Perspectives

Applying an Automated-Alert System for Tuberculosis Control in Schools in China

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Tuberculosis (TB) control in schools has been a major priority in China, and the implementation of strengthened active case finding and the "TB Prevention and Control in School Work Standard (2017 version)" have resulted in a decline in the reported incidence of active pulmonary TB in students from 27.92/100,000 students to 13.30/100,000 during 2008–2015, which followed a similar trend in the overall population. However, this reported incidence rose to 17.50/100,000 in 2019 (*1*–*2*), which ran counter to the continual reduction of TB incidence seen in the overall population (*3*) and indicated an increased percentage of students with TB. In 2019, TB cases in students accounted for 6.19% of all TB cases.

Disease surveillance exerts a key role in disease control by laying a foundation for policymaking and showing areas for improvement by revealing the current challenges, changing trends and characteristics of the diseases, and evaluating the effects of existing intervention. In January 2004, China's National Notifiable Disease Reporting System (NNDRS) was launched and became the world's largest internet-based communicable disease information system as it required the real-time reporting of 37 notifiable diseases into this system. Because TB is one of these notifiable diseases, the demographic and diagnostic information for every pulmonary TB patient is required to be reported within 24 hours, which allow obtaining precise data on the TB disease burden (*4*). Based on the initiative "Management specifications for infectious disease information reporting" launched by China's National Health and Family Planning Commission (now known as the National Health Commission) in 2015, patients that are teachers or students must also be reported with detailed information for their school (*5*).

The internet-based NNDRS provided a data source for discovering outbreaks of certain notifiable diseases and making early-stage alerts possible. Following multi stage research and pilots, the China Infectious Diseases Automated-Alert and Response System (CIDARS) was launched by China CDC on April 21, 2008 (*6*). Through using mathematical algorithms and data from the NNDRS, abnormal increased numbers and clusters of cases with certain notifiable diseases could be captured, and an alert signal could be automatically sent to the designated CDC staff at the county level. For active pulmonary TB cases in schools, requiring the reporting of occupations and detailed information on school names and accurate addresses in the NNDRS facilitates automated-alerts for TB outbreaks in specified schools. Single TB cases will trigger the alerts because TB is a chronic infectious disease, and these automated alerts for single TB cases in schools were started nationwide on July 6, 2018. As soon as a pulmonary TB patient is reported in the NNDRS as a student, teacher, or person aged 3–24 years (the age range for most students in China), an alert signal will be sent to local CDC staff automatically and the designated staff must identify if the person is a student or teacher and provide feedback in CIDARS within 24 hours.

Students concealing their active pulmonary TB status is a significant factor contributing to TB outbreaks in schools (*7*) as TB transmission probably occurs in schools due to close contact of students. The use of CIDARS dramatically decreased the risks of TB transmission due to increased sensitivity for capturing TB patients in schools, and mistakes in recording occupations can be revised based on the identification process (*8*) and TB response activities being promptly conducted, including TB patient management, close contact screening, isolation of suspected TB patients, preventative therapy for close contact at high risk of developing TB, and other control measurements. These control measures could decrease transmission significantly, and the automated-alert system also contributes to it by increasing sensitivity for identifying TB cases in schools and shortening the time needed to respond (*9*).

CIDARS is an immense repository of data, and information on workload and performance of alert signal response for county-level CDCs could be evaluated by using these data. From July 2018 (the start of CIDARS operation in TB) to the end of 2019, nearly 390,000 signals were sent, and county-level CDC staff finished responding to more than 380,000 signals with a median response time interval of 2.3 hours (*9*). However, nearly 10% of signals were finished beyond 24 hours, showing room for improvement. Data from the automated-alert system in 2020 showed an elevated response rate and shortened response time, and by fully utilizing CIDARS, more complete assessments can be made. First, trends in TB distribution in people aged 3–24 years can be more completely monitored by continuous surveillance. Second, the percentage of students concealing their status can be detected, which could increase the quality of reporting information by local health facilities and the effect of health education and promotion can be evaluated. Finally, schools with many TB cases can be quickly identified and targeted interventions could be deployed to prevent larger TB outbreaks.

Through its two years of operation, CIDARS has already shown a great contribution to TB outbreak response in schools. With the improvement of TB control work, this system could be used in more facilities, such as elder care institutions, hospitals, and others, to find signs of TB outbreaks and prevent transmission in these high-TB-risk areas as early as possible.

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