

Invited Editorial Commentary

## Squaring the circle – Insulin pump therapy and health inequalities in patients with type 1 diabetes mellitus

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Effective management of type 1 diabetes mellitus (T1DM) aims to reduce high blood glucose levels to near physiological levels. The Diabetes Control and Complications Trial showed that intensive insulin therapy improved glycemic control and reduced microvascular complications.<sup>[1]</sup> Insulin pump therapy (IPT), also known as continuous subcutaneous insulin infusion, is recommended for patients with T1DM to achieve improved glycemic control.<sup>[2-4]</sup> The National Paediatric Diabetes Audit (NPDA) from England and Wales in the United Kingdom highlights a positive association between the use of modern diabetes technologies and improved hemoglobin A1c (HbA1c) in young people with diabetes.<sup>[4]</sup> A study by Aleppo *et al.* showed improved HbA1c in the short-term, namely a mean HbA1c reduction of 0.9% (10 mmol/mol) after 90 days of IPT.<sup>[5]</sup> Similarly, a Norwegian childhood diabetes registry study showed improvement in the long-term too. Over a 10-year period (2013–22), mean HbA1c decreased from 8.2 to 7.2%, the proportion of patients achieving an HbA1c of <7.0% increased from 13 to 43%, with a simultaneous increase in IPT from 65 to 91%. However, there was also an increase in use of continuous glucose monitoring (CGM) from 34 to 97% (2016–22), which clearly was an important confounding factor.<sup>[6]</sup> IPT has shown improved quality of life indicators with less injections and flexible lifestyle. IPT is also practical in small children with unpredictable eating habits and small insulin requirements.<sup>[3]</sup> However, there are multiple challenges with insulin pump use and the study by Mulhern *et al.* adds evidence to the association of socioeconomic deprivation and reduced pump therapy effectiveness.<sup>[7]</sup>

IPT does not “always” guarantee improved glycemic control. Education and support for patients and families are crucial in the management of T1DM with insulin pumps. Comprehensive structured education, that is both acceptable and feasible, is essential before commencing insulin pumps, along with ongoing periodic re-education as appropriate. Children and families must be trained in carbohydrate (carb) counting and glucose monitoring. Support systems should be established for regular data reviews from pumps and monitors.<sup>[3]</sup> Families should be familiar with troubleshooting, recognizing glucose patterns, and responding appropriately, both proactively and reactively to achieve good glycemic control. It is important to set realistic expectations and goals with families on what pump therapy can and cannot achieve within the context of the individual patient. On the other hand, CGM use has been shown to improve glycemic control, with or without IPT, by reducing both high and low glucose levels.

Uptake of insulin pumps has been on the rise with improved technology and increasing emphasis from professional bodies and governments. The historical data from three large pediatric

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diabetes registries from 2015 showed that the use of insulin pumps was 41% in the German/Austrian Prospective Diabetes Follow-up Registry, 47% in the United States T1D exchange, and 14% in the England and Wales NPDA.<sup>[8]</sup> This shows a huge variation in insulin pump use across developed countries too. The NPDA reports show increasing insulin pump use to 38% in 2020 and 55% in 2024 across England and Wales, where diabetes technology is supplied free by the hospitals, with no costs for the patients.<sup>[4]</sup>

However, inequalities in technology uptake remain, with its use being less prevalent in ethnic groups and those living in deprived areas. Significant health disparities are reported by NPDA with certain groups having less access to these beneficial technologies, leading to poorer outcomes.<sup>[4]</sup> Socioeconomic deprivation is associated with higher baseline mean HbA1c and lower reduction in HbA1c following Dose Adjustment For Normal Eating (DAFNE) education in adults. Adjusting insulin and carbohydrate counting rely heavily on numeracy skills.<sup>[9]</sup> Patients with less confidence in their numeracy skills may not estimate the appropriate amount of insulin required, leading to poor glycemic control. Sussman *et al.* compared the use of automated bolus calculators versus manual calculation of insulin doses and revealed an error rate of 63% when insulin doses were calculated manually; thus, negatively impacting glycemic control.<sup>[10]</sup> Difficulties with calculating bolus doses may lead to some patients reverting to fixed insulin boluses.

Inadequate education and support may also contribute to poor glycemic control. Ethnicity and language barriers can affect the success of IPT education. Factors related to healthcare providers such as the number of diabetes educators and their available time to provide focused education, and if required, additional training sessions, play a role. Improving access to technology should be accompanied by providing support and education for families in deprived communities. The Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) program which was set up to improve patient education with diabetes management, targeting those patients with low literacy rates demonstrates the importance of education.<sup>[11]</sup> Better glycemic control and clinically significant improvements in body mass index and weight were seen at 6 months among participants who attended the DESMOND program and returned for the follow-up session. The number of participants achieving a HbA1c <7.0% increased from 52 to 71%.<sup>[12]</sup>

The study by Mulhern *et al.*, reports an association between socioeconomic deprivation and stopping IPT in children. In this study, 72 out of 323 patients (22.3%) stopped IPT between 2015 and 2020.<sup>[7]</sup> 40 out of 60 (67%) of those who stopped insulin pumps reported poor glucose control, and 35 out of 60 (58%) had Scottish Index of Multiple Deprivation quintile scores of 1 and 2, versus 14 out of 60 (23%) had scores of 4 and 5. The HbA1c before and after starting

insulin pumps was not reported in this study. Information relating to the preparation of patients and parents before starting IPT or ongoing re-education information were also not available. In contrast, a study from Poland reports that pump discontinuation is rare, with 4% of patients on pumps reverting to insulin injections. This study reported that individual factors such as the psychological state of the child and appropriate education are important at the start and continuation of IPT.<sup>[13]</sup> Another study from Canada also reported that pump discontinuation is rare but confirmed an association with deprivation.<sup>[14]</sup> In India, pump therapy in rural underprivileged children ( $n = 50$ ) with T1DM with an non-governmental organization-private-industry partnership showed good uptake and a statistically significant reduction in HbA1c at 6 months and 1-year of IPT compared to baseline. In addition, significant reductions in diabetic ketoacidosis and severe hypoglycemia admissions were also seen in this cohort.<sup>[15]</sup> Therefore, the high rate of pump discontinuation reported from the study by Mulhern *et al.*<sup>[7]</sup> remains unexplained. The main reason for discontinuation which is reported as poor glycemic control remains perplexing. However, this study adds evidence that more patients who stop IPT are likely to be associated with economic deprivation.

The above study relates to insulin pump use from 2015 to 2020; however, since that time, diabetes technology has progressed at a rapid pace. The use of CGM has been positively associated with glycemic improvement, with or without pump therapy. It is unclear whether CGM was used with IPT in the above cohort. The onset of hybrid closed-loop systems has been a game changer, benefitting more patients, including those with non-compliance and poor carb counting skills to an extent, to improve their diabetes control despite their inherent challenges.

Poor health outcomes in economically deprived populations are multi-dimensional with various factors influencing the overall glycemic control. Patients and families from deprived areas require additional support, both at the outset and over time. Developing guidelines for focused education and training at pump initiation, tailored to their existing knowledge and age, would be beneficial. This can be followed by repeat sessions as necessary to mitigate the inherent risk of information overload at the initial session. Appropriate use of psychology services can increase the resilience and success rates, as advances in technology are rarely a replacement for poor motivation and poor self-care. The operating health care systems and expenses associated with T1DM care are critical factors in those countries, including India, where funded health care is not fully operational. Further research is essential to address health inequalities, identifying barriers to improving HbA1c and determining the best ways to support children and young people with T1DM from areas of economic deprivation.

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## REFERENCES

1. Diabetes Control and Complications Trial Research Group, Nathan DM, Genuth S, Lachin J, Cleary P, Crofford O, *et al.* The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 1993;329:977-86.
2. Berget C, Messer LH, Forlenza GP. A clinical overview of insulin pump therapy for the management of diabetes: Past, present, and future of intensive therapy. *Diabetes Spectr* 2019;32:194-204.
3. Blair JC, McKay A, Ridyard C, Thornborough K, Bedson E, Peak M, *et al.* Continuous subcutaneous insulin infusion versus multiple daily injection regimens in children and young people at diagnosis of type 1 diabetes: Pragmatic randomised controlled trial and economic evaluation. *BMJ* 2019;365:I1226.
4. National Paediatric Diabetes Audit. Annual report 2023-24: Care processes and outcomes. London: RCPCH; 2025.
5. Aleppo G, DeSalvo DJ, Lauand F, Huyett LM, Chang A, Vienneau T, *et al.* Improvements in glycemic outcomes in 4738 children, adolescents, and adults with type 1 diabetes initiating a tubeless insulin management system. *Diabetes Ther* 2023;14:593-610.
6. Bratke H, Biringer E, Ushakova A, Margeirsdottir HD, Kummernes SJ, Njølstad PR, *et al.* Ten years of improving glycemic control in pediatric diabetes care: Data from the Norwegian childhood diabetes registry. *Diabetes Care* 2024;47:1122-30.
7. Mulhern EC, Lamb F, Whyte K, Kuehne V, Craigie I, Shaikh MG. Socioeconomic status influencing the cessation of insulin pump therapy in children with type 1 diabetes: A cohort study. *J Pediatr Endocrinol Diabetes* 2025;5:87-90.
8. Sherr JL, Hermann JM, Campbell F, Foster NC, Hofer SE, Allgrove J, *et al.* Use of insulin pump therapy in children and adolescents with type 1 diabetes and its impact on metabolic control: Comparison of results from three large, transatlantic paediatric registries. *Diabetologia* 2016;59:87-91.
9. Innes CW, Henshall DE, Wilson B, Poon MT, Morley SD, Ritchie SA. Socioeconomic deprivation is associated with reduced efficacy of an insulin adjustment education program for people with type 1 diabetes. *Diabet Med* 2022;39:e14902.
10. Sussman A, Taylor EJ, Patel M, Ward J, Alva S, Lawrence A, *et al.* Performance of a glucose meter with a built-in automated bolus calculator versus manual bolus calculation in insulin-using subjects. *J Diabetes Sci Technol* 2012;6:339-44.
11. Chatterjee S, Davies MJ, Stribling B, Farooqi A, Khunti K. Real-world evaluation of the DESMOND type 2 diabetes education and self-management programme. *Pract Diab* 2018;35:19-22a.
12. Scannell C, O'Neill T, Griffin A. The effectiveness of a primary care diabetes education and self-management program in Ireland: A 6-month follow-up study. *Endocrinol Diabetes Metab* 2025;8:e70036.
13. Binek A, Rembierz-Knoll A, Polańska J, Jarosz-Chobot P. Reasons for the discontinuation of therapy of personal insulin pump in children with type 1 diabetes. *Pediatr Endocrinol Diabetes Metab* 2015;21:65-9.
14. Shulman R, Stukel TA, Miller FA, Newman A, Daneman D, Guttman A. Insulin pump use and discontinuation in children and teens: A population-based cohort study in Ontario, Canada. *Pediatr Diabetes* 2016;18:33-44.
15. Swaminathan K. One-year follow-up of 50 rural underprivileged type 1 diabetes children on insulin pump therapy: Breaking socio-economic barriers in diabetes technologies. *Indian J Endocrinol Metab* 2023;27:213-5.

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