



# Diabetes Technologies: We Are All in This Together

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The United States faces a shortage of both primary care physicians (PCPs) and endocrinologists—the two groups of clinicians who provide the majority of care to people with diabetes (1–3). Patients treated with intensive insulin therapy, including all of those with type 1 diabetes and many with type 2 diabetes, face numerous daily self-management decisions. These decisions include factoring insulin dosing, glucose management, diet, activity, and other behavioral factors into their decision-making. These patients stand to gain from using the treatment and monitoring technologies that are rapidly advancing and accumulating evidence in support of their benefits. Despite this situation, the actual use of such technologies, including continuous glucose monitoring (CGM) and closed-loop artificial pancreas systems, remains relatively low (4,5).

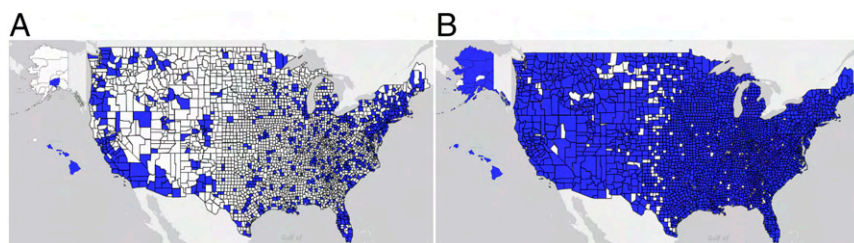
One potential barrier to uptake of such advanced diabetes technologies is a hypothesized mismatch between geographical location of people with diabetes and available clinicians. Employing datasets from the U.S. Census Bureau (6) and the American Medical Association Health Workforce Mapper (7), as well as prevalence estimates from the American Diabetes Association and JDRF, we sought to compare the distribution of PCPs and endocrinologists across the United States to the distribution of people with diabetes. This endeavor was undertaken as a step toward

understanding whether encouraging PCP management of advanced diabetes technologies might benefit people treated with intensive insulin therapy.

The distribution of people with diabetes approximates the distribution of the general population of the United States (8,9). The distribution of PCPs largely matches that distribution; of 3,143 U.S. counties, 3,017 (96.0%) have at least one PCP, and only 126 have no PCPs. The distribution of endocrinologists, on the other hand, is quite different; 777 counties (24.7%) have an endocrinologist, leaving 2,366 counties (75.3%) with none. Although every U.S. county borders at least one county with at least one PCP, the distribution of endocrinologists reveals many sizable gaps. These are depicted in Figure 1.

Although no person with diabetes is ever more than one county away from a PCP, the nearest endocrinologist can be hundreds of miles and many counties away. This situation contributes to a disparity in care. Current diabetes technologies such as insulin pumps (traditional or closed-loop systems) and CGM systems are associated with better diabetes management, including improving A1C resulting from reductions in both hyperglycemia and hypoglycemia (10) and are also generally managed by the geographically concentrated endocrinologists rather than by most of the more geographically dispersed PCPs. This not only adds strain to the relatively smaller endocrinology workforce; it also forces many patients to miss work, travel considerable distances, and/or incur considerable expense to gain access to such technologies or to forgo the opportunity to use them. Social determinants of health, including issues related to income, employment, and transportation, may leave many patients unable to access subspecialty care even if they wanted to try.

Advanced diabetes technologies such as CGM and closed-loop artificial pancreas systems are poised to improve



**FIGURE 1** U.S. counties with A) at least one pediatric or adult endocrinologist or diabetologist and B) at least one PCP.

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outcomes and patient experiences even more, and in the hands of PCPs could reach many more patients than in the hands of endocrinologists alone. Research on CGM use is increasingly showing improved outcomes and better patient experience, but little of this research has been done with primary care populations. Additionally, research and development of closed-loop artificial pancreas systems have focused nearly exclusively on endocrinologist-treated populations thus far. Future research should evaluate whether and how such advanced diabetes technologies would and could be incorporated into diabetes management among broader and expanding delivery models and provider roles. This research should include primary care settings to help ease the strain on the endocrinology workforce and to help bring such technologies to the many locales in which endocrinologists are not available.

Additional efforts could include enlisting other health workforce colleagues to help do this work, as was made clear at a recent workshop cosponsored by JDRF and the Leona M. and Harry B. Helmsley Charitable Trust. At this event, where attendance and enthusiasm both overflowed the meeting room, certified diabetes educators, pharmacists, school nurses, social workers, representatives from professional organizations, industry representatives, and researchers all sat shoulder to shoulder with endocrinologists, family physicians, general internists, and pediatricians. The assembled group reviewed resources available to support clinicians caring for people with diabetes to identify resource gaps and discuss how we can work together to serve this population we all want to help.

Together, participants at the workshop envisioned a future landscape of diabetes care, perhaps 10 years from now, in which PCPs and endocrinologists alike comfortably prescribe automated, closed-loop artificial pancreas systems; diabetes educators and social workers are more accessible to all patients and can help support patient education and insurance approvals for advanced diabetes devices; psychologists are more frequently engaged to round out whole-person treatment of people living with diabetes and the behavioral health issues that often go hand-in-hand with having a chronic condition and using new technologies; and school nurses are recognized as important contributors to children's diabetes care and can help to support students using advanced diabetes devices at school. As disparate as the workshop participants were, we held a unified belief and spoke in a single voice. Although our roles are different and there are striking differences in the distribution of our workforces, we share the common goal of providing the best available care to our patients, and we are all in this together.

## DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

## AUTHOR CONTRIBUTIONS

S.M.O. and T.K.O. conceived of the concept, conducted literature review, and wrote the text. S.M.O. performed data analysis and map creation. T.K.O. performed final editing. S.M.O. is the guarantor of this work and, as such, had full access to all data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

## PRIOR PRESENTATION

Some of the data in this article was first presented as an abstract at the 46th North American Primary Care Research Group Annual Meeting in Chicago, IL, 9–13 November 2018.

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