

Evaluation and Epidemiological Research in Tuberculosis Control: Linking Medical Care and Public Health

*The epidemiology of tuberculosis among foreign-born populations differs considerably from area to area. To tailor tuberculosis-control efforts to local needs, tuberculosis-control programs should develop epidemiologic profiles to identify groups of foreign-born persons in their jurisdictions who are at high risk for [tuberculosis].*¹

Such is the official position of the Centers for Disease Control and Prevention. From this perspective, Jump et al,² in the current issue of the *Mayo Clinic Proceedings*, present an analysis of patients with tuberculosis who were treated in a large, unified medical system in Minnesota. This analysis builds on previous work^{3,4} and is an excellent example of the development of a local epidemiological profile of tuberculosis in a defined population.⁵⁻¹⁴ In the United States, the proportion of tuberculosis cases reported in foreign-born persons has been increasing steadily, reaching 53.3% in 2003.¹⁵ The number of tuberculosis cases in Minnesota far exceeds this figure, with 81% of the state's cases reported in 2003 occurring in foreign-born persons (state tuberculosis surveillance data are available at www.health.state.mn.us/tb). Jump et al elucidate the epidemiology of tuberculosis in Olmsted County, Minnesota, by comparing cases in US-born and foreign-born persons, which revealed important information. For example, Somalia was the most common country of origin for foreign-born patients with tuberculosis. A considerable proportion (17%) of the foreign-born patients reported no tuberculosis symptoms at the time of diagnosis. Also, isoniazid resistance occurred frequently among these patients. By elucidating such characteristics, this study highlights the need for medical providers to be cognizant of subpopulations in their communities who are at increased risk of tuberculosis, to maintain a high level of suspicion for tuberculosis among patients in these groups, and to anticipate the unique diagnostic and treatment challenges posed by such a population with a high incidence of extrapulmonary and drug-resistant tuberculosis. On the basis of results that characterize specific high-risk groups, Jump et al² also encourage targeted screening and treatment of latent tuberculosis infection, an important role for primary care providers and a critical

part of the national strategy to eliminate tuberculosis in the United States.¹⁶

The study by Jump et al was enabled by the unified health care system in Olmsted County, which allows a close approximation of population-based research. The value of such a system lies in the potential to create and reinforce beneficial collaborations between the medical care and public health sectors, including academic institutions. As such, this work enhances the capacity for evaluation of the tuberculosis control program,^{16,17} defined as "the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and inform decisions about future programming."¹⁸

The prevalence of isoniazid resistance among foreign-born patients with tuberculosis described in the study points to the potential value of universal genotyping of *Mycobacterium tuberculosis* isolates in this community. Most tuberculosis cases among foreign-born persons arise from latent infection acquired in their countries of origin; however, episodes of recent transmission and outbreaks among communities of foreign-born persons living in the United States have been documented.¹⁹ Recently, US tuberculosis controllers were given the opportunity to use national reference laboratories designated to implement universal genotyping of *M tuberculosis* in their states.²⁰ Minnesota is among the first states to participate in this program, which provides a framework for using real-time genotypic data. When analyzed in conjunction with public health data from epidemiological investigations, genotypic data can be used to detect clusters of recent transmission. The genotyping program offers the potential to substantially augment traditional epidemiological investigations of tuberculosis transmission.

The study by Jump et al creates a unique potential platform for evaluating the tuberculosis surveillance systems in Olmsted County and the state of Minnesota. The completeness of reporting in the US national tuberculosis surveillance system is estimated to exceed 95%.²¹ The authors point to a discrepancy between the number of tuberculosis cases enumerated in their medical system and surveillance data reported by the Minnesota Department of Health. In Minnesota's centralized tuberculosis reporting system, newly diagnosed cases are reported by providers and laboratories directly to the state health department. During the study period, 90 new tuberculosis cases in

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Address reprint requests and correspondence to Michael F. Iademarco, MD, MPH, Division of Tuberculosis Elimination, Centers for Disease Control and Prevention, Mailstop E-10, 1600 Clifton Rd, Atlanta, GA 30333 (e-mail: miademarco@cdc.gov).

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residents of Olmsted County were reported to the Minnesota Department of Health, whereas 71 tuberculosis cases were identified by Jump et al through the unified health care system in Olmsted County. Given the study design, which used a clinical case definition that differs slightly from the definition used for national public health surveillance purposes, it was not possible to determine what proportion of the 71 cases in this study is represented in the state surveillance data, although overlap is probably substantial. Possible explanations for the different case counts include the use of slightly different case definitions and the study's exclusion of patients with tuberculosis in Olmsted County who received care from the few local providers who are not affiliated with the unified medical system, such as the county-operated tuberculosis clinic mentioned by the authors. For example, state surveillance data for this period included at least 9 inmates at a federal medical correctional facility located in the county who had tuberculosis and received medical care from physicians at the facility. Collaboration between medical care delivery and record-keeping systems and public health surveillance systems can yield more complete data than either entity could produce on its own, thereby facilitating a uniquely practical opportunity to evaluate clinical, epidemiological, and programmatic data simultaneously. This information could be used to improve the completeness and accuracy of the surveillance system to measure disease burden and trends. The information also could be used to enhance the understanding of the relationships between important clinical factors that are typically unavailable to public health surveillance systems, such as those included in the study by Jump et al.

The methods in their study represent a portion of a comprehensive evaluation strategy, which includes specialized studies such as the characterization of common epidemiological profiles. This work should be a collaborative effort between health departments and other health care systems. Evaluation research should focus on (1) monitoring demographic data to determine trends in the incidence of tuberculosis in the community and to identify areas for possible intervention, (2) determining who is providing health care services to foreign-born populations at high risk for tuberculosis, (3) identifying factors that cause delays in diagnosing tuberculosis, (4) uncovering obstacles to seeking health care and identifying effective methods to overcome barriers to care, (5) assessing the role of managed-care organizations in the treatment of foreign-born patients with tuberculosis, and (6) determining the capacity of local practitioners to provide tuberculosis-related services for foreign-born populations. For example, the authors note a dramatic increase in the number of tuberculosis cases occurring among foreign-born persons in Olmsted County over 12 years, particularly during the

latter half of the study period. Countries of origin and refugee status of these cases also are reported. These findings correlate with both statewide tuberculosis surveillance data and data on new refugee arrivals in Minnesota. During the study period, the Refugee Health Program at the Minnesota Department of Health was notified of 2056 arrivals of primary refugees to Olmsted County. Similar to the larger increase in tuberculosis cases reported during the latter half of the study period, the number of refugee arrivals to Olmsted County has increased at a higher rate in recent years. Collaboration between medical systems and the state health department's tuberculosis and refugee health programs could elicit a more detailed description of foreign-born persons with tuberculosis in Olmsted County, thereby assisting in identifying missed opportunities for prevention and early detection of tuberculosis cases in this population. For example, data from the Minnesota Department of Health indicate that 72% of refugees who arrived in Olmsted County during the study period were screened for latent tuberculosis as part of a recommended domestic health assessment protocol. The remaining 28% who received no screening for tuberculosis suggest a missed opportunity to identify and treat latent tuberculosis.

Surveillance data from the Minnesota Department of Health indicate that during the study period tuberculosis cases reported in Minnesota occurred in persons originating from more than 70 different countries and that tuberculosis case-patients in Olmsted County represented 20 countries of origin (unpublished tuberculosis surveillance data, Minnesota Department of Health). Concurrent with recent years of increasing numbers of immigrant and refugee arrivals and a growing awareness of their unique health issues, the Minnesota Department of Health has developed an extensive collection of health education materials for patients with tuberculosis, which have been translated into 12 languages, including Somali (www.health.state.mn.us/tb). It is important to incorporate ethnographic studies²² and cultural sensitivity²³ into the design and evaluation of such health education interventions, and descriptive data from epidemiological profiles such as that performed by Jump et al are critical components of those elements. Such educational efforts should address the role of traditional and folk healers in caring for foreign-born populations. Information about cultural factors and local epidemiological trends should be included in provider education presentations and materials to help ensure that health care providers have the knowledge and skills needed to work with diverse populations.

Following this study, next steps should include measurement and evaluation of treatment and outcomes; for example, what were the trends in treatment completion and cure? When program efforts are evaluated longitudinally,

novel insights are achieved, and improvements in program function can be made²⁴ that improve the health of the community. For information about tuberculosis control efforts in Minnesota, see <http://www.health.state.mn.us/tb>.

Michael F. Iademarco, MD, MPH
Division of Tuberculosis Elimination
Centers for Disease Control and Prevention
Atlanta, Ga

Deborah Sodt, RN, MPH
Wendy Mills Sutherland, MPH
Infectious Disease Epidemiology
Prevention and Control Division
Minnesota Department of Health
Minneapolis

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