RESPONSE TO COMMENT ON NANDITHA ET AL.

Secular TRends in DiabEtes in India (STRiDE–I): Change in Prevalence in 10 Years Among Urban and Rural Populations in Tamil Nadu. Diabetes Care 2019;42:476–485

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We appreciate the interest shown by Tönnies et al. (1) in their comment on the prevalence data published by us and for having calculated the incidence based on the data provided in our article (2). In order to properly understand the causes of changes in the prevalence of diabetes, it is essential to assess incidence, as this, not prevalence, is the key index of population risk. Tönnies et al. (1) calculated the mean incidence across the 2006–2016 time period based on mathematical assumptions using the prevalence, temporal changes, mortality rate, etc. This calculation included a number of assumptions, since not all the actual data were available (1).

Taking a different analytical approach to the same problem, we have now used the data from the cross-sectional studies conducted in 2006 (3) and 2016 (2) to directly estimate incidence in each of the two study years, using methods adopted for national estimates of diabetes incidence in the U.S. (4). In this approach, incidence was calculated as the percentage of survey participants with a self-reported history of known diabetes (KDM) with ≤1 year of duration (numerator) among the total survey population minus the number of KDM cases with >1 year of duration (denominator). Diabetes duration was verified from medical records. We thus assessed the change in incidence of diabetes between 2006 and 2016 in a city, town, and periurban villages (PUVs) in Tamil Nadu, southern India, among adults aged ≥20 years. Statistical comparisons were performed with the *t* test and *z* test as relevant. As shown in Table 1, the incidence of diabetes increased in 2016 compared with 2006 in

Table 1—Age-standardized incidence and prevalence of diabetes in 2006 and 2016 surveys in different populations in southern India

	City				Town				PUVs			
	2006		2016		2006		2016		2006		2016	
Incidence	*n* = 1,962		*n* = 3,386		*n* = 2,094		*n* = 3,132		*n* = 2,466		*n* = 2,335	
Total	28	1.5 (0.9–2.1)	133	3.8 (3.1–4.4)*	22	1.2 (0.6–1.8)	156	4.1 (3.5–4.8)*	33	1.4 (0.9–1.9)	40	1.7 (1.2–2.2)†
Men	18	2.1 (1.1–3.1)	67	3.9 (3.0–4.9)*	9	1.3 (0.3–2.3)	68	3.8 (2.9–4.8)*	24	2.0 (1.1–2.8)	20	1.8 (1.0–2.7)
Women	10	1.0 (0.3–1.7)	66	3.5 (2.7–4.4)*	13	1.0 (0.4–1.5)	88	4.4 (3.5–5.3)*	9	0.9 (0.2–1.6)	20	1.5 (0.9–2.2)*
Prevalence	*n* = 2,192		*n* =3,850		*n* = 2,290		*n* = 3,530		*n* = 2,584		*n* = 2,468	
Total	409	18.6 (16.6–20.5)	970	21.9 (20.5–23.3)†	323	16.4 (14.1–18.6)	931	20.3 (18.9–21.6) *	241	9.2 (8.0–10.5)	348	13.4 (11.9–14.8)*
KDM	258	11.7 (9.1–14.3)	597	13.5 (12.4–14.6)†	218	11.1 (8.2–14.0)	554	12.1 (11.1–13.1)	151	5.8 (4.3–7.3)	173	6.7 (5.7–7.7)*
NDM	151	6.9 (6.2–7.6)	373	8.4 (7.5–9.3)*	105	5.3 (4.7–5.9)	377	8.2 (7.4–9.0)*	90	3.4 (2.9–3.9)	175	6.7 (5.7–7.7)*
KDM:NDM	1.7		1.6		2.1		1.5		1.7		1.0	
Incidence/ total KDM	10.9 (6.4–13.8)		22.3 (18.5–26.1)*		10.1 (5.9–14.3)		28.2 (23.8–32.6)*		21.9 (14.4–29.4)		23.1 (15.9–30.3)*	

Data are shown as *n* and % (95% CI) unless otherwise specified. NDM, screen-detected new diabetes. *P* values computed by *z* test for 2006 vs. 2016. *$P < 0.0001$. †$P < 0.05$.

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all locations. Although the incidence increased in the urban and rural areas, a sharper increase was noted in the city and town when compared with the villages. The ratio of known to new cases showed a reduction in all regions, a probable indicator that the rise in incidence was not due to higher detection or screening rates in the latter years. The proportion of incident diabetes to total KDM rose significantly only in the city and the town. This probably suggests that the higher incidence may be a recent phenomenon in the urban populations. Thus, in a decade the incidence of diabetes rose sharply in urban areas but only moderately in the villages. The increase in incidence has contributed to the higher prevalence reported in the Secular Trends in DiabEtes in India (STRiDE-I) study in all the populations (2).

While our incidence data and the data presented by Tönnies et al. (1) are not directly comparable (different methods and time frames), it is interesting to note that the modeled incidence values by Tönnies et al. for the period 2006–2016 differ by less than 20% from the mean of our 2006 and 2016 estimates shown in Table 1 (Tönnies et al. vs. the present analysis: 2.34 vs. 2.65 for city, 2.19 vs. 2.65 for town, and 1.48 vs. 1.55 per 100 person-years for PUV).

Because a sharp increase in the incidence has been noted, especially in the urban areas, a further increase in prevalence is likely to occur. Primary prevention strategies at the societal level would be an effective tool to curb the burden of diabetes in the urban and rural populations of India.

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References

1. Tönnies T, Hoyer A, Brinks R. Comment on Nanditha et al. Secular TRends in DiabEtes in India (STRiDE–I): change in prevalence in 10 years among urban and rural populations in Tamil Nadu. Diabetes Care 2019;42:476–485 (Letter). Diabetes Care 2019;42:e138. DOI: 10.2337/dc19-0835

2. Nanditha A, Snehalatha C, Satheesh K, et al. Secular TRends in DiabEtes in India (STRiDE–I): change in prevalence in 10 years among urban and rural populations in Tamil Nadu [published correction appears in Diabetes Care 2019;42:1155]. Diabetes Care 2019;42:476–485

3. Ramachandran A, Mary S, Yamuna A, Murugesan N, Snehalatha C. High prevalence of diabetes and cardiovascular risk factors associated with urbanization in India. Diabetes Care 2008;31:893–898

4. Geiss LS, Wang J, Cheng YJ, et al. Prevalence and incidence trends for diagnosed diabetes among adults aged 20 to 79 years, United States, 1980–2012. JAMA 2014;312:1218–1226