York Health Economics Consortium

NHS Innovation Accelerator

Economic Impact Evaluation Case Study: My Diabetes My Way

Summary

My Diabetes My Way (MDMW) is a tool for patients with diabetes to provide them with information on their specific health status, and also more general information and advice on the management of their condition. The tool is provided via an interactive website and mobile app and is licensed to care commissioners on a 'per patient' cost basis. Observational studies have shown that people with Type 2 diabetes using MDMW were able to improve their glycaemic control by 4 mmol/mol over a 3 year period. The developers believe that there is an equivalent benefit in people with Type 1 diabetes.

Modelling the costs and benefits of diabetes is complex so there is a great deal of uncertainty in the analysis carried out in this case study. Costs for a 5 and 10 year period were estimated from the developer's own per patient costs. Benefits were drawn from a paper that estimated the reduction in diabetes-related complications if an 11 mmol/mol improvement in glycaemic control could be sustained over a 5 or 10 year period for people with Type 2 diabetes and a 4 mmol/mol improvement in people with Type 1 diabetes. Even if only 20% of that benefit is achieved through using MDMW, a comparison with the costs of providing the service shows a net benefit of £20 million after 5 years and a net benefit of £84.4 million after 10 years. However, this is a conservative approach and if a less conservative approach was taken then the net benefits could be greater.

1. BACKGROUND

My Diabetes My Way (MDMW) is an electronic personal health record in the form of an interactive website and mobile app. It was originally developed by the University of Dundee and hosted by NHS Scotland but is now being deployed by NHS England with contracts with around 32 CCGs. The record uses data from NHS systems, including primary and secondary care, specialist screening services and laboratories. It also provides information to explain results and provides tailored educational materials. This enables people to monitor their condition and to self-care, and also to add their own information and results which they can securely communicate to their clinical team.

The theory of change is that providing patients with these tools to monitor their condition and understand their results and giving them information on diabetes, enables them to self-manage their condition better. That should lead to improvements in the risk factors associated with the development of diabetes-related complications. These complications can result in microvascular problems such as heart attacks and strokes, as well as macrovascular problems relating to the eyes, feet, kidneys and nerves.

Diabetes is a complex disease and outcomes and complications relate to a variety of factors including glycaemic control (HbA1c), blood pressure and lipid levels. This economic analysis presents a cost benefit analysis based on research carried out into changes in the rates of complications as a result of sustained improvements in glycaemic control for people with Type 2 diabetes. The developers believe that there is an equivalent benefit in people with Type 1 diabetes.

The limitations of the analysis are as follows:

- The data upon which the benefits of MDMW are predicated are based on observed improvements in HbA1c for a case matched cohort of patients over a 3 year time horizon. The benefits would need to be sustained over longer periods such as 5 or 10 years to generate the assumed benefits in terms of avoided diabetes-related complications.
- The benefit estimates were derived from research that examined the impact of an 11 mmol/mol reduction in HbA1c over a 5 and 10 year period. The observed improvement in HbA1c for the MDMW Type 2 diabetes cohort was 4 mmol/mol over 3 years, so conservative assumptions about the level of impact have been made.
- The analysis only considers the healthcare costs of treatment related to reduced or avoided levels of diabetes-related complications. It does not take into account the health-related quality of life benefits that patients would gain through avoiding these complications.
- The analysis uses the base case data modelled using the IQVIA Core Diabetes Model and they may not reflect the improvements shown in other risk factors such as blood pressure, weight and lipid levels in people using MDMW.
- Potential improvements in clinical efficiency and consequent cost or resource use reductions have not been accounted for in the analysis, for example avoided need for face-to-face appointments and education sessions.

2. INPUT COSTS

The annual costs of the service vary depending on location and the diabetes population covered. In the UK, the costing model equates to between £1 and £2 per patient per year, based on the total population with diabetes. There is also an initial set-up fee to develop and create the necessary data interoperability so that the service can be used, but this cost is not disclosed by the developer.

The cost model per patient works on the following basis:

- £2 per patient for populations of <25,000
- £1.75 per patient for populations of 25,000 to 100,000
- £1.40 per patient for populations of 100,000 to 200,000
- £1.15 per patient for populations of 200,000 to 300,000
- £1 per patient for populations >300,000

If it is assumed that the set up cost is included within the 'per patient' cost then an overall cost for the population with Type 2 diabetes can be estimated. The 2015 Quality and Outcomes Framework reported the number of people in England with Type 2 diabetes as being 2,223,654 and the number with Type 1 diabetes as being 247,073. If it is assumed that the average cost per patient would be midway between £1 and £2, then the total cost of providing MDMW to people with Type 2 diabetes in England would be £3,335,481 per year and £370,610 for people with Type 1 diabetes.

3. OUTCOMES

The developers have conducted qualitative research which has demonstrated that 90% of people improved their knowledge of diabetes and 89% of people were motivated to manage their condition better.

The developers also conducted a case control cohort study of long term users versus those in the inactive background diabetes population, using the UK Prospective Diabetes Study (UKPDS) outcomes model. This involved 7,689 active users with three or more years of follow-up data. The study showed the following outcomes:

- HbA1c. The cohort showed an improvement of 4 mmol/mol over 3 years for Type 2 diabetes patients not using insulin.
- Hypertension. The cohort showed an improvement of -0.56 mmHg (p=0.007) in diastolic blood pressure over 3 years.
- Weight. Users of MDMW showed an improvement of 0.12 BMI (p=0.02) and a reduction in weight of 0.45kg (p=0.003) over 3 years.
- Lipids. The cohort showed an improvement in total cholesterol of 0.6 mmol/l (p=0.002) over 3 years.

The paper developed by Baxter et al.[1] examined the potential reduction in incidence of diabetes-related complications and associated costs if HbA1c levels could be reduced to and maintained at targets recommended in the NICE guideline for Type 2 diabetes.[2] The modelling was carried out using the IQVIA Core Diabetes Model[3] (CDM) which includes algorithms based on research such as the UKPDS study.[4] This allows users to model the effects of adjusting HbA1c levels for a cohort of patients while controlling for other key factors such as blood pressure and lipid levels. The ability to control for other factors provides a more robust estimate of changes in levels of complications than a simple linear analysis based on risk reduction results from research.

Based on the findings of the Baxter paper, data were modelled to assess the impact across the population of people with Type 2 diabetes in England. Data from the Quality and Outcomes Framework (QOF) database [5] reported there were 2,223,654 people with Type 2 diabetes in England in 2015. The QOF classified these people into their basal levels of glycaemic control, with the majority (70%) having a basal level of HbA1c of 58 mmol/mol or below. Applying an 11 mmol/mol reduction to the reported basal levels, the CDM was able to estimate the number of reduced complications over a 25-year period along with associated cost-reductions. These results are shown in Tables 3.1 and 3.2.

Table 3.1: Cumulative reductions in incidence of complications if an 11 mmol/mol reduction in HbA1c is sustained among patients with Type 2 diabetes in England

	5 years	10 years	15 years	20 years	25 years
Eye Disease	30,009	51,763	85,111	100,875	102,002
Renal Disease	20,422	34,941	58,283	69,232	70,463
Foot & Nerve Disease	64,639	95,464	136,992	145,408	136,543
CVD	16,088	23,469	37,488	40,362	34,549
Total	**131,159**	**205,638**	**317,873**	**355,878**	**343,556**

Table 3.2: Cumulative cost reductions if an 11 mmol/mol reduction in HbA1c is sustained among patients with Type 2 diabetes in England

	5 years	10 years	15 years	20 years	25 years
Eye Disease	£14.3m	£47.5m	£107.9m	£168.4m	£216.0m
Renal Disease	£6.2m	£46.4m	£181.5m	£392.1m	£599.8m
Foot & Nerve Disease	£68.4m	£263.9m	£542.5m	£788.7m	£917.7m
CVD	£70.8m	£116.7m	£170.0m	£123.2m	-£16.4m
Total savings	**£159.6m**	**£474.5m**	**£1,001.9m**	**£1,472.4m**	**£1,717.2m**

1 Baxter et al. Estimating the impact of better management of glycaemic control in adults with Type 1 and Type 2 diabetes on the number of clinical complications and the associated financial benefit. Diabet Med. 2016 Nov;33(11):1575-1581

2 The National Collaborating Centre for Chronic Conditions. Type 2 Diabetes. National Clinical Guideline for Management in Primary and Secondary Care (update). London: Royal College of Physicians, 2008.

3 The IQVIA CORE Diabetes Model. Available at https://www.core-diabetes.com/

4 Hayes et al. UKPDS outcomes model 2 a new version of a model to simulate lifetime health outcomes of patients with type 2 diabetes mellitus using data from the 30 year UK Prospective Diabetes Study: UKPDS 82. Diabetologia 2013; 56:1925-1933.

5 https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/general-practice-data-hub/quality-outcomes-framework-qof

The developers report that MDMW has shown a 4 mmol/mol improvement within people with Type 2 diabetes who are not using insulin. On that basis, the results in Table 3.2 would be an overstatement of the potential benefits for MDMW because the modelling relates to all people with Type 2 diabetes, including those taking insulin, and it relates to an 11 mmol/mol improvement across the population rather than a 4 mmol/mol improvement.

If the population with Type 1 diabetes is also considered then this would include an additional 247,073 people. In the Baxter paper people with Type 1 diabetes were assumed to have a one-off improvement of around 4 mmol/mol, based on observations in the Diabetes Control and Complications Trial (DCCT)[6], if they receive an intervention to improve glycaemic control. The results of this level of improvement on HbA1c on a population basis are shown in Tables 3.3 and 3.4.

Table 3.3: Cumulative reductions in incidence of complications if a 4 mmol/mol reduction in HbA1c is sustained among patients with Type 1 diabetes in England

	5 years	10 years	15 years	20 years	25 years
Eye Disease	13,336	21,820	25,914	26,604	25,324
Renal Disease	7,269	11,478	13,350	14,582	15,828
Foot & Nerve Disease	8,570	15,403	19,645	21,454	20,673
CVD	898	2,007	3,495	4,962	5,721
Total	30,073	50,708	62,404	67,602	67,546

Table 3.4: Cumulative cost reductions if a 4 mmol/mol reduction in HbA1c is sustained among patients with Type 1 diabetes in England

	5 years	10 years	15 years	20 years	25 years
Eye Disease	£0.6m	£3.5m	£9.8m	£17.5m	£22.0m
Renal Disease	£2.6m	£26.3m	£101.3m	£234.7m	£389.6m
Foot & Nerve Disease	£14.4m	£50.3m	£99.0m	£143.4m	£173.1m
CVD	£3.9m	£11.5m	£21.1m	£27.6m	£20.9m
Total savings	**£21.5m**	**£91.6m**	**£231.3m**	**£423.2m**	**£605.6m**

4. ECONOMIC ANALYSIS

A cost-benefit analysis was carried out based on the evidence provided by the developer. To develop a case study, the costs and benefits for the population of England were modelled.

The nature of diabetes means that interventions that are preventative need to be analysed over a period of time to observe benefits, rather than over one year. The economic analysis based on the Baxter paper indicates a cost reduction of £181.1 million would be generated over a 5-year period for people diabetes, and a cost reduction of £566.1 million would be generated after 10 years, based on a reduction of 11 mmol/mol in the Type 2 diabetes population in England and a reduction of 4 mmol/mol in the Type 1 diabetes population.

[6] Nathan D. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study at 30 Years: Overview. Diabetes Care 2014 Jan; 37(1): 9-16. https://doi.org/10.2337/dc13-2112

A 4 mmol/mol reduction in HbA1c represents around 35% of the 11 mmol/mol reduction modelled for the population with Type 2 diabetes, so to adopt a very conservative approach to this analysis we estimated that the improvement in HbA1c observed through the use of MDMW in the diabetes population would be 20% of that produced from the model. This was on the basis that the observed improvement in HbA1c is lower than that modelled and the observed improvement was over a shorter time period than that modelled. Using this assumption then, the potential cost reductions over 5 and 10 years would be £36.2 million and £113.2 million respectively.

The benefits were uprated using the Health Services (HS) index using the consumer price index (Health) from 2014/15 values to current values. This changed the 5 and 10 year benefits to £37,661,862 and £117,704,164 respectively.

The estimated annual costs have been inflated over 5 and 10 years by 1% but a discount rate of 3.5% has also been applied to the annual cost each year. This gives a 5-year cost of providing MDMW to the population of England with diabetes of £17,656,627 and a 10-year cost of £33,281,369.

If these base case values hold, then at 5 years there would be an estimated net benefit of £20,005,235 (£37,661,862 - £17,656,627). This would, however, rise to £84,422,795 (£117,704,164 - £33,281,369) at 10 years if glycaemic control continued to be maintained over that period.

5. CONCLUSIONS

MDMW has the potential to enable people with diabetes to understand their condition better and to manage their health. Observational research has shown people with diabetes and using MDMW demonstrating improvements in their glycaemic control, blood pressure, weight and lipid levels over a period of 1 year. The analysis in this case study uses research findings to consider the potential cost benefits if the improvements in glycaemic control shown over one year were maintained over a 5 or 10 year period.

The cost benefit analysis is based on a conservative assumption that around 20% of benefits observed in economic modelling would be generated if the improvements in glycaemic control shown by people using MDMW were sustained over 5 or 10 years. The base case results showed a net benefit of £20 million over 5 years rising to a net benefit of more than £84 million after 10 years. This demonstrates the nature of diabetes prevention strategies; that benefits, in terms of avoided complications, tend to be accrued over a longer time period. If the benefits were sustained over an even longer period then greater economic benefit could be generated.

Applying 20% of the benefit from the economic modelling to this cohort is a conservative approach, based on the fact that MDMW shows an improvement of 4 mmol/mol rather than 11 mmol/mol in people with Type 2 diabetes and the observed period is shorter than modelled. If 10% of the benefit from the economic modelling was used, then the net benefits would be £1.2 million at 5 years and £25.6 million at 10 years. If 30% was used then the net benefits would be £38.8 million at 5 years and £143 million at 10 years. If a value of 35% was used, reflecting the fact that a 4 mmol/mol improvement is around 35% of the modelled 11 mmol/mol improvement for people with Type 2 diabetes, then the net benefits would be £48 million at 5 years and £173 million at 10 years. This demonstrates the sensitivity and uncertainty of this analysis.

As previously mentioned, there are some limitations within the analysis, relating to the use of benefits research that did not match the glycaemic control benefits shown by MDMW and because the analysis was unable to consider other potential benefits from improvements in other risk factors and greater clinical efficiency. Any assumptions made in this case study have been clearly stated.

York Health Economics Consortium, August 2019

Glossary

Term	Description
Return on investment	Return on investment (ROI) measures the amount of return on a project relative to its cost. An ROI is calculated by subtracting the incremental costs from the value of the incremental benefits, and dividing the result by the incremental costs. The result is expressed as a percentage. For example, if the ROI is 100%, there will be a return of £1 for every £1 spent on the intervention.
Incremental	The incremental costs and benefits of an intervention are those that would not otherwise have occurred in the absence of the intervention.
Cost-benefit analysis	Cost-benefit analysis is a comparison of interventions and their consequences in which both costs and resulting benefits (health outcomes and others) are expressed in monetary terms. This enables two or more treatment alternatives to be compared using the summary metric of net monetary benefit, which is the difference between the benefit of each treatment (expressed in monetary units) less the cost of each.
Cost-effectiveness analysis	Cost-effectiveness analysis evaluates the effectiveness of two or more treatments relative to their cost. Interventions that are both more effective at producing health benefits than other interventions, and are associated with net cost savings (i.e. the additional cost of the intervention is outweighed by the cost savings elsewhere) are said to be a "dominant" strategy.
Cost-consequence analysis	Cost-consequence analysis compares the costs (such as treatment and hospital care) and the consequences (such as health outcomes) of a test or treatment with a suitable alternative. Unlike cost-benefit analysis or cost-effectiveness analysis, it does not attempt to summarise outcomes in a single measure (such as the quality-adjusted life year) or in financial terms. Instead, outcomes are shown in their natural units (some of which may be monetary) and it is left to decision-makers to determine whether, the treatment is worth carrying out".
Cost-minimisation analysis	Cost minimisation analysis is a method of comparing the costs of alternative interventions which are known to have an equivalent effect. This type of analysis can be used to determine which of the alternatives provides the least expensive way of achieving a specific health outcome for a population.