



Persistence of pandemic influenza on the development of children: Evidence from industrializing Japan



Kota Ogasawara

Faculty of Law, Politics and Economics, Chiba University, 1-33, Yayoi-cho, Inage-ku, Chiba 263-8522, Japan

ARTICLE INFO

Article history:

Received 29 September 2016

Received in revised form

9 March 2017

Accepted 11 March 2017

Available online 20 March 2017

Keywords:

Chest girth

Fetal origins

Gender

Height

Weight

Pandemic influenza

Long-run effect

ABSTRACT

In this study, we estimate the persistent effects of fetal exposure to the 1918–1920 influenza pandemic of Japan on the physical development of primary school children. By using a unique nationwide longitudinal physical examination dataset of children aged 6–13 in units of 47 prefectures between 1929 and 1939, this study is the first to adopt the bilateral-specific fixed effects approach to identify the impact of fetal influenza exposure on the physical development of children. We find that the children born in 1919–1920 were shorter than those in surrounding cohorts. Our result from the specification using regional heterogeneities in the timing and severity of the influenza pandemic also implies that the persistency of fetal exposure to shocks on children's development could vary by gender.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

The fetal origins hypothesis in epidemiology and medicine argues that the metabolic characteristics of a fetus exposed to inadequate nutrition in utero are more likely to lead to diseases in adulthood (Barker, 1992). This long-term effect of fetal damage has been widely studied in economics since Almond and Mazumder (2005) and Almond (2006) noted the importance of the links between fetal damage and the long-run effects on adult health outcomes. Almond and Currie (2011) and Currie and Vogl (2013) provide comprehensive reviews of the literature on this topic.

Since testing the fetal origins hypothesis is difficult, the long-run effects of fetal damage have been analyzed by employing the random assignment of shocks to children in utero via natural experiments. For example, previous studies have used the exogenous variation of the influenza pandemics of 1918 and 1957 to investigate the long-term impacts of fetal damage on adults' health outcomes, educational attainment, and labor market outcomes. Almond (2006), for example, tests the fetal origins hypothesis by using the 1918 influenza pandemic, employing data derived from the 1960–1980 decennial U.S. Census. He notes the adverse effects

of in utero influenza exposure on adults' health outcomes, educational attainment, and socioeconomic status. Almond and Mazumder (2005) and Garthwaite (2008) also show the negative effects of the influenza pandemic of 1918 on the health outcomes of adults in the United States. In addition, the recent study by Parman (2015) shows that parents reinforce pandemic-related health shocks on one child by shifting educational investment to healthy siblings. Similar adverse health shocks owing to the 1918 influenza pandemic have been observed in Switzerland, Brazil, and Taiwan (Neelsen and Stratmann, 2012; Nelson, 2010; Lin and Liu, 2014). These works show that fetal damage from sudden pandemic influenza is associated with human resource outcomes in adulthood.

The present study examines the physical development of Japanese children in utero during the two waves of the 1918–1920 influenza pandemic rather than their outcomes in adulthood. While the effects of fetal damage on birthweight and adulthood status have been widely researched (see Almond and Currie, 2011), the impacts of influenza epidemics on the status of the juvenile population have been relatively understudied. Of this scarce literature, Kelly (2011) finds negative effects of the 1957 influenza pandemic on the cognitive test scores of British children aged 7–11, using an individual-level dataset from the National Child Development Study. The effects on birthweight and children's height are

E-mail address: ogasawara.k.ab@chiba-u.jp.

negative only when their mothers smoked before pregnancy. [Lin and Liu \(2014\)](#) also show that the average height of child and adolescent cohorts affected by the 1918 influenza pandemic is shorter than that of other birth cohorts, using data on children aged 7–10 in 12 regions of Taiwan in 1927.

The effects of the influenza pandemics in Japan were huge. The total number of patients in the August 1918–July 1919 and September 1919–July 1920 waves was 23,580,495, accounting for approximately 21% of the Japanese population at that time. Indeed, the death toll from influenza was 385,029, accounting for approximately 14% of deaths in the pandemic period. Hence, the magnitude of the influenza pandemic in Japan was greater than that in the United Kingdom and the United States ([Richard et al., 2009](#), pp. 1068–1069). This immense damage implies that cohorts in utero during the pandemic period may have experienced adverse health effects on their physical development relative to other cohorts.

This study compiles its dataset from the official statistical reports of the physical examinations of all primary school students conducted by the Japanese government, issued by the Physical Education Bureau, Ministry of Education (PEBME). In particular, we construct a unique multidimensional panel dataset of children aged 6–13 in units of 47 prefectures between 1929 and 1939. Our sample covers approximately 95% of the primary school age population and approximately 60% of the higher primary school age population during the survey period. By exploiting this comprehensive and precise information on anthropometric measurements, we then investigate whether fetal influenza exposure had a negative impact on Japanese children's physical development.

In addition to the relevance of pandemics and high data quality, Japanese data from the early 20th century are considered to be a suitable source with which to test the fetal origins hypothesis. The public health environment in prewar Japan was more similar to those in present-day developing countries compared with the countries used to test this hypothesis. For instance, while the number of infant deaths (children aged under one year) per 1000 live births around 1920 was around 100 or less in western countries, this rate in Japan at the same time exceeded 150 (see [Ito, 1998](#)). Hence, infant mortality rates in prewar Japan were rather close to the highest rates in present-day developing countries (see [World Health Organization, 2013](#), p. 59). Accordingly, owing to the lower standards of public health in Japan compared with those in industrially advanced nations such as the United States at that time, the enormous losses from the pandemic caused a considerable decline in human resources in modern Japan by reducing the production-age population (e.g., [Ikeda et al., 2005](#); [Richard et al., 2009](#)). In light of these considerations, the present study makes an important contribution by providing knowledge of the long-run effects of fetal influenza exposure on child development in developing countries.

This study contributes to the literature in the following four ways. The first contribution is to estimate the effects of fetal influenza exposure on the juvenile population by using the nationwide longitudinal physical examination statistics described above. As our sample covers a greater proportion of Japanese primary school age children, the present study is more comprehensive in terms of observations than previous research investigating child development.

The second contribution is that it adopts several anthropometric measures. In addition to height, which has been widely used as an anthropometric measure in previous works, this study employs measures of weight, chest girth, basal metabolic index (BMI), and Vervaeck's index (VI) to capture the effects of fetal influenza exposure precisely.

The third contribution is to identify the impact of pandemic influenza by using a multidimensional panel dataset. By employing

the bilateral-specific fixed effects model, we control for time-varying unobserved factors at the prefecture level that might have affected the determinants of the biological standards of living of children such as wealth levels, trends in nutritional attainment, and changes in the timing of the pubertal growth spurt. These unobservables are difficult to control for by using a simple fixed effects model with two-way error components.

The fourth contribution is to offer case study evidence for the fetal origins hypothesis in Japan. Since human biological features genetically vary across countries as well as ethnic groups, multi-dimensional verifications for the hypothesis are indispensable. Indeed, while the fetal origins hypothesis has been widely investigated for western countries by using natural experiments related to pandemic influenza, little is known about the impact of sudden influenza shocks on East Asian countries (see [Lin and Liu, 2014](#)). Moreover, the findings of this study are relevant to present-day developing countries, as noted above.

We find that exposure to influenza in utero had a negative impact on the physical development of the sampled children, which might have changed their later health and socioeconomic outcomes in adulthood. Overall, the children born in 1919–1920 were approximately 0.1 cm shorter than those in surrounding cohorts. The children born in 1919, who were in utero during the first pandemic wave, which had a higher infection rate than the second wave, were approximately 0.2 cm shorter than those in surrounding cohorts. The results from an alternative specification using regional variations in the timing and severity of fetal influenza exposure show that in utero exposure to influenza had a strong negative effect only for girls. The estimate shows that fetal influenza exposure in pandemic years reduced the height of girls by approximately 0.2 cm, suggesting gender differences in the effects of the persistency of fetal exposure. A set of sensitivity checks confirms our findings.

The structure of the remainder of the paper is as follows. Section 2 reviews the influenza pandemics of 1918 and 1920 in Japan and examines the possible channels for children's biological standards of living. Section 3 describes the data used in this study. Section 4 explains our empirical strategy. Section 5 presents the main results. Section 6 discusses the results obtained in this study and concludes.

2. Background

2.1. Influenza pandemic of 1918–1920 in Japan

After the first reported case of Spanish influenza in the United States in March 1918, 600 million people were infected and 20–40 million patients died due to influenza pandemics globally ([Kilbourne, 2006](#); [Taubenberger and Morens, 2006](#)). In Japan, cases of Spanish influenza occurred between August 1918 and July 1920. [Fig. 1](#) shows the monthly death toll from influenza between January 1918 and December 1921 in Japan. Although clear spikes can be observed both in November 1918 and in January 1920, the first wave also experienced a “relapse” of flu from January 1919 to June 1919, which might have been caused by variants of the influenza virus (e.g., [Ikeda et al., 2005](#), p. 371). The serious aspect of pandemics is more remarkable if we also take deaths from pneumonia into account (see [Appendix A.1](#) for details).

As mentioned in the Introduction, the official records published by the Central Sanitary Bureau of the Home Ministry reported the total number of patients in the pandemic periods, August 1918–July 1919 and September 1919–July 1920, as 23,580,495. This figure accounted for approximately 21% of the population at that time. The death toll from influenza was reported to be 385,029. This means that approximately 14% of deaths in the pandemic periods

Download English Version:

<https://daneshyari.com/en/article/5046597>

Download Persian Version:

<https://daneshyari.com/article/5046597>

[Daneshyari.com](https://daneshyari.com)