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RESEARCH LETTER

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Type-1 diabetes onset age and sex differences between Ghanaian and German urban populations

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Highlights

- Type 1 diabetes onset age in Kumasi/Ghana has a peak at around 17 to 20 years, whereas the peak is at 11 to 12 years in North Rhine-Westphalia, Germany.
- Higher proportions of females were found in the type 1 diabetes cohort from Ghana, and males were more frequent in the German cohort.

KEYWORDS: Germany, onset age, sex distribution, sub-Saharan Ghana, type 1 diabetes

1 | TO THE EDITOR

Type 1 diabetes (T1D) poses a worldwide challenge for humankind, and regional differences in disease epidemiology, for example, between Caucasian and African populations, can provide insight into underlying pathologic mechanisms and influential factors. Only few studies on insulin-dependent T1D epidemiology have been performed in sub-Saharan African populations.[1] T1D incidence varied markedly in these studies performed in east and south African countries, and this was at least partly due to concomitant occurrence of T1D-related diabetic diseases (eg, malnutrition-dependent diabetes) and misdiagnosis.[2] Differences between urban and rural populations may also have confounded results.[2] Importantly, these studies found heterogenous T1D onset age ranging from late adolescence (15-19 years) to young adult (21-30 years) periods,[1] which differed largely from Caucasians,[3] and "white" populations from South Africa.[1] Against the background of reported heterogeneous T1D onset age distributions, and since no data from west African sub-Saharan countries were available, we performed a hospital-based retrospective

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study to characterize T1D epidemiology in Kumasi/Ghana. Since only sparse information about onset age distribution in Caucasians exist, we assessed T1D onset age of patients from North Rhine-Westphalia (NRW)/Germany concomitantly.

2 | METHODS

In a retrospective hospital-based study, we determined onset age and sex of T1D patients from Kumasi/Ghana and NRW/Germany. Kumasi is the second biggest city of Ghana with an increasing population of currently about three million inhabitants for whom the Komfo Anokye Teaching Hospital (KATH) is the central T1D facility. Data were received for T1D patients (n = 1,607) diagnosed at the KATH between 1992 and 2018. Diagnosis was based on persistent insulin dependency at recruitment and during follow-up (including a routine clinical examination every 3 months). C-peptide serum levels and/or autoantibodies were determined for definite proof of doubtable cases. The place of residence was assessed for a randomly selected subgroup of T1D patients from Kumasi (n = 320) using self-reported data and google/maps-based localization. The following categories were classified: a) within Kumasi city limits, b) in the region surrounding Kumasi, or c) not defined because of insufficient patient reports or maps/google databases. For NRW, with a population of about 18 million people, anonymized data of incident cases of T1D (n = 16,181) for the period between 2002 and 2018 were received from the NRW diabetes register maintained at the German Diabetes Center.[4] The distribution of T1D onset age and the respective mode were estimated based on two-year age groups. The study was approved by the Committee on Human Research, Publication and Ethics (CHRPE/AP/063/13) at the Kwame Nkrumah University of Science and Technology in Kumasi and the data protection agency of NRW. All participants provided informed consent.

3 | RESULTS

During the study period insulin-dependent T1D was diagnosed for 1607 individuals at KATH in Kumasi. Among the randomly selected subgroup of T1D patients (n = 320), the place of residence could be determined for 84.4% of individuals, and the majority (73%) lived within the city borders of Kumasi (Figure 1A). We concluded that the majority of recruited T1D patients lived in an urban environment.

Females with T1D (n = 913, 56.8%) were more frequent than males in the Ghanaian cohort, and the onset age showed a late peak occurrence between 17 and 20 years (females: 17-18 years; males: 19-20 years) (Figure 1B). Interestingly,

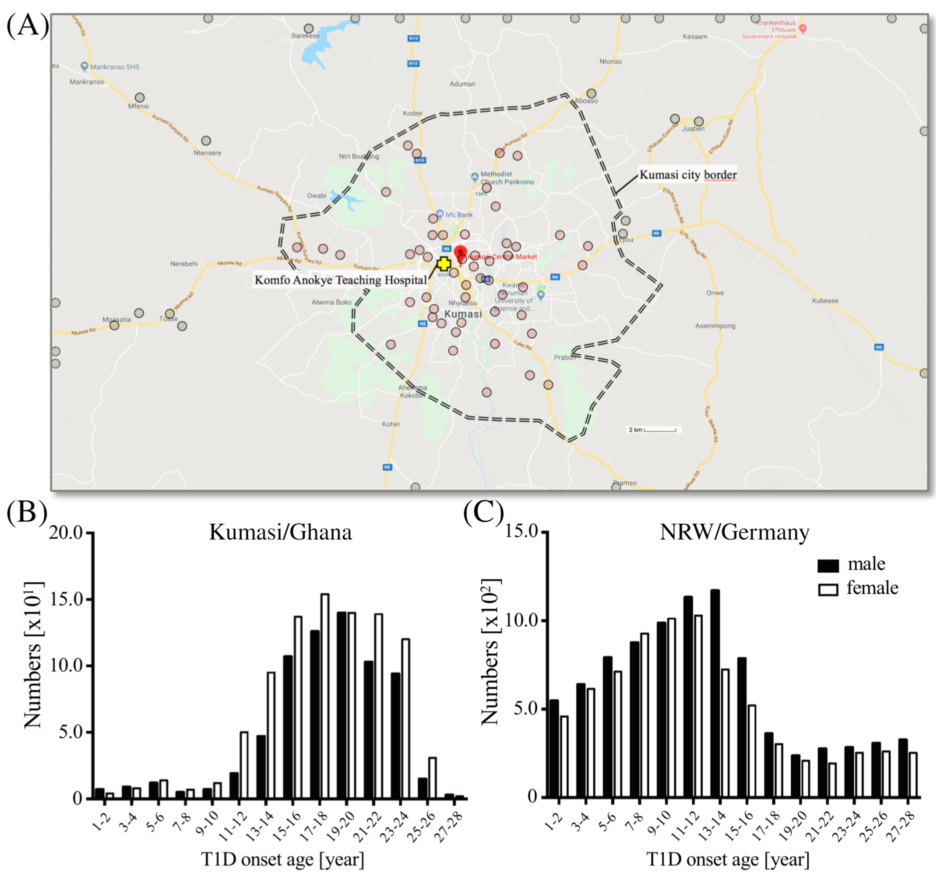

FIGURE 1 Onset age distributions and localization for T1D patients from NRW/Germany and Kumasi/Ghana. A, Self-reported residence places for the randomly selected subgroup of Ghanaian T1D patients (n = 270). Residence places (circles) within (red, transparent) and outside (green, transparent) Kumasi city borders are indicated on a Google map. Each circle indicates the residence place for up to 12 T1D patients. Localizations outside the map borders are indicated by dotted circles at the map margins. B, Onset age of T1D patients from Ghana (n = 1,607). C, Onset age of T1D patients from Germany (n = 16,181). Female (open) and male (black) T1D patient numbers are depicted. T1D, type 1 diabetes; NRW, North Rhine-Westphalia

hardly any T1D cases with early onset (<5 years) were found (1.7%). In contrast, T1D patients from NRW in Germany comprised a moderately higher male proportion (54.0%) and a largely different age distribution (Figure 1C). The peak onset age was between 11 and 12 years (females: 11-12 years; males: 13-14 years) (Figure 1C), and a significant proportion of individuals had early T1D onset (14.0%). These results show marked differences of T1D onset age and sex distribution between urban populations from Ghana and Germany.

4 | COMMENT

Exogenous (eg, vaccinations, infections) as well as endogenous factors (eg, immune genetics) affect susceptibility to T1D. The relatively late T1D onset seen in the urban T1D cohort from Ghana may reflect differences in T1D susceptibility gene distribution between both populations as well as distinct prevalent infections in sub-Saharan Ghana. General differences between Ghanaian and German populations may bias results, and since appropriate characterization of potential influential factors on the individual patient and T1D cohort level could not be included as part of this retrospective pilot study, statistical tests have not been performed. However, similar sex distribution for Kumasi and NRW populations (52.2% and 50.9% females, respectively, according to official censuses) render a bias of differential sex distribution between T1D cohorts unlikely.

We found a peak of T1D onset between 17 and 20 years in Ghana, and this was similar to previous studies from east and south African countries.[1] Differences of genetic factors can affect T1D onset age,[5] and future studies need to include characterization of T1D susceptibility genes. BCG vaccination has been shown to protect nonobese diabetic (NOD) mice from T1D[6] and ameliorates T1D symptoms in patients with T1D.[7] Since BCG vaccination at birth is done in Ghana (but currently not in Germany), this difference may contribute to differential onset age. However, migration studies showed that other external factors are also relevant for T1D susceptibility.[8] Differences in T1D onset age may be partially due to diagnostic differences including early deaths because of late T1D diagnosis.[1] This study forms an important basis for future case-control studies to characterize crucial mechanisms (eg, infections, vaccination) contributing to late T1D onset in Ghana. Identification of relevant effects on autoimmune pathology will be key for development of interventional immune modulatory treatments to delay—or even prevent—onset of T1D.

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DISCLOSURE

None declared.

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