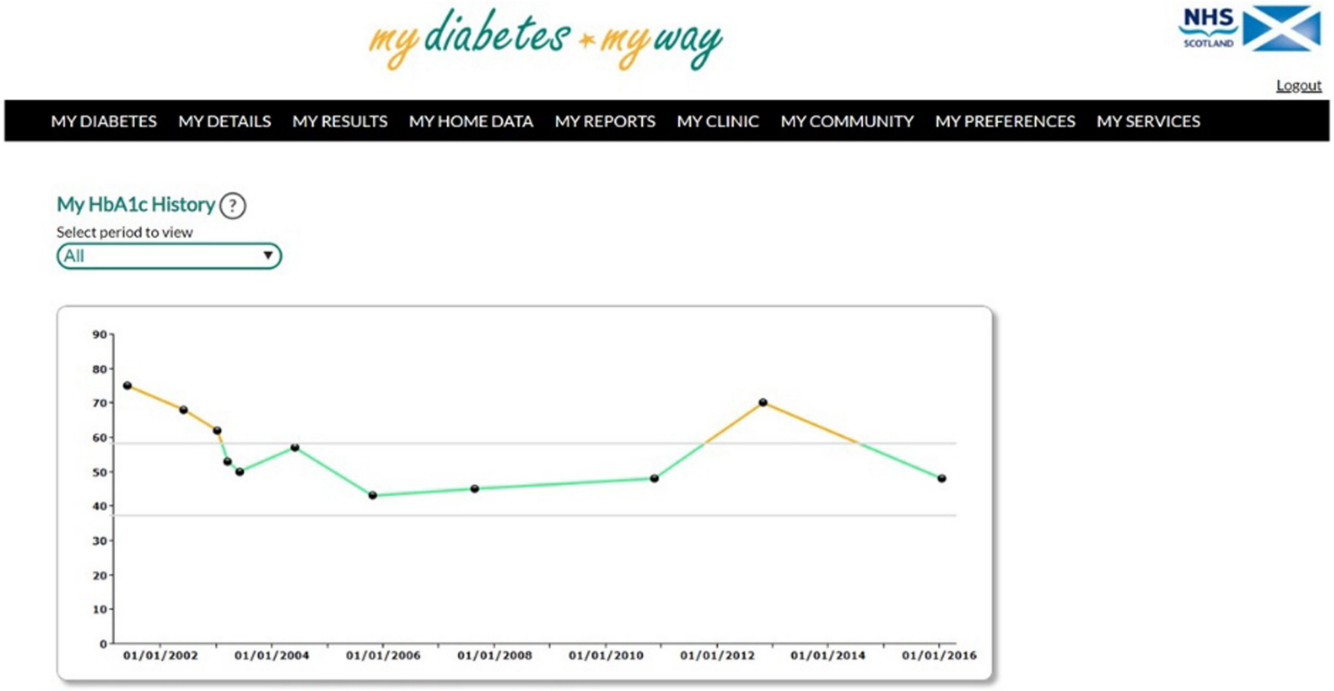

FIGURE 1 Screenshot from My Diabetes My Way website showing a HbA_{1c} history graph (fictional patient). Line graph shows when results are in range (green) and elevated (yellow).

order to verify that the email address is for the correct person), login details are emailed to this verified address.

Some users expressed the desire to use MDMW via a mobile App, in addition to the website. The MDMW App (Figure 2) has since been launched (in July 2018).

We present here the results of a questionnaire sent to MDMW users in Scotland in September 2019, intended to assess their experience of using MDMW; their views on the benefits and limitations of the system; and their suggestions for possible improvements. We compare our qualitative findings with those of the previous user questionnaire[15] in an attempt to gauge the effectiveness of resulting changes to the system. We also outline how fresh user insights arising from this study will be acted upon to improve the service further.

2 | METHODS

A questionnaire was created to gauge users' satisfaction with MDMW and collect their perceptions and experiences of using the tool. Users were asked whether they mainly access MDMW via the website or the App. The questionnaire included nine Likert scale items plus two free-text questions. Likert scale items had five possible responses ('strongly agree'/'agree'/'do not know'/'disagree'/'strongly disagree'). The questionnaire was adapted from a previous (2015) questionnaire[15] that had been sent to MDMW users. The number of questions was reduced compared with the 2015 questionnaire, focusing on the perceived benefits of records access, rather than logistics around day and time of use, or management of user feedback which had been included previously. It was hoped that this would reduce participant burden, thereby encouraging more users to complete the questionnaire. The questions in the current questionnaire focussed on gaining insights that would inform further improvements to MDMW. Questions were agreed through 'Face validation'[20] by several health informatics experts. The questionnaire was deployed in Survey Monkey and sent via email to MDMW users in Scotland. 'MDMW Users' were defined as the cohort of individuals who had successfully logged on to access the service at least once prior to the launch of the questionnaire in September 2019. The questionnaire remained open for 12 weeks. Question items are shown in Appendix.

My Diabetes My Way-held demographic data on respondents were retrospectively (pseudonymously) linked to questionnaire responses. These included age, ethnicity, sex, diabetes type, diabetes duration and socio-economic status (SES). SES was derived from postcode using the Scottish Index of Multiple Deprivation (SIMD)[21] and expressed in quintiles ranging from most deprived (1) to least deprived (5). Respondents' SES was compared with that of non-respondents through a Chi square test.

A 'utility score' was calculated for each respondent by converting 5-point Likert scale responses to numeric

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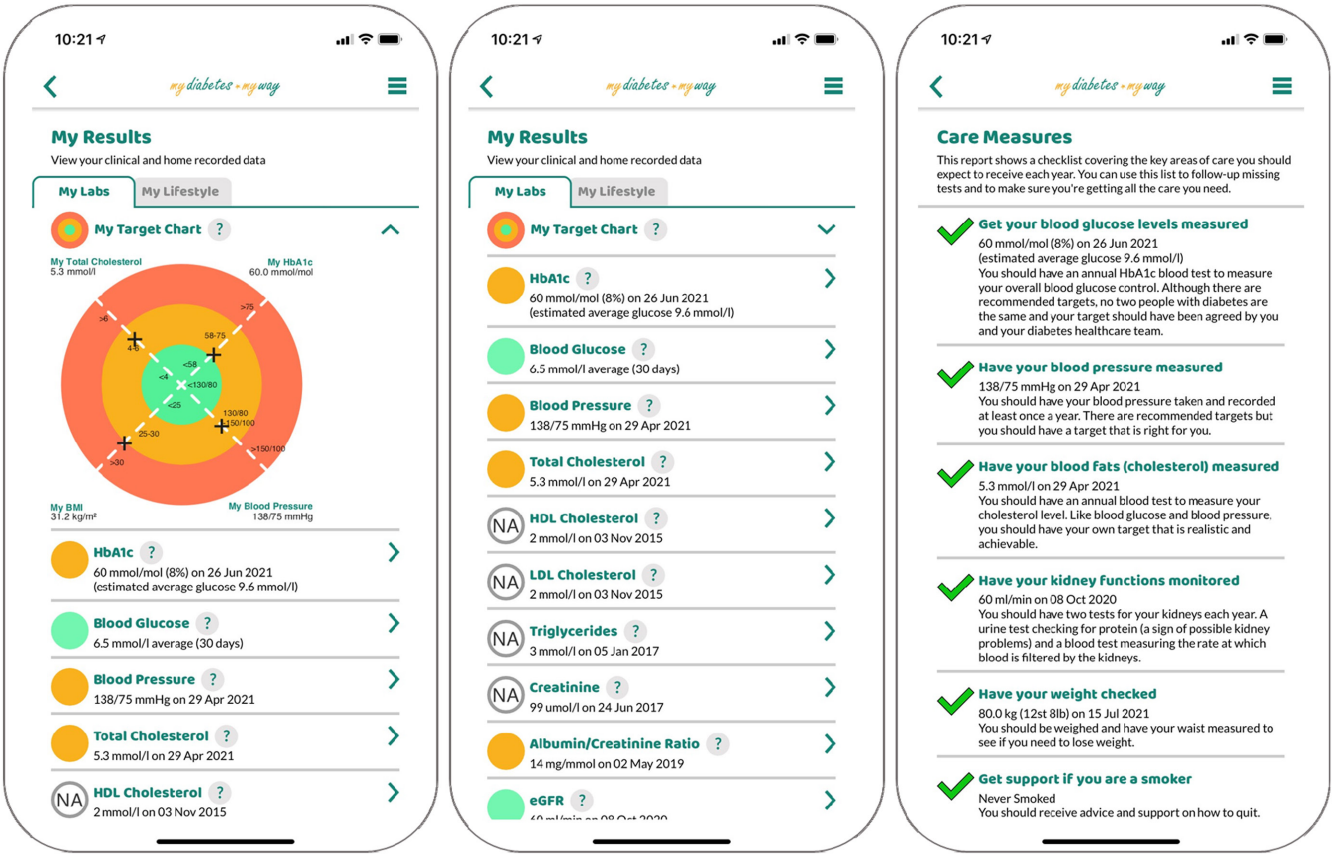

FIGURE 2 Screenshots from My Diabetes My Way App showing a menu page and 'target chart' mapping HbA_{1c}, cholesterol, blood pressure and body mass index; the 'My Results' page; and 'Care Measures' page, which allows users to track missed appointments. All screenshots are for a fictitious patient.

values. This resulted in an overall utility score out of 1 per user (where 0 = lowest possible utility and 1 = highest possible utility). This concept of utility score is similar to that used in a previous MDMW user questionnaire.[15]

Statistical analyses were carried out using IBM SPSS 25 software. Univariable and multivariable regression analyses were used to determine whether users' demographic and socio-economic variables were associated with user-assigned system utility scores. Utility score was used as the outcome variable in univariable regression analyses. All demographic (predictor) variables that exhibited non-significance ($p > 0.1$) in univariable analyses were excluded from the multivariable analysis.

Demographic groups were compared using *t*-tests where data were normally distributed (e.g. for age) and Mann–Whitney *U* tests where not normally distributed (e.g. for diabetes duration).

Free-text responses were analysed by the lead author through deductive thematic analysis, with major themes and subthemes generated from the data.

This was a service improvement project, and medical research ethics review was therefore not required. All users invited to complete the questionnaire had previously (upon MDMW enrolment) consented to receiving unsolicited emails from the MDMW team for service improvement purposes.

3 | RESULTS

A total of 4713/22,665 (21%) users completed the questionnaire between September and November 2019. For 61 respondents, diabetes type was unknown. These were removed, giving 4652 users included in the analysis. Of these, 817 (18%) had Type 1 diabetes and 3835 (82%) had Type 2 diabetes. Users with Type 2 diabetes were significantly over-represented in the questionnaire compared to non-respondents (82% of respondents had Type 2 diabetes, whereas only 72% of non-respondents had Type 2 diabetes ($p < 0.001$)). In the background population (Scottish Diabetes Survey [SDS] data), 11% of PWD have Type 1 diabetes, and 89% have Type 2 diabetes.[22]

A total of 2936/4652 (63%) of respondents were men and 1716 (37%) were women. Non-respondents (59%) were men, and men were significantly over-represented as respondents ($p < 0.001$). In the background diabetes population, 56% of PWD are men (SDS data).[22]

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Mean respondent age was 62 years (SD: 11, range: 16–94). This was significantly higher ($p < 0.001$) than mean non-respondent age, which was 57 years (SD: 14, range: 15–95). The mean age of users with Type 1 diabetes was significantly younger than those with Type 2 diabetes (mean years [SD]: 52 [14] vs. 64 [10] respectively; $p < 0.001$). Mean age of women respondents was significantly younger than that of men respondents (mean years [SD]: 59 [12] vs. 64 [11] respectively; $p < 0.001$).

Duration of diabetes ranged from 1 month to 66 years, and was skewed towards those more recently diagnosed (median duration: 98 months, interquartile range: 190–43 = 147). Respondents had slightly shorter median diabetes duration compared with non-respondents (who had median duration of 110 months). This difference was significant ($p < 0.001$). The median duration of diabetes was significantly higher for users with Type 1 diabetes compared with those with Type 2 diabetes (median months [IQR]: 261 [429–115 = 314] vs. 87 [159–37 = 122] for Type 1 diabetes and Type 2 diabetes respectively; $p < 0.001$).

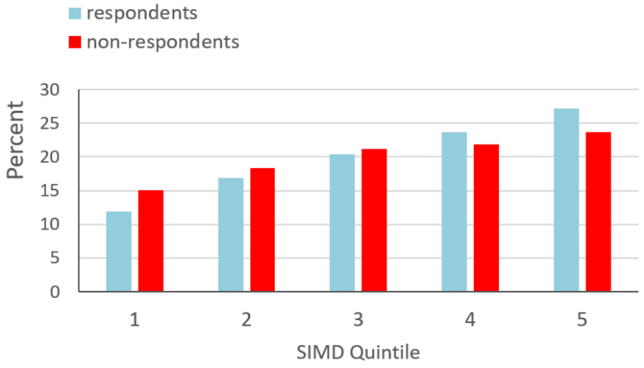

FIGURE 3 Scottish Index of Multiple Deprivation (SIMD) quintiles of all users invited to complete the questionnaire. Percentage of respondents falling in each of the quintiles is shown alongside percentage of non-respondents in each quintile (quintile 1 = most deprived, 5 = least deprived).

There was a greater number of respondents (compared with non-respondents) from the least deprived socioeconomic groups, and fewer respondents (compared with non-respondents) from the most deprived group (Figure 3). Overall, this produced a significant difference in SES between respondents and non-respondents (Chi square, $p < 0.001$). This finding echoes MDMW use in the background diabetes population, with those in the least deprived groups being more likely to engage with the platform.[22]

The majority of respondents (3642/4652, 78%) identified as 'White' ('White Scottish', 'White British', 'White Welsh' and 'Other white ethnic group' combined). A total of 221/4652 (5%) were in other minority ethnic groups, with the remainder (17%) being of unknown ethnicity. Users in minority ethnic groups were slightly but significantly under-represented among respondents (compared with non-respondents) ($p = 0.021$).

When asked how they mainly accessed MDMW, 3522/4652 (76%) of users accessed it mainly through the website and 1130/4652 (24%) accessed it mainly through the App.

Users' responses to a variety of statements about MDMW are shown in Figure 4, where the original five Likert responses ('strongly agree'/ 'agree'/ 'do not know'/ 'disagree'/

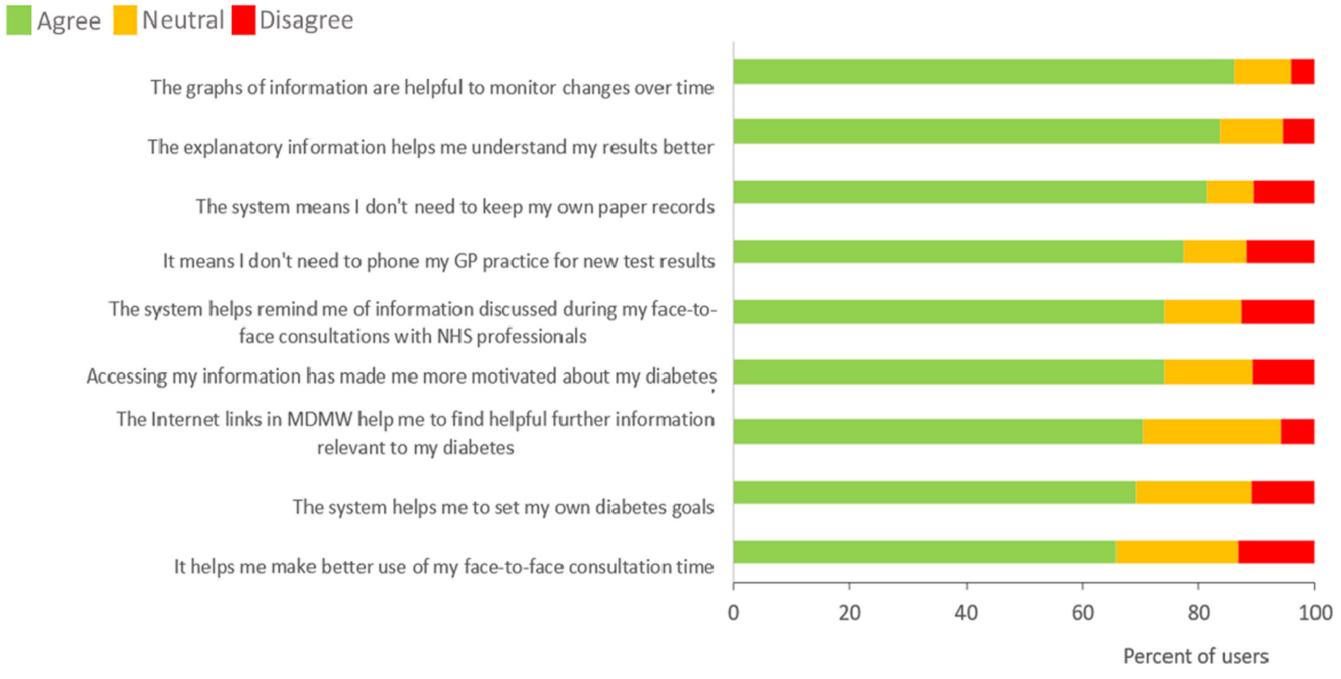

FIGURE 4 Collapsed responses to statements regarding system utility ($n = 4652$), listed by decreasing order of agreement.

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TABLE 1 Univariable and multivariable predictors of My Diabetes My Way utility score.

	Univariable			Multivariable		
	B	**95% CI**	***p***	***B***	**95% CI**	***p***
Diabetes type						
Type 2 diabetes compared with Type 1 diabetes	0.059	0.044, 0.073	<0.001	0.035	0.014, 0.056	0.001
Diabetes duration						
Years since diagnosed (years)	−0.002	−0.002, −0.001	<0.001	−0.01	−0.002, −0.001	<0.001
Age						
Years	0.001	0.0003, 0.001	0.001	0.0004	−0.0002, 0.001	0.143
SIMD quintile compared against first quintile (most deprived)						
SIMD second quintile	0.003	−0.018, 0.023	0.787	—	—	—
SIMD third quintile	−0.004	−0.014, 0.006	0.403			
SIMD fourth quintile	0.003	−0.01, 0.003	0.293			
SIMD fifth quintile	−0.005	−0.01, 0.00006	0.053			
Sex						
Women compared with men	0.005	−0.007, 0.016	0.402	—	—	—
Ethnicity						
Other ethnicities compared to 'White'	0.032	0.006, 0.058	0.017	0.026	−0.00028, 0.053	0.052

'strongly disagree') have been collapsed into three categories ('agree'/ 'neutral'/ 'disagree'). Of the 4652 respondents, 86% agreed or strongly agreed that their results graphs in MDMW help them to monitor changes over time. A total of 84% felt that explanatory information on the system helps them to understand their results better. Only <6% of respondents disagreed with either of these statements. Many users (81%) felt that access to MDMW negated the need to keep their own paper records, and many (77%) no longer felt the need to phone their GP to access new test results. For 74% of respondents, using the system had made them feel more motivated about their diabetes, while for 69%, MDMW had helped them to set their own diabetes goals. A total of 66% of respondents felt that using MDMW helped them to make better use of face-to-face consultations.

Utility score was skewed towards higher scores (median: 0.74, interquartile range: 0.86–0.67 = 0.19). Results of univariable and multivariable regression analyses are presented in Table 1. Diabetes type was a significant predictor of utility score, with Type 2 users awarding higher scores compared with Type 1 users. This was true even when diabetes type was considered simultaneously with other significant predictors. These were: diabetes type, diabetes duration, age and ethnicity. Utility score was inversely associated with duration of diabetes, even when other significant variables were considered. The predictive effect of age that was found in univariable regression was not, however, significant once other predictors were controlled for. Ethnicity was a predictor of service utility score in univariable analysis, with white users tending to award higher scores, although this effect also lost its significance once the effect of other significant variables were controlled for.

Themes from thematic analysis on free-text response data are shown in Table 2.

3.1 | Benefits of using MDMW

Benefits cited by users of MDMW were that the system helps them to 'keep track of their progress', 'better understand their diabetes' and 'better manage their diabetes'. This suggests that MDMW has the potential to empower users, giving them more autonomy and agency in looking after their own health.

> 'It has all the information I need to monitor the long-term progression of my diabetes in one place, accessible at any time'. (Age 64, Men, Type 2)
>
> 'This system has been so beneficial to me. As a type 1 of 48 years, I now have the best understanding of how to best control my diabetes' (Age 60, Women, Type 1)
>
> 'It helps me manage my diabetes and take more control and responsibility for my condition'. (Age 72, Men, Type 2)

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TABLE 2 Thematic analysis of free-text responses.

Theme	Subtheme
MDMW features praised by users	Explanations of results and terms are useful
	Useful that Fitbit data are linked
	I like being able to print out my results
	Monthly email newsletter is useful
	I like the educational resources
	Praise for history graphs and 'target chart'
How MDMW helps me	Easy access to my records
	Easy access to information
	A record of my prescriptions/medications
	I can digest information in my own time
	I feel supported
	MDMW supplements my other care
	Useful to upload my own measurements at home
How MDMW empowers me	Helps me to manage my diabetes better
	Helps me keep track of my progress
	Improves my understanding of my diabetes
	Helps me to set my own goals
	Helps me to better prepare for my appointments
	Helps me explain results to friends and family
	Reduces the need to contact my HCP
Barriers to using MDMW effectively	I would prefer to see my HCP in person
	Concerns over data security
	Confusion over who should input data
	Difficulty understanding information presented in MDMW
	Difficulty uploading home data
	Difficulty using the site
	Users' own lack of digital skills is an issue
Changes that would make MDMW more helpful	I want my HCP to be more aware of MDMW
	Desire for my HCP to see my home data uploaded to MDMW
	Desire for MDMW to link up with other devices
	Desire for more personalisation
	Desire for more phone or email notifications (e.g. when new result added)
	Desire for non-diabetes results to be included
	Desire for simpler login procedure
	Desire to talk to others with diabetes
	MDMW needs to be more user friendly
	Desire for more educational resources
Technical issues with MDMW	Inaccurate information about me on MDMW
	App not performing as well as website
	Difficulty accessing information
	Difficulty logging in to MDMW
	Clinical correspondence not available, as it should be
	Out-of-date or missing records

Abbreviation: HCP, Healthcare Professional; MDMW, My Diabetes My Way.

Many users also stated that MDMW helps them to 'better prepare for appointments', including giving the ability to print out their results and discuss these with their healthcare professional (HCP). Some described feeling more 'in control' of their appointments or feeling that they were working 'as a team' with HCPs as a result of using MDMW.

> 'I like being able to view all my results. It makes you feel that you are working along with the nurses and doctors as part of a team. It makes it easier to discuss things with them when you have all the knowledge made available to you on this site, which is clear and easy to understand' (Age 60, Women, Type 2)
>
> 'It really helps to focus the discussions on the key issues at each review' (Age 55, Men, Type 1)

Moreover, users felt that MDMW reduced the frequency with which they contacted their HCP (e.g. to ask for new test results) and they also valued the ability to 'take their time' in digesting and understanding their results, rather than feeling 'under pressure' to take in a lot of information during a consultation.

> 'It is empowering to have your own data to reflect upon rather than having to concentrate for a few fleeting moments when the doctor or nurse (themselves under severe time pressure) are discussing and interpreting your results'. (Age 55, Men, Type 2)

Another perceived benefit to users was that MDMW helped them explain their results to family and friends.

> 'Others don't always get what I'm trying to explain to them about diabetes. Showing them my results in the coloured circle has had a huge impact—no longer trying to push cakes and biscuits on me'. (Age 53, Women, Type 2)

Users praised the graphical representation of results (in graph form Figure 1) and in a bullseye-style 'target chart' (Figure 2). They also appreciated the educational resources within MDMW, as well as the annotated explanations appearing alongside medical or technical terms. They expressed a desire to see more educational resources (specifically more resources around diet, and instructions on how to use MDMW). The latter comments appear to demonstrate

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that some users were unaware of existing guidance on how to use the site.

Users responded very positively the linking of Fitbit data with MDMW. This functionality had been introduced in July 2019, giving several months for users to access it prior to completing the questionnaire. There was an appetite for data from more devices, apps or online tools to be linked up, with Apple Health, MyFitnessPal, Neutracheck, Libre and Garmin all mentioned.

3.2 | Barriers to using MDMW effectively

Some users had difficulty using the site and accessing and understanding the information that is presented within MDMW. Several pointed to their own lack of digital skills as a barrier to using the site effectively. This could point to the need for including resources on basic digital skills within MDMW.

> 'I'm not very good at using the internet for things like this'. (Age 71, Women, Type 2)
>
> 'I seem to not understand the technology needed. It is too difficult' (Age 62, Women, Type 2)

Some users reported delays in data from test results appearing within MDMW, and some suggested that text or email notifications when a new result is added would be helpful, as this would avoid them checking the site for results that have still not appeared.

Several users were concerned about data security and were mistrustful of the site. Conversely, others (who desired a simpler login process) felt that 'over-the-top' security made accessing the site more difficult than it needs to be.

3.3 | User suggestions for improving MDMW

Some users felt that they would further benefit if their healthcare professional engaged more with MDMW.

> 'I would like more HCPs to ask about it in clinic/appointments—it would save them a lot of time to know what I think ....' (Age 55, Men, Type 1)
>
> 'General knowledge of it is poor in my diabetic team. It has never come up in discussions with my GP or hospital consultant'. (Age 65, Men, Type 1)

Lack of HCP knowledge of (or engagement with) MDMW could preclude some users from having the highly positive experience described by others.

Some users expressed the desire for more 'personalisation' within the site—e.g. some health and lifestyle measures have different recommended targets for people of different ages, and users felt that MDMW should reflect this. Currently, the site has some tailoring based on ethnicity, foot risk, eye screening status and hypertension.

> 'The appropriate levels—e.g. weight, or BP or Hba1c seem to be blunt measures. Do recommended levels change with age, in the same way that sight or hearing does? If so, perhaps this could be reflected in feedback'. (Age 72, Men, Type 2)

Many users desired MDMW to encompass all their healthcare records, not just those directly related to diabetes.

4 | DISCUSSION

Users' scoring of the MDMW system was favourable, reflected by a median utility score of 0.74. Of all the demographic and socio-economic variables considered in relation to scoring, only diabetes type and diabetes duration were significant predictors of utility score once other significant variables had been controlled for. Diabetes duration showed an inverse association with score; and Type 2 users tended to score the system more highly than Type 1 users. The reasons for why these are not known, but the association between utility scoring and time since diagnosis was also found in a previous MDMW user questionnaire.[15] It has been shown in another study that people with Type 2 diabetes adhere less well to education programmes and self management practices compared with more recently diagnosed people.[23]

A large majority of users agreed that MDMW helps them to understand their results better and track changes over time. Most users also agreed with statements about the helpfulness of explanatory information within the site and the presence of curated links to trusted external diabetes resources.

Many respondents agreed that MDMW helps them to make better use of face-to-face consultations and reminds them of information discussed in consultations. These sentiments were echoed in answers to free-text items, where some users also talked about MDMW helping them to 'better prepare' prior to consultations. Some said that MDMW allows them adequate time to 'digest' complex medical information. It is well established that patients

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remember only a limited proportion of health information they receive during consultations,[24] due to factors such as complex medical terminology being used by the clinician, and the patient's own capacity to retain complex information delivered in a short space of time.[25] Spoken information is not retained as well as written information, the latter being associated with better treatment adherence.[26] Based on the user responses outlined above, MDMW appears to 'scaffold' the retention of health information delivered in face-to-face consultations, which could improve treatment adherence and diabetes management (with potential downstream implications for reduced or delayed complications and associated cost savings). The impact of MDMW on reducing HbA_{1c} and reducing complications costs in users with Type 2 diabetes has previously been demonstrated though an economic health analysis.[27]

A high proportion (77%) of users agreed that MDMW reduced the need for them to contact their GP, for example, to request new test results. This would be expected to contribute further to economic savings, due to reduced clinician and administrative staff time (e.g. answering patients' phone calls).

In a recent study on uptake of MDMW by different demographic groups in Scotland, white and mixed race PWD were disproportionately more likely to be users of MDMW than were PWD of other ethnic groups, when compared to the background diabetes population.[22] The same study also demonstrated greater uptake of MDMW by PWD in those from the least deprived SIMD quintile, compared with PWD in the background population.[22] MDMW users from these socio-economic and demographic groups were also over-represented among respondents to the current questionnaire. These findings, that those in certain demographic and socio-economic groups engage better with technology, are indicative of the 'digital divide' that is known to exist between different demographic groups, which could have implications for health inequalities. A range of digital and non-digital modes of service/information delivery need to be available, so that digital health solutions do not exacerbate these disparities.

Some users in this study stated that their own lack of digital skills prevented them from making full use of the service. As digital technologies become more pervasive, the notion of the digital divide has extended to encompass not only *access* to digital technology but also the degree of *engagement* with that technology.[12] Those with limited digital skills are potentially being excluded from many of the benefits that digital technology brings to modern life, including in healthcare. The ability of interventions such as MDMW to address the digital divide in society is limited, but in response to this finding, online links to trusted external resources on basic digital skills will now be added. It is hoped that this may facilitate some users in taking a 'first step' towards developing their IT skills, which could have knock-on benefits in other areas of life.

Several respondents expressed the need for instructions on how to use MDMW. This finding highlights that some users were unaware of instructional materials already present within the site. Possibly these materials are not being located easily, particularly by those with limited digital skills. In response to this finding, user guides will be 'pushed out' to users more frequently within existing monthly newsletter emails.

Many users desired MDMW to encompass all their healthcare records, not just those directly related to diabetes, apparently viewing the platform as a potential 'gateway' to accessing all their health information. From the user point-of-view, this may seem a simple request. However, the digital landscape for diabetes in Scotland is relatively mature compared with other medical specialties, making wider data integration problematic. The Scottish Government's long-term plan is for care in Scotland to be 'enhanced and transformed' through the use of digital technology, with an aspiration to improve interoperability across different systems and provide patients with access to their health records.[28] As more specialties 'catch up' to diabetes in this respect, it is envisaged that data will be able to be shared between different electronic clinical records.

Some users also expressed a desire for their healthcare team to be more aware of, and engaged with, MDMW, and to refer to it during consultations. Using ePHRs such as MDMW as a basis for conversations about the patient's care would fit well with the 'house of care' model, which recognises the importance of clinicians and patients working together collaboratively in shared decision-making.[29] The house of care model is being actively promoted in Scotland. A new study is currently underway to assess (for the first time) healthcare professional perceptions of MDMW, which should shed more light on this area.

There were some calls from users for more 'personalisation' within the site. For example, displaying different recommended targets (e.g. for HbA_{1c}) for people of different ages. Some tailoring already exists within the site, based on users' ethnicity, foot risk, eye screening status and hypertension. Further tailoring is possible, and will be considered in the future in response to this user feedback.

In contrast to the 2015 questionnaire, the registration process was not criticised by the respondents to the current questionnaire, demonstrating that registration issues have now been resolved. However, some users still reported problems with logging in. MDMW login relies on a Scottish Government public service gateway. This not only adds an extra layer of security but also a layer of complexity. The authentication processes within this system are to some extent out of the control of MDMW, although attempts are being made to streamline this for users.

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While some users complained about the 'overly secure' login processes, others expressed concerns about the security and privacy of their MDMW-held data. These views can be seen as two sides of the same coin, and they highlight the challenge faced by a digital health intervention such as MDMW in striking an acceptable balance between security/data privacy and usability.[30] It should be noted that the majority of users did not express concerns over either of these issues.

One of the outcomes of the previous 2015 questionnaire was the development of the MDMW mobile App. The App is now the preferred means of accessing MDMW for 24% of users. In the current questionnaire, a minority of users reported that the App did not perform as well as the website (e.g. that their records were not up-to-date within the App). There was a known issue with data synchronisation at the time of the survey, and this issue has now been addressed.

The addition of functionality that allows Fitbit data to be uploaded to MDMW in response to the 2015 questionnaire has been popular with users, some of whom asked for data from other Apps and wearable devices to be integrated. Integration with *Apple Health* data is planned within the next 12 months, and it is planned that more devices will follow shortly, once funding has been secured.

4.1 | Limitations

The response rate for the questionnaire 21%, which could be considered fairly low. However, this is comparable with other electronic questionnaires in the literature.[31]

When compared with MDMW users who did not respond to the questionnaire, respondents were not very representative of the MDMW user population. This was true for diabetes type, with Type 2 users being proportionately over-represented among respondents compared with non-respondents (albeit slightly closer to the proportions seen in the background diabetes population). In the case of gender, men in the background population were not only more likely to engage with MDMW, but they are also more likely to respond to the questionnaire, meaning that they were significantly over-represented in the respondent population. Similar patterns were also observed with SES and ethnicity, meaning that participants are skewed towards being more white and more affluent than non-participants.

5 | CONCLUSION

This study uncovered largely very positive user views of MDMW. For the majority of users, MDMW helped them to understand their results better, prepare better for face-to-face consultations, acted as a reminder of consultations and allowed users more time to digest complex health information. This could be expected to have beneficial downstream impacts on treatment adherence and therefore diabetes management.

The questionnaire used in this study was designed to highlight areas where further improvements can be made to MDMW. Some users' limited digital literacy is a barrier to benefitting fully from using MDMW, and more will be done to signpost users to help in this area. There is a growing expectation from users that MDMW should link data from more wearable devices and health apps (following the success of Fitbit data being linked up with the system). This is now being planned. User comments highlighted the difficult balance between security and usability, which is an issue for online health interventions like MDMW.

AUTHOR CONTRIBUTIONS

Scott G. Cunningham: Co-ordinated meetings to discuss the study methodology and guided the data analysis and writing of the article. Cathy Shields: Analysed questionnaire data, drafted the initial article and developed this, with feedback from others. Nicholas T. Conway: Supported methodological development, advised on analysis, results interpretation and article review. Deborah J. Wake: Supported methodological development, advised on analysis, results interpretation and contributed to article revision. Brian Allardice: Set up questionnaire in Survey Monkey and administered the release to all eligible MDMW users. He extracted questionnaire results for analysis and reviewed the article.

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CONFLICT OF INTEREST STATEMENT

Dr Cunningham reports grants from Scottish Government, outside the submitted work; personal fees, non-financial support and other from MyWay Digital Health, during the conduct of the study. Dr Wake reports non-financial support and other from MyWay Digital Health, during the conduct of the study.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX

Questions included in the questionnaire.

Initial question:
Do you access MDMW mainly through the website or the App?

Likert scale questions:

1. The system helps remind me of information discussed during my face-to-face consultations with NHS professionals.
2. It helps me make better use of my face-to-face consultation time.
3. The system means I do not need to keep my own paper records.
4. It means I do not need to phone my general practitioner practice for new test results.
5. The explanatory information helps me understand my results better.
6. The Internet links in MDMW help me to find helpful further information relevant to my diabetes.
7. The graphs of information are helpful to monitor changes over time.
8. Accessing my information has made me more motivated about my diabetes.
9. The system helps me to set my own diabetes goals.

Free-text questions:

1. 'Are there any other helpful things about My Diabetes My Way that you'd like to mention?'
2. 'Is there anything you'd like to suggest that would improve the product and service?'

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