Evaluating Intersectionality of Policies and Populations

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Although policies and populations do not occur in isolation, researchers often investigate them as if they do. When variables are one-dimensional (ex, race-ethnicity, rural-urban), statistical models produce outputs that do not represent the real world. Uncovering and addressing health disparities necessitates an approach that captures the complexity of population health.[1]

Intersectionality embraces the overlap of identities, social positions, and social policies.[2] We used this approach when evaluating tobacco control policies related to prenatal smoking and found a significant interaction between women's race and ethnicity, education, and cigarette taxes. Low-educated white and Black women had the highest prevalence of smoking during pregnancy and were the most responsive to taxes, which in turn, improved birth outcomes.[3] Examining the effects by women's race and ethnicity or, separately, education would not have produced the same conclusions.

An underresearched disparity in tobacco control is geographic differences within state boundaries. Adolescents in rural areas have higher levels of tobacco use[4–6] and are covered by less comprehensive tobacco control policies.[5–7] In this issue of *Pediatrics*, Dai et al[8] examine rural-urban differences in the effect of tobacco 21 (T21) policies on youth electronic cigarette (e-cigarette) use in Kansas. These authors highlight that the intersection of T21 policies and geography uncovers the challenges local communities face within an evolving policy context.

Dai et al[8] found that from 2018 to 2019, e-cigarette use among high school students increased by 3.9 percentage points in urban areas without T21 policies, but there was no significant change in urban areas that enacted a T21 policy. In contrast, e-cigarette use increased by 7.1 percentage points in rural non-T21 areas compared with 3.1 percentage points in rural areas that enacted a T21 policy. In summary, T21 policies had a protective effect on increasing adolescent e-cigarette use; however, their enactment curbed use in urban areas, whereas the prevalence continued to rise, albeit to a lesser extent, in rural areas. This suggests that although T21 policies should be an essential component in addressing adolescent e-cigarette use, more targeted efforts are needed in rural communities to reduce and eliminate these disparities.

To advance methodologic approaches to examine intersectionality, it is imperative that empirical strategies are transparent and reproducible. Without specification of the equations used to estimate the main results, it is difficult to understand the empirical strategy used by Dai et al.[8] Table 2 presents annual prevalence estimates and the change across years. Was year fully interacted with all explanatory factors? We presume so or it would not be feasible to compute a point and interval estimate for the change

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across years. This aspect should be spelled out. In Table 3, an interaction appears between the rural-urban classification and the presence of T21 and year, but it is not clear whether all factors used to adjust the model were interacted with year. When stratified by grade (middle versus high school), the marked differences in prevalence across those groups suggests that the pooled "full analysis" should allow for grade-level interactions.

We also address the need to allow for interaction effects among the factors used for adjustment. The results presented in Table 2 assume that sex, grade, and race and ethnicity have independent, additive effects on the prevalence of e-cigarette use. From the perspective of intersectionality, independence in the statistical sense may not be a plausible maintained assumption. Introducing interactions among sex, grade (6–8 vs 10–12), race and ethnicity, year, and the rural-urban/T21 categorical variable would allow for the possibility that those factors have an impact on prevalence that is not merely the sum of individual factors' contributions. Those interactions can then be tested for statistical significance and removed in instances for which it is lacking. This approach follows the "general-to-specific" econometric methodology.[9]

Furthermore, the limited literature on rural-urban differences in tobacco control is not due to a lack of awareness but rather the lack of data. Dai et al[8] were able to examine local-level policy change within Kansas. Unfortunately, state-representative surveys, such as the Youth Risk Behavior Survey, can evaluate state-level tobacco control policies across dozens of states[10] but not rural-urban differences. In contrast, nationally representative surveys, such as the National Youth Tobacco Survey, can compare tobacco use between rural and urban adolescents[4] but cannot evaluate state-level policies. Although Dai et al[8] fill a critical gap in the literature, these findings need to be reproduced across states and policy contexts. With larger sample sizes, another dimension may be included, such as examining T21 differences in e-cigarette use by rurality and household income or education. There is a limit to the number of intersections that can be reasonably investigated without reducing statistical power and ultimately generalizability, but there is likely a better balance that can and should be struck.

It is essential that researchers move beyond single variables that only represent one dimension of policies and populations. Greater flexibility in the application of statistical methods is needed as well as data that allow for analysis across multiple domains and levels of geography. Incorporating intersectionality into population health research will inform policy and clinical practice by generating evidence that truly represents the communities we serve.[2]

ABBREVIATIONS

e-cigarette: electronic cigarette
T21: tobacco 21

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