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GLYCAEMIC CONTROL AND ACUTE COMPLICATIONS IN EUROPEAN CHILDREN, ADOLESCENTS AND YOUNG ADULTS WITH TYPE 1 DIABETES (T1D) IN THE TEENs STUDY

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INTRODUCTION

- Suboptimal glycaemic control in persons with type 1 diabetes (T1D) increases risk for chronic complications; poor control in the current era of intensive insulin therapy is also associated with acute complications, such as diabetic ketoacidosis (DKA) and hypoglycaemia[1]
- International treatment guidelines recommend glycaemic targets to preserve health and reduce the risk of complications;[2–4] however, many youth with T1D fail to achieve these targets and many experience acute complications[5]
- Understanding the current levels of glycaemic control and factors associated with achieving glycaemic goals may provide an opportunity to develop more effective treatment strategies
- TEENs is the largest worldwide (20 countries, 6 regions), contemporary, cross-sectional study of T1D in 5960 youth aged 8–25 years old (y/o)
- The TEENs study aims to assess the factors associated with optimal glycaemic control and quality of life in order to develop recommendations to improve glycaemic control and outcomes; this presentation includes data on the European youth in the TEENs sample

OBJECTIVES

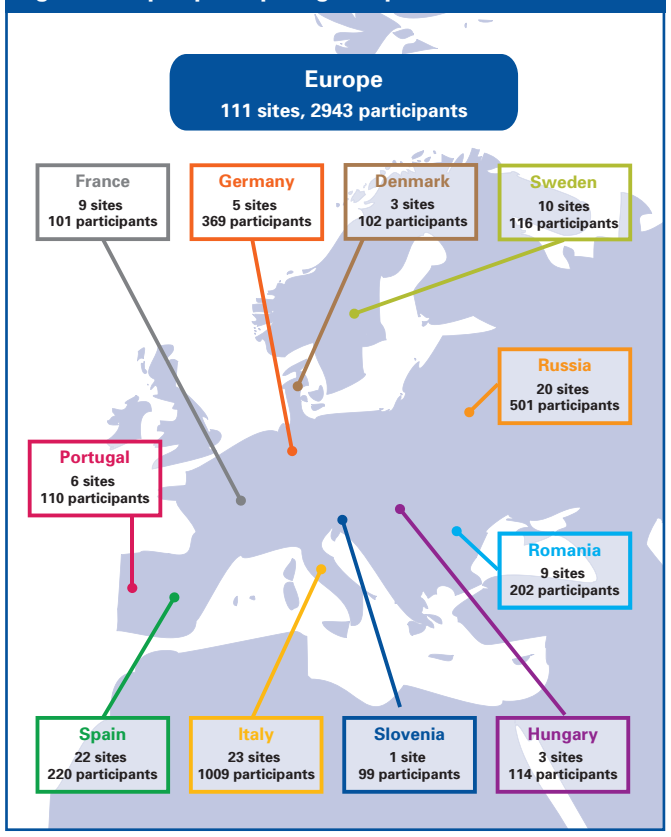
- To examine current levels of glycaemic control in a sample of European youth with T1D in three predefined age groups (8–12, 13–18 and 19–25 y/o)
- To assess and compare rates of acute complications according to age group, glycaemic control and treatment regimen

METHODS

Study design and population:

- 111 centres in 11 European countries **(Figure 1)** collected data via participant interviews, medical record review and participant/parent surveys, completed during a single study visit

Figure 1: Map of participating European countries



- A target recruitment ratio of 1:2:1 was implemented for three predefined age groups, 8–12, 13–18 and 19–25 y/o, respectively. Participants were sampled sequentially to avoid recruitment bias
- HbA_{1c} levels were measured uniformly using the A1cNow® device (Bayer, reference range 4–6%)
- Age-specific HbA_{1c} targets for glycaemic control were defined according to published guidelines:
  - ≤18 y/o (ISPAD): HbA_{1c} <7.5% (<58 mmol/mol)[2]
  - >18 y/o (adults) (ADA): HbA_{1c} <7% (<53 mmol/mol)[3]
- Occurrence of DKA and severe hypoglycaemia were assessed during the 3 months prior to the study visit; severe hypoglycaemia was defined as hypoglycaemia resulting in either seizure or loss of consciousness
- All participants, or parents/guardians, provided written informed consent/assent to participate in the study as appropriate, following institutional review board approval of the protocol. The study was conducted in accordance with the Declaration of Helsinki

Data analysis and statistics:

- Descriptive statistics (frequency/percentages, means ±standard deviation [SD]) are presented for the complete European cohort and according to HbA_{1c} target attainment, insulin regimen and age group

RESULTS

Participant demographics:

- A total of 2943 European youth (8–12 y/o, n=887; 13–18 y/o, n=1451; 19–25 y/o, n=605) participated in the study. **Table 1** outlines the participants' demographic information

Insulin regimen and glycaemic control:

- Overall, mean (±SD) HbA_{1c} was 8.1 ± 1.6% (65 ± 18 mmol/mol), and varied by age **(Table 1)**. **Figure 2** shows the distribution of HbA_{1c} levels according to age group. The youngest age group had the smallest percentage of participants with HbA_{1c} levels ≥9.0% (75 mmol/mol); 8–12 y/o, 18%; 13–18 y/o, 26%; 19–25 y/o, 21%
- Overall, 35% of participants achieved HbA_{1c} targets **(Table 1)**. A higher proportion of 8–12 y/o (39%) attained target HbA_{1c} compared with 13–18 y/o (37%) and 19–25 y/o (23%)
- In all age groups, the majority of participants (8–12 y/o, 69%; 13–18 y/o, 70%; 19–25 y/o, 76%) used injections/pens, and most of these participants used basal-bolus insulin **(Table 1)**

Occurrence of acute complications:

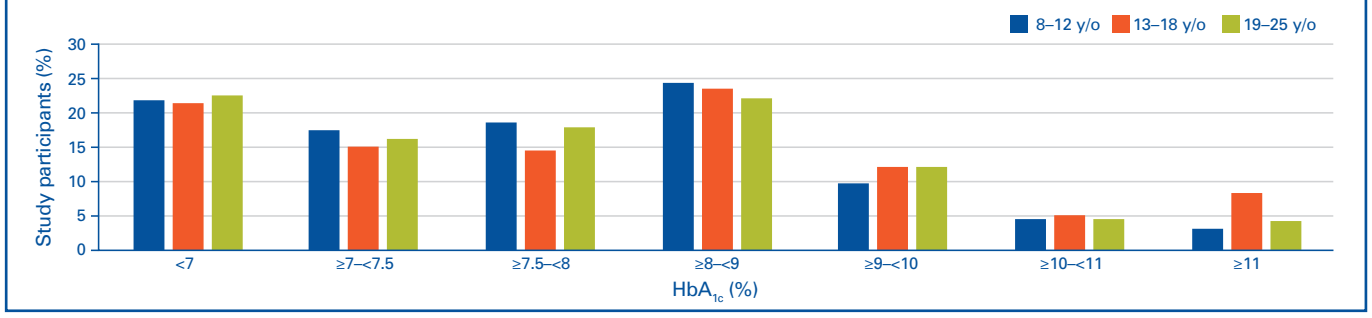
- In the 3 months prior to the study, 3.7% of those not at HbA_{1c} target and 2.0% of those at target had ≥1 DKA episode. In all age groups, the percentage of participants experiencing DKA was higher in those who were above HbA_{1c} target compared with those who achieved target HbA_{1c} **(Figure 3)**
- Overall, the occurrence of DKA, irrespective of target attainment, was higher in children and adolescents (3.3% in both age groups) than young adults (2.5%) **(Figure 3)**
- Overall, in the previous 3 months, 1.1% of participants not at HbA_{1c} target and 1.4% of those at target HbA_{1c} had ≥1 severe hypoglycaemic event (leading to seizure or loss of consciousness). Occurrence of severe hypoglycaemia was greater in young adults at target than those not at target **(Figure 3)**

Table 1: Participant characteristics

	Overall (N=2943)	8–12 y/o (n=887)	13–18 y/o (n=1451)	19–25 y/o (n=605)
Participant demographics				
T1D duration, years, mean (SD)	7.2 (4.5)	4.7 (2.7)	6.9 (3.8)	11.7 (4.9)
Female, %	48	48	47	49
Caucasian, %	94	94	94	96
BMI*, %				
Overweight	n/a	27	23	25
Obese	n/a	6	5	4
Insulin regimen				
Insulin therapy, %				
Injections/pens	71	69	70	76
Pump	29	31	30	24
For injections/pens, type of insulin used, %				
Basal-bolus	94	92	94	96
Premixed insulin + other insulin	6	7	6	3
Glycaemic control				
Mean (SD) HbA_{1c}				
%	8.1 (1.6)	7.9 (1.4)	8.2 (1.7)	7.9 (1.5)
mmol/mol	65 (18)	63 (15)	66 (19)	63 (16)
HbA_{1c} at target†, %	35	39	37	23

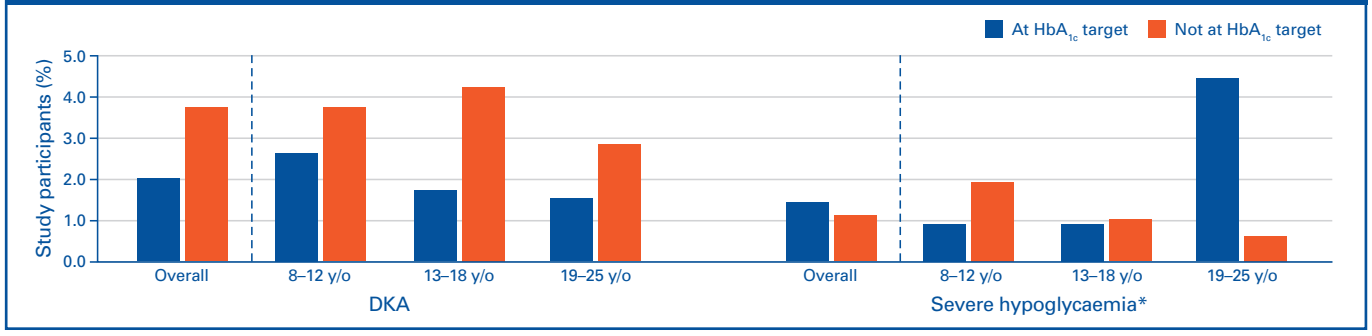
*Calculated based on ISO BMI (8–18 y/o) and BMI (19–25 y/o); overweight ≥25–<30 kg/m²; obese ≥30 kg/m²; †HbA_{1c} targets were defined as <7.5% (ISPAD) for participants aged ≤18 y/o[2] and <7% (ADA) for participants aged >18 y/o.[3] Note: ADA 2014 guidelines now also recommend HbA_{1c} target <7.5% for <18 y/o[4]; BMI, body mass index; n/a, not applicable (due to the use of different methods to calculate BMI for 8–18 y/o and 19–25 y/o); SD, standard deviation; T1D, type 1 diabetes; y/o, years old

Figure 2: Distribution of HbA_{1c} levels according to age group



y/o, years old

Figure 3: Complications in the 3 months prior to study enrolment, according to age group and glycaemic target attainment†



*Defined as hypoglycaemia resulting in seizure or loss of consciousness; †HbA_{1c} targets were defined as <7.5% (ISPAD) for participants aged ≤18 y/o[2] and <7% (ADA) for participants aged >18 y/o.[3] Note: ADA 2014 guidelines now also recommend HbA_{1c} target <7.5% for <18 y/o[4]; DKA, diabetic ketoacidosis; y/o, years old

CONCLUSIONS

- Data from the TEENs European sample demonstrate that T1D remains poorly controlled in many young people, with approximately two-thirds of participants failing to reach target HbA_{1c} levels; in addition, many youth experienced acute complications
- The mean HbA_{1c} level achieved in adolescents aged 13–18 y/o was similar to that achieved by adolescents (13–17 y/o) in the intensive treatment group of the Diabetes Control and Complications Trial[6] (8.2 ±1.7% and 8.1 ±0.1% respectively)
- A higher percentage of participants in the younger age group attained HbA_{1c} target. This trend was also seen in the TEENs global population[7]
- Severe hypoglycaemic events occurred in a similar percentage of participants in all age groups; the occurrence of DKA was more common in children and adolescents than young adults and in those not at HbA_{1c} target
- Overall, in European youth with T1D, diabetes outcomes remain suboptimal and further improvements in the management of T1D are required

DISCLOSURES:
C Domenger, C Candelas and V Pilorget are employees of Sanofi. M-P Dain was previously an employee of Sanofi. M Phillip, T Danne, L Laffel, C Mazza, B Anderson, R Hanas, S Waldron, R Beck and C Mathieu are members of the TEENs steering committee. M Phillip reports paid lecturing for Johnson & Johnson (Animas), Sanofi, Medtronic and Roche; stock ownership in CGM3 Ltd; participation in advisory boards for Bristol-Myers Squibb, Sanofi, Medtronic, Eli Lilly, and AstraZeneca; consultancy for Andromeda; and commercially sponsored research for Medtronic, Novo Nordisk, Eli Lilly, Merck, Sanofi, Andromeda and DexCom. L Laffel reports participation in advisory boards for Sanofi, Roche, Lilly, Novo Nordisk, Oshadi, Animas/LifeScan, Johnson & Johnson, Boehringer Ingelheim, AstraZeneca, DexCom and Menarini; commercially sponsored research for DexCom; and an unrestricted educational grant from Bayer. T Danne reports consultancy and participation in advisory boards for Sanofi, Novo Nordisk, Eli Lilly, AstraZeneca, Roche, Unomedical and Medtronic. C Mazza reports participation in the Type 1 Diabetes Advisory Board for Sanofi. B Anderson reports participation in advisory boards for Sanofi, research support from the National Institutes of Health; and an unrestricted educational grant from Bayer LLC. R Hanas reports participation in advisory boards for Eli Lilly, Novo Nordisk, and Abbott; speaker honoraria for Novo Nordisk, Eli Lilly, Sanofi, Roche, Medtronic, DexCom, Menarini, and Abbott. S Waldron reports participation in an advisory board for Sanofi and consultancy for Sanofi and Lilly. R Beck reports participation in advisory boards for Sanofi, consultancy for Animas and research funding from Sanofi. C Mathieu reports participation in advisory panels for Novo Nordisk, Sanofi, Merck Sharp and Dohme, Eli Lilly and Company, Novartis, Bristol-Myers Squibb, AstraZeneca LP, Pfizer, Johnson & Johnson, and Mannkind; and research support from Novo Nordisk, Sanofi, Merck Sharp and Dohme, Eli Lilly and Company, and Novartis; and participation in speaker bureaus for Novo Nordisk, Sanofi, Merck Sharp and Dohme, Eli Lilly and Company and Novartis.

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