Importance of applying treatment data to ascertain type 1 diabetes cases in health registries

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We read with great interest the article by Casagrande and colleagues concerning the comparison of the survey-based algorithms to ascertain type 1 diabetes (T1D) in the National Health and Nutrition Examination Survey (NHANES) and the National Health Interview Survey (NHIS).[1] Emphasizing the recent updates about the distribution of age at T1D onset is a great point in their work; however, an evidence-based comparison between the algorithms' accuracy would have been useful to the reader.

We had previously developed a treatment-based algorithm for identifying diabetes type in the NHANES after evaluating the magnitude of misclassification for each of the potential criteria for the classification from the epidemiologic evidence.[2] We excluded age at the diabetes diagnosis criterion because of its high rate of misclassification in the ascertainment of T1D.[3 4] Instead, we used 'No use of oral hypoglycemic medication', 'Current insulin use', and 'Started taking insulin within a year after the diagnosis' criteria.[2] We agree with Casagrande *et al* that 'No use of oral hypoglycemic medication' alone is not enough for excluding type 2 diabetes (T2D) cases from the T1D ascertainment. Still, we disagree that the small percentages of use of oral hypoglycemic agents (2.4%–5%) among patients with T1D make the criterion improper for inclusion in a T1D ascertainment algorithm, as implied by the authors as the main weakness for algorithm 7, which used diabetes diagnosis at age <30 years, current insulin use, and not using oral hypoglycemics criteria.[1] Of note, none of the oral hypoglycemic medications have the Food and Drug Administration approval for use in people with T1D.[5] Consequently, the T1D Exchange report of 5% of their patients with T1D taking oral non-insulin medications should be an upper bound compared with the national level since the T1D Exchange cohort comprises patients from diabetes clinics and with better access to care than the national level.[6]

Our algorithm may underestimate the prevalence of T1D by excluding less than 5% of patients with T1D who took oral hypoglycemic medications. It instead minimizes misclassification of patients with T2D who took insulin (~15% to 25% of T2D)[7] as T1D, which is crucial considering that 90%–95% of diabetes cases are T2D.[8] The American Diabetes Association guidelines recommend metformin as the first-line treatment for patients with T2D, which indicates that early use of insulin in patients with T2D would be an adjunct to metformin, not as monotherapy.[9] Therefore, 'No use of oral hypoglycemic medication' in our algorithm minimizes the misclassification of T2D with early use of insulin, as T1D. Moreover, the 'Started taking insulin within a year after the diagnosis' criterion would exclude the patients with T2D with later use of insulin from T1D ascertainment. The equivalent of our algorithm for the NHIS would be 'No use of oral hypoglycemic medication', 'Current insulin use', and 'Continuous use of insulin'.

The self-report of T1D added to the NHIS in 2016–2017, and applied by Casagrande's algorithms 4, 5, and 6, does not match with 'Current insulin use' and 'Continuous use of insulin' consistently enough to help improve the ascertainment of T1D. As the article reported, among persons who self-reported T1D, about one-third reported taking no insulin, and only around one-third reported continuous insulin use.[1] Algorithms 2, 3, and 7 used age at diabetes onset and consequently excluded about 40% of T1D from T1D ascertainment. Algorithm 1 applied 'Current insulin use' and 'Continuous use of insulin', but misses 'No use of oral hypoglycemic medication', which means it would misclassify T2D cases with early use of insulin as T1D. Since the majority of total diabetes cases are T2D (90%–95%), and studies like the Outcome

Reduction with Initial Glargine Intervention trial support early initiation of insulin therapy in patients with T2D,[10] misclassifying T2D cases with the early use of insulin as T1D would be a bigger misclassification in T1D ascertainment than potentially missing less than 5% of patients with T1D who took oral hypoglycemic medications.

Consequently, our treatment-based algorithm improves the accuracy of ascertaining T1D cases in the US health registries compared with the discussed algorithms. We strongly support the call for future research linking survey questions to medical records and providing additional information on which algorithms perform best for classifying T1D using survey data, and again thank Casagrande and colleagues for their valuable work in this area.

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