Collateral Impact of the Covid-19 Pandemic on Tuberculosis Control in Jiangsu Province, China

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Abstract

The Covid-19 pandemic may impede global tuberculosis elimination goals. In Jiangsu Province, China, tuberculosis notifications dropped 52% in 2020 compared to 2015–2019. Treatment completion and screening for drug resistance decreased continuously in 2020. Urgent attention must be paid to tuberculosis control efforts during and after the Covid-19 pandemic.

Keywords: tuberculosis, COVID-19, China, drug resistance.

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Introduction

The tuberculosis burden in China has seen dramatic reductions in the past three decades.[1,2] Between 1990 and 2010, there was a 65% and 48% decrease in the prevalence of smear- and bacteriologically-positive tuberculosis throughout China.[2] These reductions represent hundreds of thousands of saved lives over the time-period and maintaining these gains in the tuberculosis burden are essential to make goals of tuberculosis elimination by 2035 set by global health organizations.[3]

The Covid-19 pandemic has the potential to substantially impact disease control for a range of diseases. Considerable increases in hospitalizations due to Covid-19 may overload health systems. For example, in the most heavily impacted regions of Italy, the national healthcare service was on the verge of collapse.[4,5] Additionally, health care workers have become sick or are repurposed to control of Covid-19 and laboratories are de-prioritized diagnosis of tuberculosis (and other diseases) concentrating on Covid-19 diagnosis. There is a concern that, due to health care shortfalls and fear of contracting Covid-19, individuals will not seek medical attention when needed. In 2001, the SARS epidemic caused a short downfall in tuberculosis case notifications, later regressing to pre-epidemic levels.[6] Recent studies have documented substantial decreases in secondary diseases including myocardial infarctions and strokes.[7,8] In addition, decreases in immunization rates and HIV testing have been reported in some settings.[9-10] The impact of the Covid-19 pandemic on disease control for tuberculosis at a population-level is not well known.[11-13]

To address this knowledge gap, we investigated several markers of tuberculosis control in Jiangsu Province, China, covering a population of approximately 80 million inhabitants. We compared tuberculosis case notifications, tuberculosis treatment outcomes, and diagnostic screening for multi-drug resistance (MDR) among tuberculosis patients from 2015–2020 before and after the Covid-19 pandemic began in China.

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Methods

Tuberculosis is a reportable disease in China and all persons with tuberculosis are managed through the Tuberculosis Management Information System of Jiangsu province. Due to this, patient diagnoses can be tracked at a city- and provincial-level over time. We included weekly data from January 2015 to the end of May 2020.

Outcomes

We concentrated our analysis on annual markers reported to the World Health Organization including the absolute number of tuberculosis notifications, notification rate, and tuberculosis treatment success rate.[3] Other measures were also analyzed to measure laboratory capacity and screening for multi-drug resistant (MDR) tuberculosis. We calculated the proportion of persons diagnosed with tuberculosis with bacteriologically positive disease, defined as the accumulation of positive culture and smear tests. Since 2015, tuberculosis control policy has changed to include screening for MDR among both new tuberculosis patients and those at high-risk for MDR tuberculosis. From 2017–2019, half of the counties in the province had GeneXpert available for drug resistance testing among tuberculosis patients; in 2020, all counties had GeneXpert available (Supplementary Appendix). The proportion of tuberculosis patients screened for MDR among those at high-risk for MDR tuberculosis or among new patients. Tuberculosis patients at high-risk for MDR tuberculosis were designated as one of the following: i) previously treated tuberculosis patients; ii) in which treatment previously failed; iii) sputum smear positive tuberculosis patients that were close contacts of MDR-tuberculosis patients; iv) a previous relapse event; or v) new tuberculosis patients who remained smear positive two months into anti-tuberculosis treatment.

Statistical analysis

We compared weekly tuberculosis notifications between 2015–2019 with 2020 levels. We also assessed indicators before and after provincial-wide quarantine (January 24, 2020) and when 90% of businesses were re-opened at the provincial-level (March 27, 2020). We stratified our results at the city-level to investigate whether our results were modified by a certain location in the province. We also investigated effect modification by the gross domestic product (GDP), the number of persons with diagnosed COVID-19 in the city, and population-size.

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Results

Over the 5½ year time-period, 143,250 persons diagnosed with tuberculosis were notified and included in the analysis. From January to May, the absolute number of tuberculosis notifications in 2020 dropped 36% and 52% compared to the same five-month time-period in 2019 (10,620 versus 6,749) and 2015 (14,180 versus 6,749) (Figure, left panel). An increase in notified tuberculosis patients occurred in April 2020 after most businesses were re-opened at the end of March however this did not reach pre-pandemic levels. Tuberculosis treatment success decreased continually throughout the first five months of 2020. May 2020 is the only month in the last five years with a treatment success rate below 90% in the province (89% success) (Figure, right panel). The trends seen in treatment success were driven by treatment completion (rather than cure); the treatment completion rate decreased in 2020 to in May 2020 51% (mean from January–May 2020, 53.2%) from 60.2% in May 2019 (mean from January–May 2019, 61.2%). Mortality among rifampin-resistant tuberculosis patients on treatment increased in the first five months of 2020 reaching 12.5% and 25% in April and May of 2020 however this was based on few total patients

Diagnostic screening for MDR amongst tuberculosis patients was substantially impacted during the Covid-19 pandemic. Screening rates of drug resistance among tuberculosis patients dropped 15% and 17% from May 2019 to May 2020 among tuberculosis patients at high-risk for MDR tuberculosis (99% versus 84%) and among new tuberculosis (98% versus 81%) (Figure, right panel).

Decreases in the numbers of notified tuberculosis patients and the treatment success rate were seen in all cities regardless of city-level GDP, the number of diagnosed COVID-19 patients in the city, and population-size.

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Discussion

This is the first data from China reporting the potential indirect impact on tuberculosis control of the Covid-19 pandemic. We found a substantial reduction, in excess of 50%, in tuberculosis notifications in 2020 compared to 2015–2019. There is substantial concern that the Covid-19 pandemic may impede global tuberculosis elimination goals by 2035 and our results suggest that tuberculosis control may be severely impacted, at least temporarily. Tuberculosis treatment outcomes and diagnostic screening for MDR among tuberculosis patients was also reduced in 2020 indicating that health care access may have reduced or health professionals may have been unavailable in dealing with tuberculosis control after being redirected to Covid-19 control efforts. Vigilance, re-prioritization of tuberculosis control practices, and sustained funding and resources for drug resistant screening, diagnoses, and promoting treatment adherence must be immediately conducted in endemic settings to mitigate the damage to tuberculosis control suggested by these results.

The decreased number of tuberculosis notifications in 2020 likely suggests lower tuberculosis patient case detection in the province. Social distancing interventions, which took place in much of China, may impact *Mycobacterium tuberculosis* transmission as well as health care access. Interventions, such as quarantine and social distancing, may have influenced tuberculosis notification numbers by reducing transmission. However, the long incubation period of tuberculosis[14] suggests that mass-scale interventions would not have shown immediate effects as seen in this study. In addition, reductions in treatment completion and MDR screening during this time period suggest that both deterred health care seeking and community disease management are likely drivers of these trends. A decrease in tuberculosis case notifications in 2020 has also been seen in other recent findings from settings outside of China.[15,16] In Nigeria, there was a 35% and 34% decrease in the number of presumptive and active tuberculosis notifications from January to May 2020[15] while, in South Korea, tuberculosis notifications decreased by 24% in 2020 compared to prior years.[16] Tuberculosis notifications and diagnoses must continue to be monitored in settings that have seen this reduction.

The finding that screening for drug resistance among tuberculosis patients has reduced by 15–17% has important implications to the tuberculosis epidemic in China. This is likely to lead to community transmission of drug resistance at a critical time when sustained tuberculosis control efforts in China has resulted in significant improvement in tuberculosis burden.[1,2] Reductions in MDR screening are likely due to de-prioritization of tuberculosis testing and diagnoses in laboratories which have been

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re-directed to Covid-19 testing. Drug resistant screening among tuberculosis patients was altered from 2015–2020 and this may have impacted our results; however, since GeneXpert became available to all counties in the province in 2020, we would've expected an increase, rather than a decrease, in screening uptake of tuberculosis patients for drug resistance if the Covid-19 pandemic had not occurred. Monitoring drug resistant tuberculosis trends in late 2020, 2021, and 2022 will be critical to understanding whether this decrease in testing leads to population-wide increases in drug-resistance.

Our analysis suggests that collateral effects of the Covid-19 pandemic on tuberculosis control are substantial, with a reduction of 36%–52% in tuberculosis notifications in 2020 compared to 2015–2019. Substantial decreases were also seen in patient treatment success and screening for MDR among new and high-risk tuberculosis patients. These findings suggest health care seeking and management are largely responsible for tese trends. Urgent attention must be paid to tuberculosis control efforts[13,17] to mitigate further impact of the Covid-19 pandemic on tuberculosis morbidity and mortality.

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NOTES

Acknowledgement:

The research was considered part of routine public health surveillance and, due to this, was considered exempt from ethical approval. All data was de-identified prior to use and identifying information was not available.

Author Contributions:

Qiao Liu, Wei Lu, Limei Zhu, and Leonardo Martinez conceived the study. Qiao Liu, Peng Lu, Wei Lu, and Limei Zhu collected the data. Leonardo Martinez analyzed the data and made the first draft of the manuscript. Limei Zhu, Wei Lu, and Jianming Wang participated in the study design. All authors assisted in data interpretation. All authors read and edited the drafted manuscript for important intellectual content. All authors have read and approved the final manuscript.

Role of the funding source:

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had access to all the data in the study and had final responsibility for the decision to submit for publication.

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Conflicts of Interest: All authors report no conflicts of interest

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Figure. Tuberculosis notifications (panel A, left) and success rate of tuberculosis treatment and community screening interventions (panel B, right) in Jiangsu Province

Vertical lines in each graph correspond to the start date of the provincial-wide quarantine (January 24, 2020) and date in which 90% of businesses were re-opened (March 27, 2020). We used these dates as indicative of the time period pre-, concurrent, and post-pandemic. High-risk groups include previously treated tuberculosis patients, patients that failed treatment, sputum smear positive tuberculosis patients that were close contacts of MDR-tuberculosis patients, tuberculosis patients that relapsed, and new tuberculosis patients who remained smear positive 2 months into anti-tuberculosis treatment.

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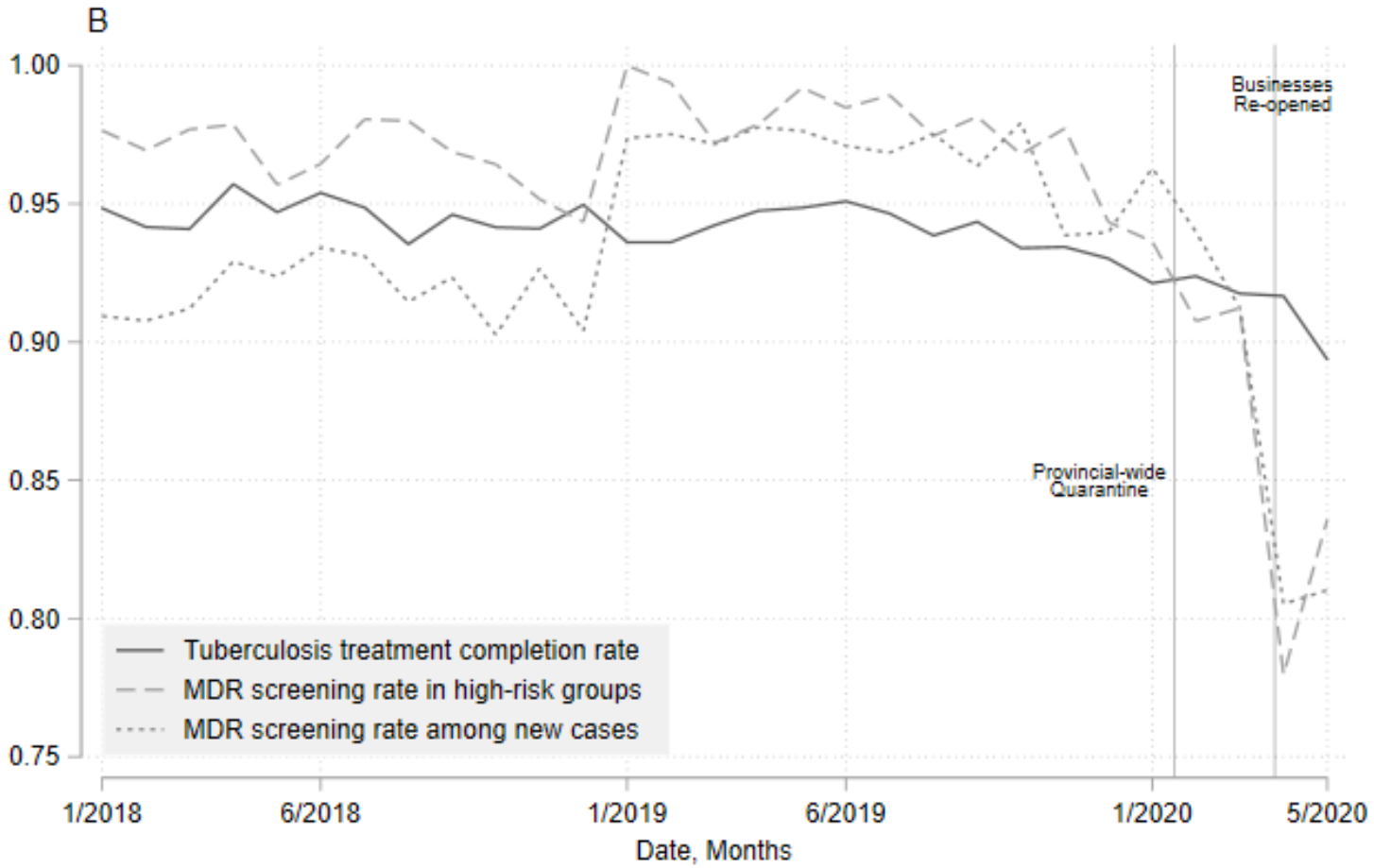
Figure-A


A
3500
3000
2500
2000
1500
1000
500
Businesses
Re-opened
Provincial-wide
Quarantine
1/2015
1/2016
1/2017
1/2018
1/2019
1/2020
Date, Months

Figure-B


B
1.00
0.95
0.90
0.85
0.80
0.75
Businesses Re-opened
Provincial-wide Quarantine
Tuberculosis treatment completion rate
MDR screening rate in high-risk groups
MDR screening rate among new cases
1/2018
6/2018
1/2019
6/2019
1/2020
5/2020
Date, Months