The Impact of China's 2003 SARS Epidemic on Behavior and Knowledge

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EXTENDED ABSTRACT

The SARS epidemic of late 2002-2003 appears to have spread from China (including Hong Kong), where it was notable for: (i) the deadliness of the SARS virus; (ii) the small number of cases; (iii) the ease with which the virus spread; (iv) and the apparently pronounced impact of the epidemic on local economies and the everyday lives of those living in affected areas.

Much of what is known about the impact of the SARS epidemic in China is derived from news media accounts of behavior, which suggest that

- Migration from rural to urban areas was temporarily halted;
- There was a flow of migrants from urban areas back to rural places of origin;
- Economic activity in a number of sectors declined precipitously, thus depriving nonmigrants as well as migrants in a broad cross-section of activities the ability to earn a living, to the extent that affected jobs were in the private sector.

The length of the social and economic disruption in China, which lasted several months in some parts of the country, is thought by many informal observers to have had a substantial aggregate impact. In this paper we examine the impact of the SARS epidemic in China using data we collected in a survey conducted in the autumn of 2003 and the winter and spring of 2004.

In principle, one kind of assessment of the impact of the SARS epidemic in China could be made using aggregate or organizational statistics—the number of enterprise shutdowns; modifications to rail, bus, and plane schedules; trends in hotel vacancies; rural village entries and departures; and so on. Responsibility for that valuable exercise belongs to those in China with ready access to process-generated data. Our research provides a complement to the aggregate/organizational approach. We attempt to answer the following questions working from individual level survey data:

1. To what extent did the SARS epidemic alter travel in China?
2. To what extent did the SARS epidemic affect employment?

3. Was there a sociodemographic basis to the distribution of knowledge and beliefs about SARS?

4. Did experience with the SARS epidemic lead to temporary or possibly even permanent changes in hygiene?

5. Was there a contextually driven response to SARS, or did individuals and local governments respond in much the same ways regardless of the prevalence of SARS in their areas?

Data

In early 2003 we began a pretest for a pilot survey of internal migration in China. The pretest, headquartered at a university in Beijing, was shut down when the university was ordered to close its gates as part of China's plan to break the SARS epidemic. We chose to partially repurpose the study, and to position the project to return to the field after the epidemic had wound down.

Originally the survey was intended only to pilot an extensive and detailed questionnaire that ranged over life histories of: (a) geographic mobility; (b) education; (c) jobs and occupations; (d) marital status; and (e) communist party membership. In addition, we sought details of current socioeconomic status and inquired at length about current health. The revised questionnaire retained information on each individual in a household, gleaned from the household roster, and life histories of geographic mobility, but added a lengthy supplement on activities immediately before, during and after the SARS epidemic, as well as SARS-related items on knowledge and beliefs.

The survey, carried out in academic year 2003-2004, had two main goals. First, the survey was intended to explore the feasibility of full enumeration of households in small areas, and the feasibility of full enumeration of individuals in all households in the selected small areas, in order to learn whether it is possible, in China, to draw a self-weighting, unbiased probability sample from the population of individuals. Because of the need to assess the possibilities for enumeration in particular kinds of areas, we chose to sample in four province-level areas. Within each of the four areas, we sampled down to the individual level in three types of places, using a balanced incomplete design. The second goal of the survey was to study the impact of the SARS epidemic. In order to determine the extent to which there was a contextually differentiated aspect to the individual and organized responses to the epidemic, we explicitly selected areas where the SARS rate was high, and areas where the SARS rate was low. In all, field work was carried out in 12 places, with interviewing taking place in six places during November-December 2003, and in the remaining six places during March-April 2004.

The SARS questionnaire had three components. The first of these addressed the extent to which respondents knew and were aware of the epidemic. It also assessed the extent to which hygiene-related practices changed during the epidemic, and whether any changes made during the epidemic endured afterwards. Finally, this section attempted to assay

whether local contexts changed during the epidemic. For example, we asked respondents whether their residence or workplace was sanitized, whether their residence or workplace restricted entries and exits, and also asked respondents for their perceptions of spitting in public (common in China) during and after the epidemic. The second component of the SARS questionnaire assessed the impact of the epidemic on travel. We obtained detailed travel histories for 2002 and 2003, so that we could compare travel in the year before SARS with the extent of travel during the epidemic year, taking type of place into account. In the third component, we obtained detailed work stoppage information for 2002 and 2003, so that we could assess the impact of the SARS epidemic on work stoppages through a between-place, inter-annual comparison.

Analysis

For knowledge and behavior questions we use an appropriate regression function (e.g., logistic or ordinal logistic regression) to model the influence of individual characteristics (education, occupation, sex, age, party membership, *hukou* (registration) status, and marital status). We also include type of place in the covariate list, in order to distinguish between high SARS and low SARS areas, and to distinguish places by their migrant composition. Our study design affords too few places to make worthwhile the estimation of a random coefficient regression model—that is, a multilevel model. Nonetheless, we can check for interactions between type of place and individual-level covariates. For example, we can determine the extent to which the education effect varies by whether an area is a high or low SARS place.

Stated in general terms, we hypothesize that socio-demographically defined social position partially determines knowledge and behavior outcomes. We further expect to find small differences, in SARS-related behavior and knowledge, between places with high and low SARS rates. A pattern in conformance with these expectations would be consistent with the hypothesis that the central government's attempt to create a uniform and deliberate response to the SARS epidemic via edict was largely successful.

For travel interruptions and work stoppages, thought to be substantial during the epidemic, we face the problem of detection through the use of retrospective data collected from individuals distributed across high and low SARS contexts. We will explore several operationalizations of outcomes. By way of illustration, for travel let Y = number of trips taken in the period from the end of Spring Festival to October 1. For work stoppages let $Y = 1$ if a respondent was laid off or fired in a given work spell in the period from the end of Spring Festival to October 1, with $Y = 0$ otherwise. Table 1 arrays means (or proportions) of Y conditional on year and type of place.

Table 1. Template for a discussion of SARS epidemic on travel or work stoppages

	Type of Place	
Year	High SARS	Low SARS
2003	$\overline{Y}_{11}$	$\overline{Y}_{12}$
2002	$\overline{Y}_{21}$	$\overline{Y}_{22}$

Interactive structuring of the means ($\overline{Y}_{11}-\overline{Y}_{12} \neq \overline{Y}_{21}-\overline{Y}_{22}$) will be consistent with the existence of a SARS effect if living in a high SARS area results in fewer trips and more work stoppages in 2003. If the structure is additive ($\overline{Y}_{11}-\overline{Y}_{12} = \overline{Y}_{21}-\overline{Y}_{22}$), possible conclusions will be that there were year and place effects; constant place effects over year and over place are inconsistent with the existence of a SARS effect.

Because individuals can contribute multiple trips or multiple work stoppages, we will test for the year by type of place interaction using regression formulations that take the clustering into account. These regressions have the generic form

$$E\{\Omega_{ij}\} = \beta_{0j} + \beta_1 Year_{ij} + \beta_2 Place_{ij} + \beta_3 Year_{ij} \bullet Place_{ij} + \mathbf{x}'_{ij}\boldsymbol{\Gamma},$$

where $\Omega_{ij} = Y_{ij}$ for trips and $\Omega_{ij} = \text{logit}\{Y_{ij}\}$ for work stoppages; *i* denotes an observation within an individual and *j* denotes an individual; and where $\mathbf{x}'_{ij}\boldsymbol{\Gamma}$ refers to a vector of *ij*-specific covariates (characteristics of individuals) multiplied by their coefficients.

For number of trips, preliminary analysis indicates that a regression with Gaussian error performs well. For work stoppages, a population average binary response logistic regression estimated using the Generalized Estimating Equation approach is our preferred specification. In this instance the random intercept approach is subject-specific, but our purpose is to estimate a population average response function.

Preliminary results indicate that there is a SARS effect for work stoppages but not travel. We will explore alternative operationalizations of travel, to determine whether greater refinement in the measure will produce results consistent with the widely perceived SARS interruption.