## LETTER TO THE EDITOR

# Connected insulin systems in diabetes patients in Spain: Present and future perspectives

## Sistemas de administración de insulina conectados en pacientes con diabetes en España: perspectivas presentes y futuras

*Dear Editor,*

Digital technologies and telemedicine have become increasingly important in the care of diabetes patients in recent years, allowing for more informed therapy decisions and increased patient access to healthcare professionals and support networks.[1,2] A recent review has shown that, for patients with diabetes treated with insulin, use of an insulin pen with connectivity capabilities is an approach that has the potential to simplify insulin treatment, reducing missed bolus injections and ultimately leading to better glycaemic control.[2] Additionally, connected insulin devices also have the potential to positively impact patient outcomes, including treatment satisfaction, adherence and quality of care.[2] As evidence in this field is still in its early stages, few fully published papers are available and most of the information is in conference abstracts and non–peer–reviewed grey literature.[2,3] In Spain, there are no guidelines on the use of connected systems in insulin-treated diabetes patients, although the COVID-19 pandemic has highlighted the potential of telemedicine and digital solutions in these patients.[4]

We sought to investigate the availability and use of connected insulin systems in Spain and their impact in routine practice in the Spanish scenario, via a systematic literature search. A search was carried out in the Medline and Embase databases on 28 January 2022 for publications published between 2015 and 2021, and congress proceedings from 2018 to 2021 were hand searched for relevant conference abstracts. In addition, a search of ClinicalTrials.gov and EudraCT, and of the grey literature available online, was conducted. A total of 164 Medline/Embase hits, 12 Spanish conference abstracts, 150 clinical trials and 20 grey literature hits were initially identified. Title and abstract screening resulted in retaining 12 Spain-specific hits in total: two journal articles; eight conference abstracts; one clinical trial, and one grey literature document. Following full-text screening, four unique hits were retained; most of these studies were small, enrolling 20 patients or fewer.[5–8]

In Spain, various connected insulin pens and caps and several diabetes management applications (apps) are currently available (Table 1). No Spanish studies were found for connected insulin platforms or connected insulin pens. Three studies in Spain investigated the use of the Insulclock® connected pen cap, and reported benefits including improved glycaemic control, a reduction in missed and mistimed doses, and improved patient satisfaction (Table 1).[5–7] One report from the grey literature describing the SocialDiabetes digital platform that is in use in some hospitals in Spain reported several benefits, as well as high patient and healthcare provider satisfaction (Table 1).[8]

Although there is a lack of data on the impact of connected care in diabetes in Spain and in broader populations, existing data from this and other studies suggest positive impacts with respect to clinical, economic and patient-reported benefits.[1–3,9] In Spain, the lack of specific guidelines and the low number of commercially available devices are current barriers to the use of connected care in Spanish diabetes management. Additionally, available caps and pens are not reimbursed, resulting in additional costs for patients. Ongoing studies on the utilisation of connected devices in diabetes, both in Spain[10] and elsewhere,[3] suggest that the evidence base for connected care in diabetes will become more robust in time. Eventually, additional devices will also come to the market and solutions are needed to make the information they generate easily accessible to healthcare providers and hospital management software.[2] Barriers to the use of connected care in diabetes remain, such as the availability of smart pens that are not compatible with every type of insulin, issues of data ownership, accessibility and operability, reimbursement and insurance coverage.[1,2]

While the use of connected systems requires adequate training, as well as users' motivation to acquire the ability to manage them properly, several subpopulations with diabetes are particularly likely to benefit from these technologies. These include young or elderly individuals, those with the potential for hypoglycaemia or frequent episodes of uncontrolled diabetes or glycaemic variability, emphasising the importance of continuing to introduce connected devices into routine diabetes management.[2]

**Table 1** Types of connected care systems identified and Spanish studies using these systems.

| Type of connected care system | Products | Spanish studies found |
|---|---|---|
| Connected insulin platforms<br>• Connected care ecosystems: connected insulin pen or pen and cap/sleeve working together with an app | ESYSTA® | None |
| Connected insulin injection pens<br>• Connected insulin pens that can communicate with apps/management platforms<br>• Insulin pens with the capacity to work with Bluetooth/Near-field communication or connected cap/sleeve that can communicate with apps/management platforms | Clipsulin®<br>DataPen®<br>InPen®[a]<br>NovoPen Echo Plus®[a]<br>NovoPen 6®[a]<br>Pendiq2®[a] | None |
| Insulin pen caps/sleeves<br>• Separate Bluetooth-enabled/connected caps or sleeves that attach to the end of an insulin pen and enable it to be connected | Easylog®<br>Go Cap®<br>Insulclock®[a]<br>Insulcheck®[a]<br>Insulog®<br>Mallya®<br>Tempo®<br>Timesulin®[a] | Three studies investigating the Insulclock® pen cap in individuals with T1D. Benefits associated with Insulclock® include:<br>• A decrease in mean glucose and glucose variability, increased TIR, decreased TAR, and a reduction in the number of missed and mistimed doses per month [7]<br>• Improved ITSQ items vs baseline, indicating increased patient satisfaction and perceived benefits [5, 7]<br>• Detection of pending hypoglycaemic events in >77% of cases, giving an advanced warning an average of 87 minutes prior [6] |
| Diabetes management mobile apps<br>• Apps focusing on diabetes management via connected insulin pens<br>• Apps that can connect to connected insulin pens/caps/sleeves | Diabeo®<br>iSage Rx™<br>Glooko[a]<br>Insulia®<br>Metadixx<br>Metenda<br>MyDiabby[a]<br>My Dose Coach™<br>MySugr[a]<br>One Drop[a]<br>SocialDiabetes[a]<br>Tidepool[a] | One report from the grey literature describing the SocialDiabetes digital platform for insulin-treated patients with T1D or T2D [8]. Benefits included:<br>• Improvements in glycaemic control, TIR for users of CGM, and glycaemic target achievement<br>• High patient approval for the platform with respect to support for improving lifestyle habits and increasing their knowledge and understanding of their disease<br>• Unanimous support from HCPs for the platform with regard to improving disease control, and high support for the platform for patient engagement and decision-making support |

CGM, continuous glucose monitoring; HCP, healthcare provider; ITSQ, Insulin Treatment Satisfaction Questionnaire; T1D, type 1 diabetes; T2D, type 2 diabetes; TAR, time above range; TIR, time in range.
[a] Currently available in Spain.

## Conflicts of interest

## Acknowledgements

## References

1. Phillip M, Bergenstal RM, Close KL, Danne T, Garg SK, Heinemann L, et al. The digital/virtual diabetes clinic: the future is now—recommendations from an international panel on diabetes digital technologies introduction. Diabetes Technol Ther. 2021;23:146–54, http://dx.doi.org/10.1089/dia.2020.0375.
2. Heinemann L, Schnell O, Gehr B, Schloot NC, Görgens SW, Görgen C. Digital diabetes management: a literature review of smart insulin pens. J Diabetes Sci Technol. 2022;16:587–95, http://dx.doi.org/10.1177/1932296820983863.
3. Jamdade V, Liao B, Newson RS. POSB30 systematic literature review of clinical, economic, and patient-reported benefits of connected insulin pen systems. Value Health. 2022;25 Suppl. 1:S31, http://dx.doi.org/10.1016/j.jval.2021.11.140.

4. Ibáñez J, Rovira E, Ribera J. Telemedicina e innovación en diabetes. Telemedicina de calidad para personas con diabetes insulinizadas; 2021. Available from: https://media.iese.edu/research/pdfs/ST-0616 [cited 07.04.22].

5. Gomez-Peralta F, Abreu Padin CA, Gomez-Rodriguez S, Cruz-Bravo M, Elvira A. Improving insulin injection technique and patient satisfaction with Insulclock® [abstract 165]. Diabetes Technol Ther. 2019;21 Suppl. 1, http://dx.doi.org/10.1089/dia.2019.2525.abstracts. A-72–A-73.

6. Gomez-Peralta F, Abreu C, Gomez-Rodriguez S, Cruz-Bravo M, María C, Poza G, et al. Evaluation of the hypoglycaemia predictive algorithm in the Insulclock® insulin pen cap digital platform in type 1 diabetes treated with insulin multidose [abstract 552]. Diabetes Technol Ther. 2021;23 Suppl. 2, http://dx.doi.org/10.1089/dia.2021.2525.abstracts. A-29.

7. Gomez-Peralta F, Abreu C, Gomez-Rodriguez S, Cruz-Bravo M, María-Sanchez C, Poza G, et al. Efficacy of Insulclock® in patients with poorly controlled type 1 diabetes mellitus: a pilot, randomized clinical trial. Diabetes Technol Ther. 2020;22:686–90, http://dx.doi.org/10.1089/dia.2019.0427.

8. SocialDiabetes. SocialDiabetes in a hospital setting: clinical impact and efficiency in management; 2022. Available from: https://blog.socialdiabetes.com/en/socialdiabetes-in-a-hospital-setting-clinical-impact-and-efficiency-in-management/ [cited 16.03.22].

9. Jendle J, Ericsson Å, Gundgaard J, Møller JB, Valentine WJ, Hunt B. Smart insulin pens are associated with improved clinical outcomes at lower cost versus standard-of-care treatment of type 1 diabetes in Sweden: a cost-effectiveness analysis. Diabetes Ther. 2021;12:373–88, http://dx.doi.org/10.1007/s13300-020-00980-1.

10. ClinicalTrials.gov. Assess the impact of Insulclock on glycemic variability and treatment compliance in uncontrolled DM1 patients (Segoclock2) [NCT04847778]; 2022. Available from: https://clinicaltrials.gov/ct2/show/NCT04847778 [cited 16.03.22].

Ignacio Conget [a,b,c], Esther Artime [d], Natalia Duque [d,*], Silvia Díaz-Cerezo [d], Miriam Rubio-de Santos [d]

[a] *Diabetes Unit, Department of Endocrinology and Nutrition, Hospital Clínic i Universitari, Barcelona, Spain*
[b] *CIBERDEM, Centro de Investigación Biomédica en Red de Diabetes y Enfermedades Metabólicas [Biomedical Research Network Centre for Diabetes and Metabolic Diseases], Madrid, Spain*
[c] *IDIBAPS, Institut d'Investigacions Biomèdiques August Pi i Sunyer [August Pi i Sunyer Biomedical Research Institute], Barcelona, Spain*
[d] *Eli Lilly and Company, Alcobendas, Madrid, Spain*

[*] Corresponding author.
*E-mail address:* duque_natalia@lilly.com (N. Duque).