Environmental Impact of Switching from Daily to Weekly Basal Insulin Administration in France

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Introduction

- In France, in 2021, 3.6 million of individuals received a treatment for diabetes[1]. Insulin therapy is a cornerstone of the management of type 1 (**T1D**) and type 2 (**T2D**) diabetes to supplement a lack or insufficient production of insulin. Different insulins with distinct pharmacokinetics are available on the market and play a different role in achieving glycemic control.
- Among them basal insulin corresponding to the administration of long-acting form ensure a constant level of insulin in the bloodstream and stabilise glycaemia throughout the day. In current practice in France, basal insulins are administered once daily (**OD**) and are in most cases associated with fast-acting insulin, to manage blood sugar peak. This results for most patients in several injections daily.
- In addition to a significant burden for the patients, the subcutaneous administration of insulin implies the consumption of single use devices ; and while durable injection devices are available most products, in the form of plastic pens, are meant to be discarded once emptied.
- The health sector is responsible for 10% of the total carbon footprint of human activities, it is crucial to find solutions to limit its impact[2].

Premise and objective

- The production and use of insulin pens is a source of carbon emissions and waste.
- This environmental burden accumulates as diabetes is a chronic condition and insulin a lifelong treatment.
- A newer generation of insulin could be administered once weekly (**OW**) and demonstrated an equivalent efficacy to OD insulin
- The aim of this study is therefore to assess the environmental impact of OW versus OD basal insulin in the treatment of people living with diabetes.

Methods

- A model was developed to compare over a year the plastic and carbon footprint of patients treated either with OW basal insulin, represented by insulin icodec, or OD basal insulin available on the market (excluding NPH).
- The comparator for OD insulins is an average basket of all products prescribed in France available in preloaded injection device, weighted by their market shares obtained from the '*Groupement pour l'Elaboration et la Réalisation de Statistiques'* (GERS)[3].
- The population considered is a mix of T1D not treated with insulin pumps and T2D patients treated with basal insulin based on national health insurance (NHI) data[4] and opinions issued by the Transparency Committee opinions for insulin degludec[5].
- The average number of insulin unit administered per patient per week was obtained:
  - For OW insulin: from the average weekly dose received in ONWARD6[6] (for T1D) and ONWARD3[7] (for T2D) trials.
  - For OD insulins: based on the average number of UI per pack obtained from the GERS[3] and the prescription and consumption information made available by the NHI (Open medic)[8].

Figure 1. Studied population

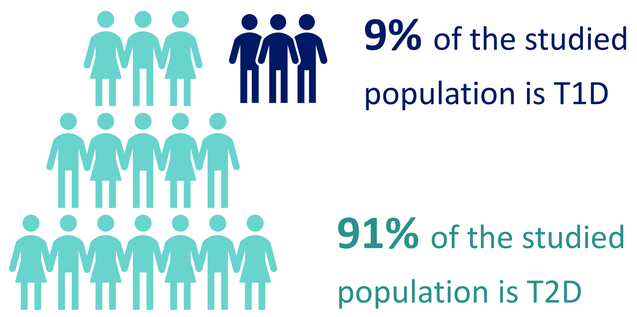
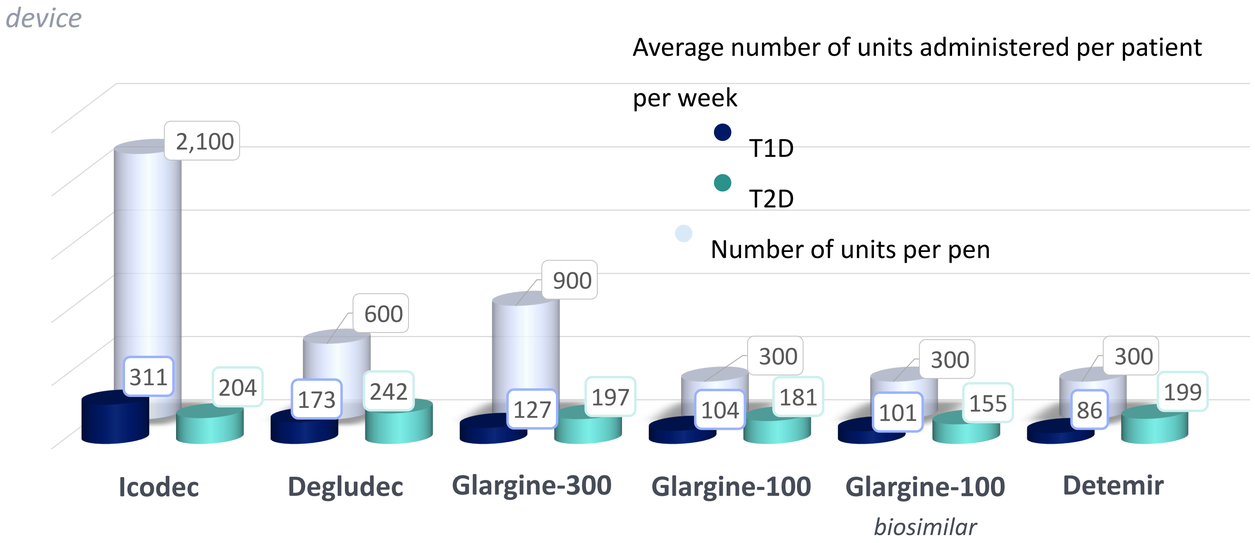


Figure 2. Average weekly UI administered per patient in comparison with the number of unit per device



- The carbon and plastic footprints associated with the production and distribution of pre-filled pens were studied and published by Novo Nordisk[9]. As no data were available from other manufacturers, it was assumed that the carbon and plastic footprints per pen are similar for all insulins considered (an only the consumption differs).
- The carbon emitted for the production and distribution of one pen was calculated based on the carbon footprint of a one-year treatment with insulin degludec and the estimated number of degludec insulin pens used in a year.
- Similarly, the plastic footprint attributable to the device for a one-year treatment was converted into a grams of plastic per device.
- The obtained carbon and plastic footprints, assumed identical for all insulins considered, are then applied to the number of pens consumed every year.
- Both were valued considering the carbon and plastic taxes currently applied in France[10,11].

Results

Pen usage

- On average, a patient treated with OW basal insulin would use 5 insulin pens per year compared with 22 pens for OD insulins.

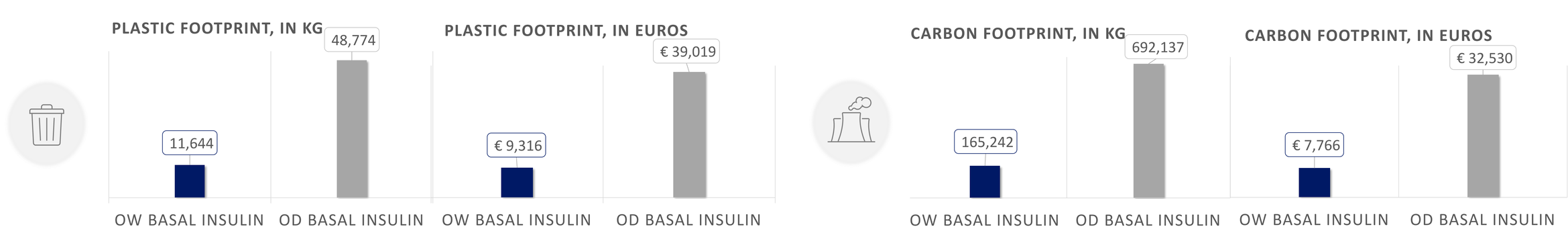
Plastic and carbon footprints

- Taking a sample of 100,000 diabetic patients, a switch from OD to OW basal insulin would therefore amount to a reduction of 37 tons of plastic waste and 1,7 kilotons of carbon emissions per year.
- Considering today's plastic and carbon taxes, it would economically translate into a reduction of 39 K€ and 25 K€ respectively for the compensation to the environmental impact.

Table 1. Carbon and plastic footprint

Plastic footprint	22 gram / pen
Plastic tax	0.8 €/ kg
Carbon footprint	313 gram / pen
Carbon tax	0.05 € / kg

Figure 4. Plastic and carbon footprint over a year for 100,000 diabetic patients



Conclusion

Results suggest that transitioning from OD to OW insulin administration could substantially reduce plastic waste and carbon emissions and translate into considerable cost savings. OW basal insulin and the development of pen recycling programs represent options to mitigate the environmental impact while offering effective and convenient option or people living with diabetes.

References

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