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Published in:
Diabetes Care

DOI:
10.2337/dc18-1253

Publication date:
2019

Document version
Publisher's PDF, also known as Version of record

Center Size and Glycemic Control: An International Study With 504 Centers From Seven Countries

https://doi.org/10.2337/dc18-1253

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The variance in glycemic control between different childhood diabetes centers is not fully understood. Although the International Society for Pediatric and Adolescent Diabetes guidelines from 2014 recommended center sizes of more than 150 patients (1), it has not been thoroughly investigated whether glycemic control is associated with center size (2–4). We have data from more than 500 childhood diabetes centers from seven different countries and thereby a unique opportunity to elaborate further on this association. Therefore, this study aims to investigate the relationship between center size and glycemic control in children with type 1 diabetes (T1D).

Patient data have been described previously (5). Briefly, the population comprised children with T1D in the age-group <18 years and diabetes duration of >3 months from seven high-income countries during 2013–2014: Austria, Denmark, England, Germany, Norway, Sweden, and Wales. Data were anonymized and obtained from five national registries/audits on children with T1D (Austria and Germany use the same electronic health record and England and Wales have a common National Pediatric Diabetes Audit, while Denmark, Norway, and Sweden have national registries). Mean HbA_{1c} was compared between groups after adjusting for sex, age (<6 years, 6 to <12 years, and 12–18 years), duration of diabetes (<2 years,

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Received 10 June 2018 and accepted 15 December 2018

Diabetes Care Publish Ahead of Print, published online January 18, 2019

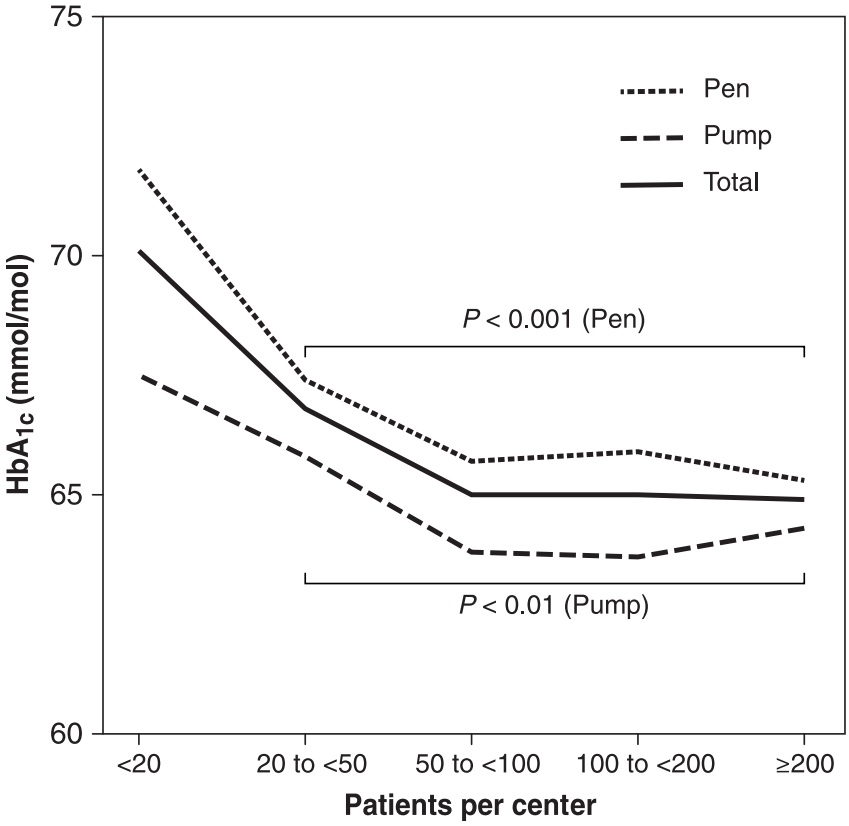

Figure 1—HbA_{1c} adj by center size total and by treatment modality. Pen users had higher HbA_{1c} adj than pump users for all center sizes ($P < 0.02$).

2 to <5 years, and ≥5 years), and minority status (yes/no) (HbA_{1c} adj) before and after stratifying for treatment modality (insulin injection/pump). Center size was defined as the number of patients with diabetes reported to be cared for in a center. Center size groupings were *1*) <20, *2*) 20 to <50, *3*) 50 to <100, *4*) 100 to <200, and *5*) ≥200 patients.

In total 54,494 children (48% females) with T1D across 504 centers in seven countries were included in the study. The number of centers per country varied between 14 (Wales) and 219 (Germany). Mean (SD) for age was 12.5 (3.9) years, mean age at T1D onset was 7.5 (4.0) years, and mean T1D duration was 5.0 (3.7) years. A total of 21% of patients had minority status, which varied between 5% (Wales) and 28% (Austria). A total of 38.1% of patients were on pump treatment, and the percentage varied between 25% (England) and 69% (Denmark). National coverage of T1D patients was >95% in all countries, apart from Austria, which had ~80% data coverage. Included patients had 100% data coverage for all variables, sex, age, diabetes duration, minority status, and HbA_{1c}. Data on treatment modality were not available for 2,428 patients (4.5%); of these, 2,130 were from England and 154 were from Sweden.

A total of 23.2% of centers had <50 patients (small centers) with T1D, which represented 4.9% of the total patient population. Most children (45.6%) were cared for in diabetes centers with a center size between 100 and 200 patients. A total of 30.2% of children were cared for in centers with >200 patients, representing 12.3% of all centers. The distribution of small and large centers in the seven countries varied. England and Sweden had few small centers (<12%), while Austria, Germany, and Norway had a higher percentage of small centers (>34%). HbA_{1c} adj was significantly higher in the centers with <50 patients compared with larger centers ($P < 0.001$), while there was no difference in HbA_{1c} adj with increasing center size above 50 patients (Fig. 1). Stratification for treatment modality (insulin injection/pump) revealed that HbA_{1c} adj was significantly higher in centers with <50 patients compared with centers with >50 patients, in both pen users ($P < 0.001$) and pump users ($P < 0.01$). The influence of center size was more pronounced in pen users, and pen users had higher HbA_{1c} adj than pump users for all center sizes ($P < 0.02$) (Fig. 1).

We conclude that the percentage of small and larger centers differed between countries, but in total the small centers (<50 patients) comprised 23.2% of all diabetes centers in the seven countries. In all countries combined, childhood diabetes centers with <50 patients had higher HbA_{1c}. This indicates that, where geographically possible, it may be beneficial to reduce the number of small centers and combine them into larger entities. As small centers did better on pump than pen, small remote centers may benefit from encouraging pump use. Diabetes centers with >50 patients managed equally well; therefore, centralizing to very-high-volume diabetes centers may not necessarily be an advantage. Future research should focus on identifying reasons leading to differences in glycemic control in T1D patients cared for in small and large centers, e.g., the lack or presence of an updated multidisciplinary diabetes team.

Acknowledgments. The authors thank all national pediatric diabetes groups, all participating centers, and all patients.

Funding. This work was supported by the German Diabetes Association, German Centre for Diabetes Research (FKZ: 82DZD01402), European Foundation for the Study of Diabetes, and EU-IMI2 consortium INNODIA. University College London Children's Policy Research Unit is funded by the UK Department of Health Policy Research Programme (funding reference 10090001) and supported by the National Institute for Health Research Biomedical Research Centre at Great Ormond Street Hospital for Children NHS Foundation Trust and University College London. The Norwegian Childhood Diabetes Registry is funded by the South-Eastern Norway Regional Health Authority. The Danish National Diabetes Registry is funded by the Health Research Fund of Central Denmark Region. The Swedish Pediatric Diabetes Quality Registry is supported by the Swedish Association of Local Authorities and Regions.

The funding sources had no role in the study design, data collection, data analysis, data interpretation, or writing of the manuscript.

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

Author Contributions. N.H.B. contributed to the design of the study and data acquisition, conducted the literature search, researched data, and wrote the manuscript. N.H.B. takes full responsibility for the work as a whole, including the study design and the decision to submit and publish the manuscript. J.M.H. was responsible for data management, did

the statistical analysis, was lead statistician for the project, and contributed to the manuscript. L.H., K.A., A.K.D., and T.S. contributed to the design of the study and data acquisition and edited the manuscript drafts. D.C. and T.S. contributed to the design of the study and contributed to the manuscript. R.W.H. contributed to the design of the study, contributed to the manuscript, and leads the DPV registry. J.T.W., R.H., and J.S. contributed to the design of the study and data acquisition and contributed to the manuscript. A.-M.S., S.F., S.J.K., R.A., B.R.-M., A.J., T.M.K., D.H., K.D.-J., E.F.-R., and M.F. contributed to data acquisition and edited the manuscript drafts. S.E.H. contributed to data acquisition, was involved in interpreting the data, and edited the manuscript drafts. All authors provided substantial contributions to data interpretation and critically reviewed and commented on several drafts of the manuscript. N.H.B. and J.M.H. are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Prior Presentation. Parts of this study were presented in abstract form at the 43rd Annual Conference of the International Society for Pediatric and Adolescent Diabetes in Innsbruck, Austria, 18–21 October 2017.

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