Findings from the outcome evaluation of the All-Wales Diabetes Prevention Programme

Type 2 diabetes is a major threat to individual health (1), although largely preventable (2). Many cases can be avoided through supporting people to adopt healthier diets and be more physically active (3), with research showing that interventions offered to at-risk populations can significantly reduce the likelihood of type 2 diabetes incidence (4). In response to this evidence, and to similar piloted approaches in Afan Valley (5) and North Ceredigion (6), Welsh Government provided funding to Public Health Wales in 2021 to deliver the All-Wales Diabetes Prevention Program (AWDPP).

The AWDPP was developed in collaboration with a wide range of stakeholders (including general practitioners, diabetes specialists, public health specialists and more) to provide structured, person-centred support for individuals at risk of type 2 diabetes (7). People identified as at risk (based on HbA1c (i.e., blood sugar) of 42-47 mmol/mol) are invited to participate in a 30 minute consultation with a trained Health Care Support Worker. These sessions raise awareness of the increased risk of type 2 diabetes and focus on promoting healthier diets, encouraging physical activity, and supporting goal setting. Where appropriate, participants are also referred into wider weight management and exercise referrals pathways as available ([8]). The overarching aim of the AWDPP is to reduce blood sugar levels among individuals at an increased risk of developing type 2 diabetes, thereby helping to delay or prevent the onset of the disease.

This short report, published by the Evaluation Team within Public Health Wales, investigates the impact of the AWDPP on blood sugar levels and associated glycaemic categories (normoglycaemia, pre-diabetes, and diabetes). The evaluation used linked service data and routine healthcare records held within the Secure Anonymised Information Linkage (SAIL) databank (9–13). The evaluation employed a stepped wedge design, comparing outcomes for nearly 2,000 individuals offered the AWDPP with close to 1,500 people identified as at risk of 2 diabetes who received care as usual prior to the programme's introduction.

Key findings

- Those who were offered the AWDPP were significantly less likely to present with blood sugar levels in the diabetes range (4% vs 26%)
- Participants offered the AWDPP had lower average blood sugar levels at 12-months compared to those receiving usual care (42.7 mmol/mol vs 43.8 mmol/mol)

Conclusion

This evaluation indicates that the AWDPP is effective in reducing blood sugar levels (HbA1c) and preventing progression to levels consistent with type 2 diabetes when compared with usual care. The findings align with a recent report capturing staff and participant perspectives of the service (14) and highlight that a brief, targeted intervention focusing on modest changes to diet and levels of physical activity can deliver significant and measurable improvements in clinical outcomes associated with type 2 diabetes. Overall, these findings suggest that the AWDPP has the potential to make a substantial contribution to reducing the future burden of diabetes across Wales.

Report pages

Building the case for a national diabetes prevention initiative in Wales

“Why prevention is important for Wales”

Around eight percent of adults in Wales – approximately 200,000 people – are living with type 2 diabetes (15). Type 2 diabetes has serious consequences for individual health and wellbeing. The condition greatly increases the risk of heart attacks and strokes (16), and can also damage small blood vessels, leading to serious complications such as blindness, kidney disease, and nerve damage that may cause pain, numbness, or even limb loss (17).

The burden is not limited to physical health. People with type 2 diabetes are also more likely to experience depression, reduced quality of life, and anxiety due to the ongoing management of the disease and the risk of future complications (18). The financial implications are also considerable, with the direct cost of patient care for 2 diabetes estimated at £500 million per year, accounting for around 10% of the NHS Wales budget (19).

Type 2 diabetes occurs when the body does not produce enough insulin or cannot use it effectively, leading to high blood glucose (sugar) levels (20) - typically assessed using HbA1c (reflecting average blood sugar levels over preceding two-three months) (21,22). In normoglycaemia, insulin works as it should to keep blood sugar within a healthy range (HbA1c <42 mmol/mol) (23). Prediabetes sits in between (HbA1c 42-47 mmol/mol) – where insulin is still made but is less effective, causing blood sugar to rise above normal, though not yet high enough for a diabetes diagnosis (HbA1c >47 mmol/mol) (24).

Prediabetes is an important warning sign for type 2 diabetes but also provides an opportunity for prevention. Research shows that modest lifestyle changes, such as improvements in diet and increases in physical activity, can improve the way in which the body uses insulin, and in turn, regulate blood sugar (25).

To support individuals at this crucial stage, the Welsh Government have funded Public Health Wales to deliver the All-Wales Diabetes Prevention Programme (AWDPP) - a national initiative aimed at reducing the incidence of type 2 diabetes in Wales (7). The AWDPP builds on pilot work undertaken in Afan Valley (5) and North Ceredigion (6), where a brief 30-minute intervention was shown to improve blood sugar levels and reduce progression to type 2 diabetes. Launched in June 2022, individuals across Wales identified as having prediabetes are invited to take part in the programme.

Embedding evaluation within the roll-out of the All-Wales Diabetes Prevention Programme

“How nationwide roll-out informed study design”

The All-Wales Diabetes Prevention Programme (AWDPP) was evaluated to see how it affected average (preceding two-three months) blood sugar levels, measured by HbA1c, in people with prediabetes over 12 months. For this evaluation, participants were also grouped into recognised

blood sugar categories indicative of type 2 diabetes risk ([26]), using HbA1c, to show whether their levels were within the healthy (normoglycaemia), prediabetes, or type 2 diabetes range:

- Normoglycaemia (HbA1c below 42 mmol/mol)
- Prediabetes (HbA1c 42-47 mmol/mol)
- Type 2 diabetes (HbA1c above 47 mmol/mol)

The study also looked at whether participants' blood sugar category had stayed the same (prediabetes)/improved (normoglycaemia) or worsened over the year (type 2 diabetes).

The study used a stepped-wedge design, with primary care practices switching from usual care to offering the AWDPP at different time points across three stages between June 2022 and June 2023. This phased roll-out was practical for implementation and ensured all practices eventually received the intervention. The design also allowed each practice to act as its own control, enabling comparison of outcomes before and after adoption.

HbA1c was measured at baseline and after 12 months using blood tests processed in NHS laboratories, giving a reliable picture of average blood sugar over the previous two to three months ([27]).

A total of 1,970 adults with HbA1c levels in the prediabetes range (within the last two to three months) were invited to participate in the AWDPP. These individuals were recruited from 59 primary care practices across Wales, representing six of the seven health boards (one health board excluded due to deviation from AWDPP protocol ([8])). This cohort is referred to as the "treatment group".

For contrast, 1,494 people from the same primary care practices and health boards who were within the prediabetes range and had 12-month follow-up HbA1c before the programme became live in their registered practice were included as a historical "comparison group".

All analyses used an intention-to-treat approach, examining changes in blood sugar levels and corresponding blood sugar category between the pre-implementation (comparison) and implementation phases. The analysis was structured using Hussey and Hughes's stepped wedge framework (28), adjusting for group allocation, practice onboarding dates, baseline HbA1c, duration of exposure (how long a practice had been delivering the intervention), and practice-level clustering. Changes in blood sugar category were modelled using generalised estimating equations, while changes in blood sugar levels were assessed using a generalised linear mixed model. Relative risk was calculated to compare the likelihood of these outcomes between the treatment and comparison groups.

Demographics of study population

"Key characteristics of study participants"

Baseline demographic information is presented in Table 1 alongside average baseline HbA1c, with the main findings outlined below:

- Average baseline blood sugar levels were almost identical between the two groups (treatment 43.7 mmol/mol vs. comparison 43.6 mmol/mol)

- Both groups showed a high level of obesity
- However, there were some differences. Over half of both groups were aged 65+ years, but those in the treatment group were, on average, 2 years younger
- A higher proportion of participants in the treatment group were male, and lived in the two most deprived quintiles

Table 1. *Baseline profile of treatment and comparison groups*

		Treatment Group (n = 1,970)	**Comparison Group (n = 1,494)**	***P***
Baseline HbA1c	**Mean**	43.7 mmol/mol	43.6 mmol/mol	n/a
	SD	1.6	1.6	
Age	**Mean**	64.2 years	66.0 years	<0.05
	SD	11.4	13.5	
	Min	20 years	18 years	
	Max	93 years	100 years	
Age Group	**18-49**	217 (11.0%)	164 (11.0%)	0.07
	50-64	708 (35.9%)	483 (32.3%)	
	65+	1,045 (53.1%)	847 (56.7%)	
Sex	**Male**	959 (48.7%)	656 (43.9%)	<0.05
	Female	1,011 (51.3%)	548 (56.1%)	
WIMD	**Most Deprived**	589 (29.9%)	412 (27.6%)	<0.05
	2	499 (25.3%)	342 (22.9%)	
	3	371 (18.8%)	266 (17.8%)	
	4	257 (13.1%)	231 (15.5%)	
	Least Deprived	253 (12.8%)	243 (16.3%)	
BMI Class*	**Healthy to Overweight**	267 (40.2%)	154 (40.2%)	0.33
	Obesity Class 1	207 (31.1%)	105 (27.4%)	
	Obesity Class 2-3	191 (28.7%)	124 (32.4%)	

*Partial data. Treatment group (n = 665), comparison group (n = 383)

Change in blood sugar category

"Impact of the AWDPP on blood sugar categories indicative of diabetes-risk"

The evaluation assessed how average blood sugar levels changed over 12 months and aligned with recognised categories indicative of diabetes-risk (26) – healthy, prediabetes, and diabetes. It also examined whether levels worsened (diabetes) or remained stable/improved (prediabetes or healthy). Relative risk was then calculated to compare the likelihood of these outcomes between groups.

Results are presented as modelled proportions of people whose 12-month blood sugar fell into each category (see Table 3), with a breakdown by step provided in the Appendix. Findings are summarised below:

- **Healthy blood sugar levels**: At 12 months, 23% of the treatment group had healthy blood sugar versus 28% in the comparison group (-5%, p = 0.35). This meant the comparison group was 1.2 times more likely to have healthy blood sugar levels, indicating the AWDPP did not increase the likelihood of returning to normal blood sugar
- **Prediabetes blood sugar levels**: The treatment group was 1.6 times more likely to maintain prediabetic blood sugar levels at 12 months, with 68% remaining in the prediabetes range compared with 42% in the comparison group (26%, p < 0.05), demonstrating the programme's effectiveness in preventing progression to type 2 diabetes
- **Diabetes blood sugar levels**: At 12 months, 4% of the treatment group had diabetes-range blood sugar compared with 26% in the comparison group, a significant difference of -23% (p < 0.05). The comparison group was 6.5 times more likely to have diabetic blood sugar levels, suggesting that the AWDPP substantially reduced progression to diabetes-range blood sugar levels
- **Blood sugar category not worsened**: Over 12 months, 96% of the treatment group did not worsen their blood sugar category, compared with 74% of the comparison group, a significant difference of 23% (p < 0.05). The treatment group was 1.3 times more likely to maintain or improve their blood sugar status, highlighting the effectiveness of the AWDPP

Table 3. Modelled proportions and group differences in blood sugar categories at 12 months

	Treatment (n = 1,970)	**Comparison (n = 1,494)**	**Treatment/Comparison**	**Lower 95% CI**	**Upper 95% CI**	***P***
Healthy	0.23	0.28	-0.05	-0.10	0.0	0.35
Prediabetes	0.68	0.42	0.26	0.16	0.36	<0.05
Diabetes	0.04	0.26	-0.23	-0.38	-0.07	<0.05

Not Worse	0.96	0.74	0.23	0.07	0.38	<0.05

Change in average blood sugar levels

“Impact of the AWDPP on blood sugar levels”

Average blood sugar levels at 12 months were modelled using the methods described previously, with Table 2 presenting the results and a brief overview provided below:

- After 12 months, people in the treatment group had lower average blood sugar levels than the comparison group (42.7 mmol/mol vs 43.8 mmol/mol)
- The difference in average blood sugar levels between the two groups grew over time (0.7 mmol/mol at step 1 to 1.7 mmol/mol at step 3)

Table 2. *Modelled average blood sugar level at 12 months*

	Treatment (mmol/mol)	**Comparison (mmol/mol)**	**Treatment/Comparison (mmol/mol)**	***P***
Overall	**42.7 (n = 1,970)**	**43.8 (n = 1,494)**	**-1.1**	**<0.05**
Step 1	42.8 (n = 1,090)	43.5 (n = 297)	-0.7	0.24
Step 2	42.8 (n = 677)	43.7 (n = 622)	-1.1	<0.05
Step 3	42.5 (n = 203)	44.2 (n = 575)	-1.7	<0.05

Conclusion "What does this mean for Wales?"

“What does this mean for Wales?”

Summary

- This evaluation found that the AWDPP is effective in reducing progression to blood sugar levels associated with type 2 diabetes. The risk of progressing to living with diabetic blood sugar levels was reduced by 23 percent among those who were identified as having prediabetes and offered the [All Wales] diabetes prevention programme – a reduction comparable to that reported across other UK diabetes prevention studies (5,29–31)

- Most participants in the treatment group maintained or improved their blood sugar status (96%), in line with findings from the Afan Valley evaluation (99%) (5) and the NHS DPP (87.3%) (30)
- Those in the treatment group experienced a modest reduction in average blood sugar level. While smaller than reported in other evaluations in Wales (5-6) and England (32,33), the improvement still represents a positive clinical effect and may partly reflect differences in the intensity and delivery of the AWDPP compared with other UK programmes
- Findings from this study show the AWDPP's ability to engage with priority populations (34), with a greater proportion of the treatment group being slightly younger and from more deprived areas

Limitations

- This study did not adjust for factors such as BMI or socioeconomic status, which are known to influence HbA1c outcomes (32,33)
- It also could not account for participants' involvement in other health programmes, such as the All Wales Weight Management Pathway, which may have affected results
- Reliance on retrospective HbA1c data from routine records may have introduced bias, as individuals who are tested more frequently could differ in health status

Conclusion

- Sustaining the availability and stability of the AWDPP throughout Wales has the potential to improve health
- The future development of robust data systems to track participants' health outcomes over time, including key indicators such as HbA1c, weight and onward referral to other health services would help better understand the benefits to the wider health and care system, including potential healthcare savings

Authors and acknowledgements

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Appendix

Table 4. *Modelled proportions and group differences in healthy blood sugar at 12 months*

	Treatment	**Comparison**	**Treatment/Comparison**	**Lower 95% CI**	**Upper 95% CI**	***P***
Overall - Healthy	**0.23 (n = 1,970)**	**0.28 (n = 1,494)**	**-0.05**	**-0.10**	**0.0**	**0.35**
Step 1	0.21 (n = 1,090)	0.35 (n = 297	-0.14	-0.31	0.04	0.31
Step 2	0.22 (n = 677)	0.29 (n = 622)	-0.07	-0.26	0.12	1.00
Step 3	0.24 (n = 203)	0.20 (n = 575)	0.04	0.13	0.22	1.00

Table 5. *Modelled proportions and group differences in prediabetes blood sugar at 12 months*

	Treatment	**Comparison**	**Treatment/Comparison**	**Lower 95% CI**	**Upper 95% CI**	***P***

Overall - Prediabetes	**0.68 (n = 1,970)**	**0.42 (n = 1,494)**	**0.26**	**0.16**	**0.36**	**<0.05**
Step 1	0.69 (n = 1,090)	0.69 (n = 1,090)	0.31	0.16	0.46	<0.05
Step 2	0.68 (n = 677)	0.39 (n = 622)	0.30	0.16	0.43	<0.05
Step 3	0.66 (n = 203)	0.49 (n = 575)	0.17	-0.05	0.39	0.35

Table 6. *Modelled proportions and group differences in diabetes blood sugar at 12 months*

	Treatment	**Comparison**	**Treatment/Comparison**	**Lower 95% CI**	**Upper 95% CI**	***P***
Overall - Diabetes	**0.04 (n = 1,970)**	**0.26 (n = 1,494)**	**-0.23**	**-0.38**	**-0.07**	**<0.05**
Step 1	0.04 (n = 1,090)	0.20 (n = 297)	-0.16	-0.35	0.03	0.21
Step 2	0.04 (n = 677)	0.29 (n = 622)	-0.26	-0.50	-0.02	<0.05
Step 3	0.04 (n = 203)	0.31 (n = 575)	-0.27	-0.59	0.05	0.22

Table 7. *Modelled proportions and group differences in not worsening blood sugar at 12 months*

	Treatment	**Comparison**	**Treatment/Comparison**	**Lower 95% CI**	**Upper 95% CI**	***P***
Overall – Not Worse	**0.96 (n = 1,970)**	**0.74 (n = 1,494)**	**0.23**	**0.07**	**0.38**	**<0.05**
Step 1	0.96 (n = 1,090)	0.80 (n = 297)	0.16	-0.03	0.35	0.21
Step 2	0.96 (n = 677)	0.71 (n = 622)	0.26	0.02	0.50	<0.05

Step 3	0.96 (n = 203)	0.69 (n = 575)	0.27	-0.05	0.59	0.22