

# Final Report on Hybrid Diabetes Care Pathway

7/10/2024





## CONTEXT

The number of people with diabetes continues to rise, with costs increasing as the disease progresses due to complications. This puts pressure on our healthcare system and the affordability of health insurance. In 2023, 110,000 Belgians with type 2 diabetes were included in the care pathway (based on RIZIV nomenclature). The care pathway provides them with five sessions of 30-minute diabetes education at home by a diabetes educator annually. However, improvements are possible. For every 30 minutes of education, educators spend 31 minutes on administration, travel, and organization. Additionally, educational sessions cannot be (adequately) scheduled based on individual needs.

Therefore, home care organization i-mens, together with Z-plus and other project partners, developed a hybrid care pathway. This pathway combines technology, telemonitoring, and live support from caregivers to improve monitoring and education efficiency for individuals with type 2 diabetes.

## CLINICAL STUDY

### RESEARCH QUESTION

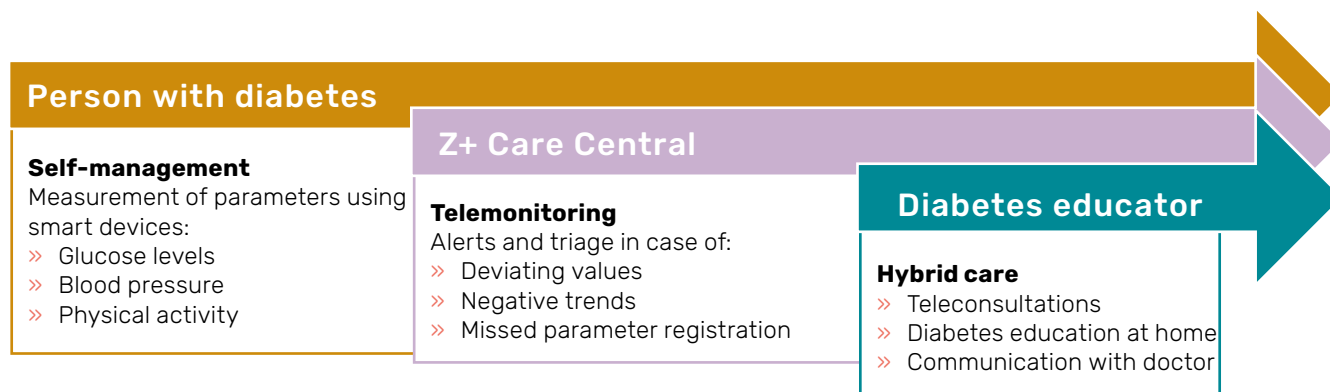
Our clinical study in 2023 aimed to determine if diabetes education could be made more effective and cost-efficient than the current care pathway by incorporating smart devices and remote support. We investigated whether the hybrid care pathway:

1. Improves patient **health** relative to the standard care pathway, measured by blood values (HbA1c and cholesterol), weight, waist circumference, and BMI.
2. Is **preferred** by patients and caregivers over the current care pathway, assessed through qualitative surveys using validated questionnaires.
3. Can be organized **cost-effectively** with existing resources, based on the calculation of QALY and ICER within a Markov model.



## METHOD

A hundred individuals with diabetes enrolled in the care pathway were included in a clinical study. Fifty received the hybrid care pathway in addition to the regular care pathway for at least nine months (intervention group). The remaining 50 received only the regular care pathway (control group).



Participants in the intervention group:

1. Monitored their own blood glucose, blood pressure, and steps using a smart meter linked to an app on their smartphones.
2. The Z-plus “Care Central” nursing operators monitored values 24/7 and responded to deviations or missing values through calls or by dispatching an on-site caregiver.
3. After each intervention, the diabetes educator was informed and, if needed, contacted the individual and/or the GP for additional follow-up.

Regarding **satisfaction**, **90%** of the intervention group preferred the new care pathway (threshold: 50%). Patients also showed improved motivation, control, and safety perception. Overall, 90% of caregivers were satisfied with the tailored approach and equipment provided.

We also evaluated the **cost-effectiveness** of the care pathway based on QALY (quality adjusted life years) and ICER (incremental cost-effectiveness ratio). If the pathway were sustained for 22 years, 5.97 QALY could be gained, costing €110,989 per QALY per patient, exceeding the acceptable threshold of €45,000 per QALY<sup>1</sup>.

## CONCLUSION

Our study does not offer conclusive results on the various outcomes.

In regards of the health of people with diabetes, we found no significant differences in blood values (HbA1c & cholesterol) between the start and end measurements in the intervention group.

However, significant differences were observed in weight, BMI, and waist circumference. The intervention group’s weight averaged 94.37 kg at the start and 92.55 kg at the end ( $p=0.012$ ), with waist circumference reducing from an average of 111.61 cm to 109.57 cm.

The study will be repeated in 2024 with 200 participants across five hospitals, for a minimum of 11 months, aiming to reduce interventions per patient per month, improve data sharing among caregivers, and manage costs to achieve affordability and cost-effectiveness.

<sup>1</sup> Based on WHO recommendations and Gross Domestic Product. Source: Annemans L. Health Economics for Non-economists. Principles, Methods and Pitfalls of Health Economic Evaluations. 2018.

## POLICY

The hybrid diabetes care pathway represents a model for integrated care. Combining patient ownership, ecosystem-building (involving partners within and outside healthcare), smart applications, and tailored interventions has broader applications for other chronic conditions. However, some policy adjustments are necessary for practical implementation.

### RECOGNITION OF CARE CENTRAL

Our study highlighted the importance of a “control tower”, where Care Central remotely monitors values and can intervene 24/7. Both patients and caregivers feel safer with this support. Currently, Care Central is a concept unrecognized in the healthcare landscape, meaning there is no government regulation on their requirements, leading to ambiguity and fragmentation.

### RECOGNITION AS A NEW CARE PATHWAY

Current funding restricts flexible diabetes education scheduling, such as more frequent but shorter sessions. Furthermore, funding for diabetes educators’ work no longer covers the costs.



Recommendations:

- » Reward doctors and nurses for keeping chronic patients healthy (with fewer visits) rather than the current pay-per-service model.
- » Make telemonitoring a recognized action that a caregiver can undertake.
- » Acknowledge validated technology as a care tool.
- » Achieve this through reallocation of existing resources.

		AVERAGE	STANDARD DEVIATION	95% CONFIDENCE INTERVAL	
				LOWER LIMIT	UPPER LIMIT
Weight (kg)	Start measurement	94,37	15,22	90,04	98,70
	End measurement	92,55	16,77	87,78	97,31
	Total	93,46	16	90,29	96,62
BMI	Start measurement	31,42	3,95	30,30	32,54
	End measurement	30,74	4,18	29,55	31,93
	Total	31,08	4,06	30,28	31,89
Waist circumference	Start measurement	111,61	9,52	108,91	114,31
	End measurement	109,57	11,58	106,25	112,90
	Total	110,60	10,58	108,49	112,71

Table 1: Descriptive statistics comparing values between the start and end measurements of the intervention group regarding the variables weight, BMI, and waist circumference.



# DETAILED RESULTS

For detailed tables, see reports (references at the end).

## HEALTH

- » In the control group, no significant difference was observed for weight, BMI, or waist circumference between the start and end measurements. For the intervention group, however, a **significant difference** was measured between the start and end measurements for: (see Table 1)
  - » Weight ( $p=1.2\%$ )
  - » Body mass index (BMI) ( $0.8\%$ )
  - » Waist circumference ( $p=1.3\%$ )
- » To evaluate the health of individuals with diabetes:
  - » HbA1C in the blood is checked, with less than 7% being the standard. For HbA1C ( $p=8.2\%$ ), there is **no significant difference for the intervention group** between the start and end measurement.
  - » Glycaemia was monitored. **No significant difference** was observed in glycaemia for the intervention group between start and end measurements ( $p=73.1\%$ ). Additionally, the variability in glycaemia decreased, reflecting stable values among participants over time.
  - » For blood cholesterol values (triglycerides, HDL, LDL, Non-HDL, and the associated HDL-cholesterol ratio), **no significant difference was found for the intervention group** between start and end measurements.

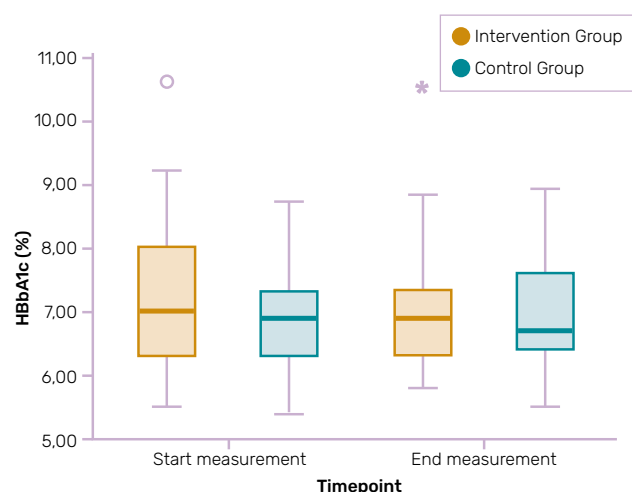


Figure 2: Boxplot of HbA1c for the control and intervention groups, shown for start and end measurements.

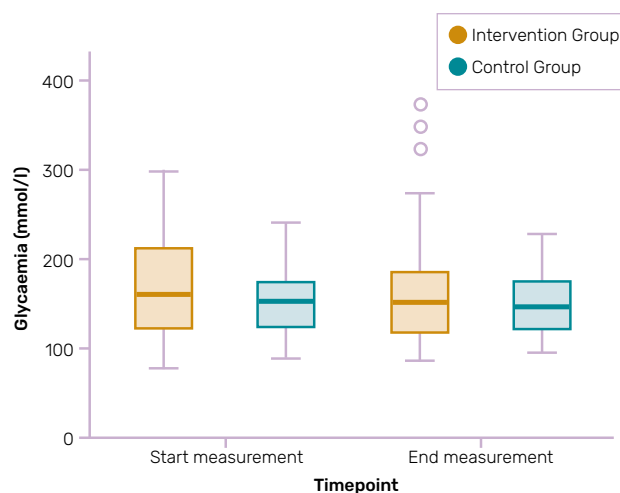


Figure 2: Boxplot. HbA1C and glycaemia values of the control and intervention groups, shown for start and end measurements.

## THE PATIENT

Through descriptive statistics, we examined the patient characteristics where the hybrid care pathway could be more effective. This was conducted using:

- » DTSQ: Standardized survey on satisfaction with the conventional care pathway
- » DTSQc: Survey on satisfaction with the hybrid care pathway
- » UTAUT Questionnaire: Digital experience
- » SES Analysis: Profiling
- » Complication Questionnaire: Disease burden

Focus groups were also organized to validate the gathered data.

**90% of participants  
in the intervention group recommend  
the hybrid care pathway for individuals  
with type 2 diabetes.**

## SELF-MANAGEMENT

Participants indicated that:

- » They are motivated to measure more regularly and are more aware of their condition.
- » They learn and gain insight into managing their diabetes. They are more aware when their glucose levels are low (hypoglycemia – 44.52%) or high (hyperglycemia – 11.10%) and respond more proactively to these values.
- » They perceive the care pathway as a push in the right direction, acting as a motivator and providing a sense of safety through external monitoring.
- » Personalized lifestyle advice (nutrition, exercise, stress management) and tailored measurement schedules would further improve the hybrid care pathway.

***For us diabetics,  
it provides a sense of safety.  
I am reassured knowing someone is  
watching over me.***

## DIGITIZATION

Throughout the project, patients reported relatively few issues with the digital aspect. On the contrary, they found it beneficial for follow-up and did not view it as invasive to their privacy.

Digital skills and user-friendliness are essential for success. Only the activity tracker was considered insufficiently user-friendly. Participants viewed the app as beneficial and reported positive and swift interactions with the care center, which contributed to their sense of safety.

## COST-EFFECTIVENESS

Using a Markov analysis (UGent), we compared the additional costs of the hybrid care pathway to quality adjusted life years (QALY) gained by the intervention. The incremental cost-effectiveness ratio (ICER) indicates the cost per QALY gained by the new pathway. If this amount exceeds €45,000/QALY, the pathway is considered not cost-effective (resources are too high relative to the achieved effect).

This calculation includes costs for:

- » Devices and mobile applications
- » Care providers' time
- » Overhead (e.g., infrastructure, buildings, administration, etc.)

The hybrid care pathway results in an increase of 5.97 QALY, costing social security €663,036 more per patient than the conventional care pathway.

This equates to €110,989/QALY (ICER), exceeding the €45,000/QALY threshold (WHO guideline for cost-effectiveness) (see Table 2).

The high costs of the application and telemonitoring are currently disproportionate to the clinical benefit. However, we see potential for achieving cost-effectiveness:

- » If HbA1C significantly decreases, resulting in more QALYs gained.
- » With a longer intervention period, monthly interventions per patient may decline further, reducing personnel costs. Also, the interventions for the hybrid care pathway were considered additional, without a reduction in time for the conventional pathway. Future studies will incorporate this impact.
- » We also expect to reduce the monthly application and monitoring costs by extending the duration and increasing the number of patients, allowing cost distribution.

	TOTAL COST	QALY'S	INCREMENTAL COST (ADDITIONAL COST FOR NEW SERVICE)	GAINED QALY'S	ICER (€ PER QALY)
Regular pathway	€ 11.696.394	803,65			
Hybrid pathway	€ 12.359.431	809,62	€ 663.037	5,97	€ 110.989/QALY

Table 2: Base scenario results for 100 patients over 22 years

## THE CARE PROVIDER

	NUMBER OF EDUCATIONS	NUMBER OF EDUCATIONS PER PATIENT	TIME PER EDUCATION (H)	TIME PER PATIENT (H)	INCL. Z-PLUS
Control group	83	1,66	3,1	5,1	
Intervention group	73	1,46	1,8	2,6	3,42

Table 3: Time tracking of diabetes educators

Educators and operators involved are generally satisfied with the hybrid care pathway:

- » 90% are satisfied with the customized approach and equipment provided.
- » The hybrid care pathway provides a sense of ease to the diabetes educator, knowing their patient is being monitored by care central nurses.
- » 62.5% wish to use the results for consultations with the patient.
- » 85.5% believe that digital care cannot replace home care.
- » Care providers particularly see added value for new diabetes patients.

***I could prepare my consultation and even make an estimation of the possible HbA1c.***

– Dr. Dieusaert (Ostend)

They identified the following challenges:

- » Digital skills: 30% of educators feel unable to use this technology.
- » Information flow between care providers (operators, educators, and Z-plus) is a prerequisite for effective monitoring; currently, certain information is inaccessible due to technical or legal reasons.

***We no longer work according to what's in the schedule, but leverage technology to intervene at the right time. Especially now, with a shortage of hands, it is essential to use technology to ensure the right person is in the right place.***

– Karin, diabetes educator at i-mens

While diabetes educators were involved in the project, they did not actively adjust the frequency or duration of their educational sessions. Nevertheless, differences were observed (see Table 3).

The number of education sessions per patient in the intervention group decreased slightly compared to the control group. Education sessions for the intervention group averaged 1.8 hours versus 3.1 hours for the control group. Finally, an average of 2.6 hours was needed for patient guidance in the intervention group compared to 5.1 hours for the control group.

Including Z-plus intervention time in the intervention group's total time still results in a lower figure (3.4 hours compared to 5.1 hours).

Although these figures provide valuable insights, further research is needed. In the next clinical study, we will map this in more detail, ensuring an

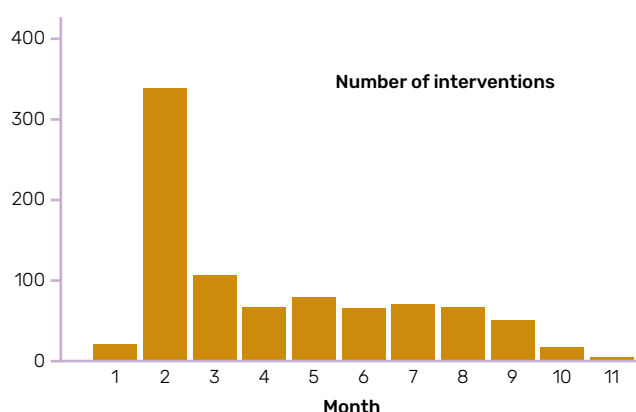
education session only occurs when the data or patient queries indicate a need.





## INTERVENTIONS

A total of 879 remote interventions were performed during the project (Figure 3), averaging 1.95 interventions per participant per month.



An intervention (phone call) lasted an average of four minutes. 52.8% of all interventions occurred within the first three months of the project. In the last six months, there were an average of 1.64 interventions per participant per month.

Most interventions were due to abnormal (47.7%) or missing values (43.1%). Others, such as contact requests or technical questions, accounted for the remaining 9.2%.

Interventions for an abnormal value mainly involved blood pressure or heart rate (39.4%) or hyperglycemia (>240 mg/dl, 40.1%), with 20.4% of interventions for hypoglycemia (<80 mg/dl).

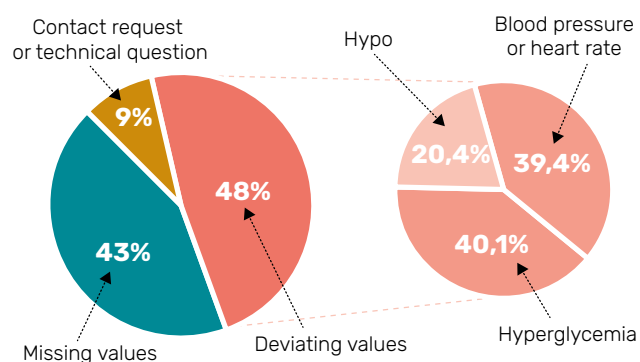


Figure 4: Cause of intervention



## SOURCE

This study was made possible through VLAIO development subsidies, RIZIV funding (nomenclature), and i-mens' own resources.

Project partners: Z-plus care central, Diabetes Liga, Solidaris, Mederi, Helan, Comarch, Roche Diabetes Care, and Ascensia Diabetes Care.

Research was conducted by Odisee University College and UGent:

- » Sandra L., Decoster R., & Loomans M. (2023). Hybride Zorgpad Diabetes: Impact van een hybride zorgpad op zorgvrager en zorgverlener (effectiviteitsstudie). Gent Odisee commissioned by i-mens
- » Van Wilder, L., De Smedt, D., Sandra, L., Vandormael, D., Kaes, J., Willems, R., & Trybou, J. (2023). Cost-effectiveness of a digital supportive healthcare pathway for type 2 diabetes compared to usual care in Belgium. Ghent: UGent commissioned by i-mens.





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