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Impact of Improved Adherence to Insulin Injection Technique Recommendations on Health Care Expenditures in Insulin-Treated People with Diabetes in Belgium

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Objectives

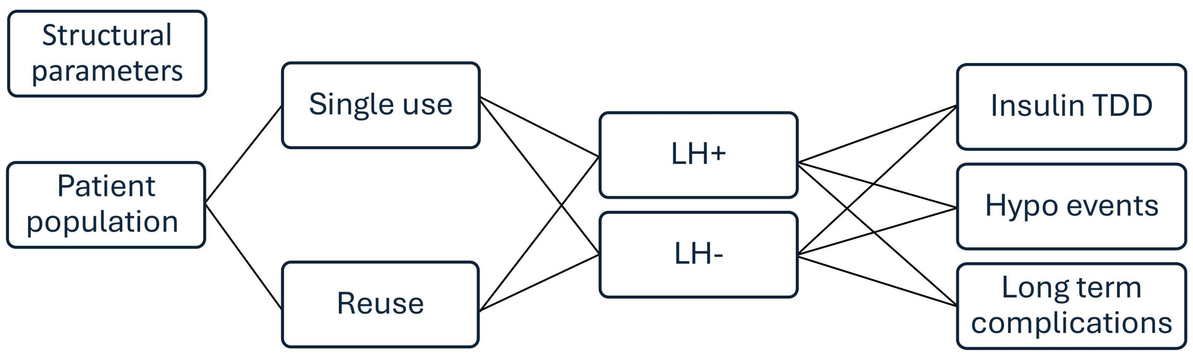
- Widespread non-practice of injection site rotation and frequent reuse of insulin pen needles (PN) promote high rates of lipohypertrophy (LH) among people living with diabetes (PwD).
- LH is associated with suboptimal insulin absorption, leading to increased healthcare costs, primarily due to higher insulin requirements, worsened glycemic control and increased risk for hypoglycemia events.
- Lower out-of-pocket patient expenditure improves adherence to proper insulin injection technique (IIT), positively affecting diabetes management and reducing the associated economic burden.

As PNs are currently not reimbursed in Belgium, this study estimated the healthcare savings from reduced PN reuse if they were to be reimbursed.

Methods

- A modelling framework was developed in the programming language R to estimate the impact of a behavior shift in PN reuse on clinical and economic outcomes for type 1 and insulin-treated type 2 PwD in Belgium (Figure 1).

Figure 1: Schematic view of model structure



LH, Lipohypertrophy; TDD, Total Daily Dose; Hypo, Hypoglycemic

- The model calculated the effect of reduced PN reuse on insulin consumption, the occurrence of hypoglycemic events as well as long-term diabetes complications, mediated by a central role for the presence of LH.
- Model population was based on narrative literature research and expert opinions obtained from a Delphi panel. A midpoint value (literature vs expert) was calculated in absence of a consensus (Table 1).

Table 1. Model parameters and values

Reuse		
Reuse prevalence before intervention (%)	90	[1]
Reuse prevalence after intervention (%)	35 (20 vs 50)	Midpoint, [1]
Reuse categories (#injections / PN)	2, 3 to 5, 6 to 10, 10+	[2]
Lipohypertrophy		
Prevalence LH+ when single use (%)	37 (27 vs 47)	Midpoint, [1]
Relative risk of LH+ when reuse	1.10, 1.25, 1.50, 1.75	[2]
Relative risk for hypo event when LH+	2.96 (2.05 vs 3.96)	Midpoint,[3]
Modelled health outcomes		
TDD insulin difference in LH status (IU)	10	[4]
Uptake of CGM (T1c, T2c, T2cp) (%)	81, 50, 0	[5]
Severe hypo's T1/T2 (pre-, post-CGM)*	0.90/0.41, 0.61/0.27	[6,7]
Hosp hypo's T1/T2 (pre-, post-CGM)*	0.07/0.03, 0.04/0.02	[6,7]
HbA1c difference in LH status (%)	0.3	[1]
Prevalence complications T1/T2**	16/50, 35/38, 13/49, 19/32	[5]
Risk reduction complications per 1% HbA1c	14, 19, 18, 43	[8]

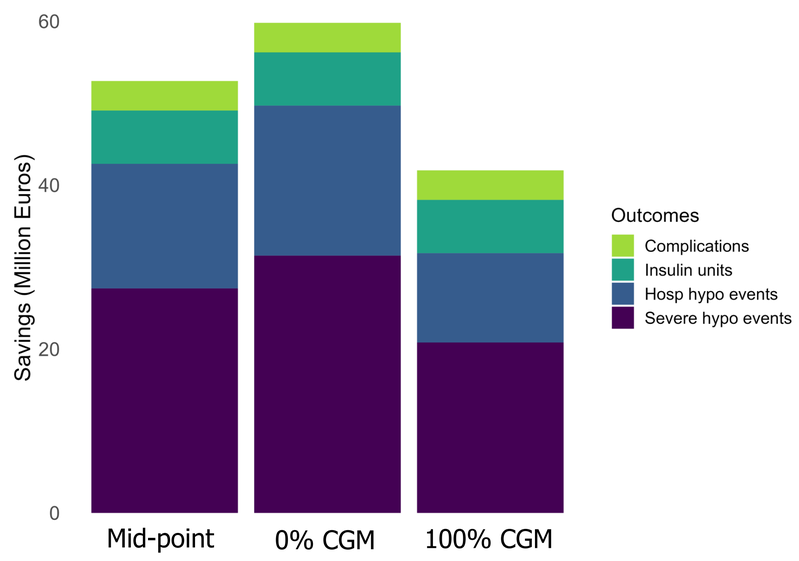
* Number of events/patient/year ** Long –term complications categorized as cardiovascular, vascular eye, kidney, foot
CGM, continuous glucose monitoring; T1, Type 1 diabetes; T2, Type 2 diabetes; T1c, T1 diabetes convention; T2c, T2 diabetes convention; T2cp, T2 diabetes care path; LT, long-term complications

- Three populations were included given diabetes type and care system.
- Severity of PN reuse was modelled by categories of increasing frequency.
- A reuse frequency distribution evolving towards less reuse, resulted in lower LH prevalence, thereby positively impacting modelled outcomes.
- Unit costs for insulin, severe and hospitalized events, and long-term complications were derived from literature or Belgium specific sources.

Results

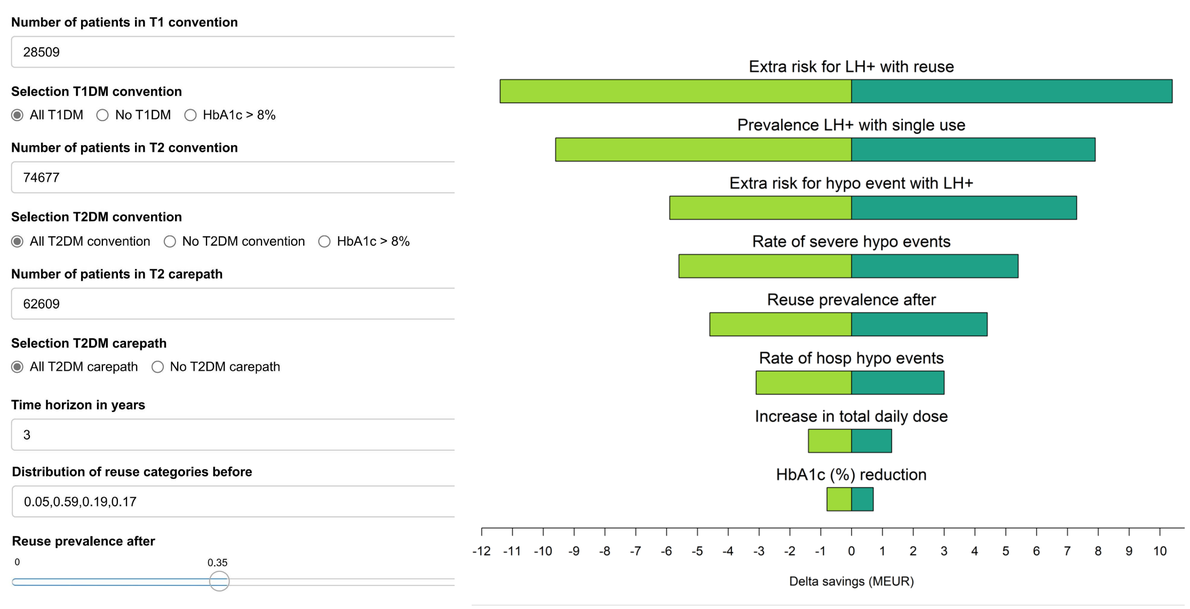
- With 170,396 PwD included, a decrease in LH+ from 84,325 to 67,515 patients was modelled, resulting in a reduction of 19.9%.
- Over a 5-year time horizon, potential savings were 52.6 million Euros (28.1 – 77.9 million Euros) when 55% of PwD decreased their PN reuse, with hypoglycemic events representing the largest cost savings (Figure 2).
- Scenario analyses were performed considering either 100% or 0% adoption of CGM by all PwD in this analysis (Figure 2).

Figure 2: Mid-point and scenario results



- An interactive Shiny application allowed different stakeholders to explore the impact of variation in assumptions and parameters.
- Figure 3 shows variation in total healthcare savings when varying parameter values by 20%.

Figure 3: Interactive tornado plot visualization



Conclusion

- Adherence to correct ITT by PwD remains important for achieving economic and health savings in diabetes care, despite ongoing technological advances.
- Modern decision support tools facilitate dynamic interactions with clinical experts, in addition to traditional expert elicitation techniques.

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