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Long-term health and socioeconomic consequences of early-life exposure to the 1959–1961 Chinese Famine

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ABSTRACT

This research investigates long-term consequences of early-life malnutrition by examining effects of the 1959–1961 Chinese Famine. Taking into account temporal and geographic variations in famine severity, we construct a difference-in-differences estimator to identify effects of early-life exposure to famine on perceived health and socioeconomic outcomes in midlife. Using a sample of 1716 adults born in 1955–1966 in rural China from a nationally representative survey—the 2005 Chinese General Social Survey—we find that the famine had adverse effects on mid-life health for males born into families where at least one parent was a Communist Party member and females regardless of parental party membership. Being born during the famine had no effects on years of education or income for either gender. Quantile regressions suggest intense mortality selection among males who had no party-affiliated parents. Our study highlights the importance of timing and contexts of life experiences in shaping health.

1. Introduction

In recent years, health studies have begun using a life-course approach more and more often, emphasizing the long-term impact of experiences during critical periods of growth on subsequent health and human capital (Kuh et al., 2003). In particular, exposure to adverse environmental influences during critical developmental stages, such as prenatal and early-postnatal periods, is found to lead to permanent changes in gene expression as well as brain and body functions as early as childhood, with increased disease risk in adulthood (Barker, 1995, 2007). From a policy perspective, it is important to understand the lasting effects of early-life malnutrition (Barker, 2003; Lumey et al., 2011; Victora et al., 2008), given that child under-nutrition is a problem not only in many developing countries (Black et al., 2008; de Onis and Blössner, 2000; Pelletier et al., 2012), but in some developed countries as well. In the United States, for example, an estimated 16.7 million children under the age of 18 lived in food insecure households in 2011 (Coleman-Jensen et al., 2012).

It is difficult, however, to measure nutritional intake during prenatal life, infancy, and early childhood. Thus, situations in which nutritional deprivation is created exogenously such as famines provide a unique opportunity to study the impact of early-life under-nutrition on subsequent health (Brown and Susser, 2008). While the 1944–1945 Dutch Famine is the most extensively examined famine in the literature, the 1959–1961 Chinese Famine lasted much longer and had more severe consequences resulting in an estimated 16.5–30 million excess deaths over the three-year period (Ashton et al., 1984; Banister, 1987; Coale, 1981; Peng, 1987; Yao, 1999). In this study we take advantage of this natural experiment to investigate

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the consequences of the Chinese Famine for perceived health and socioeconomic outcomes in midlife. Previous research on the Chinese Famine mostly relied on samples with limited regional coverage and yielded mixed findings (Almond et al., 2007; Chen and Zhou, 2007; Gørgens et al., 2012; Huang et al., 2010, 2012; Luo et al., 2006; Meng and Qian, 2009; Mu and Zhang, 2011; St Clair et al., 2005; Xu et al., 2009; Yang et al., 2008), and none of them examined perceived health, an important predictor of mortality (Idler and Benyamini, 1997).

Drawing on the life course perspective, we use nationally representative data from the 2005 Chinese General Social Survey (CGSS) to investigate the long-term health and socioeconomic consequences of early-life exposure to the 1959–1961 Chinese Famine. We use a difference-in-differences method taking advantage of the temporal and regional variations in famine intensity. Recognizing the importance of social contexts in shaping the linkage between early life experiences and later life chances (Elder et al., 2003), we examine famine effects separately among four subgroups at different risk levels of nutritional deprivation, classified by gender and family background. By doing so we extend prior studies that examined the powerful role of social forces in producing health inequalities (Link and Phelan, 1995). We also contribute to the literature by demonstrating that, contrary to conventional wisdom, when combined with biological mechanisms (such as mortality selection), advantageous family background does not necessarily serve as a buffer when mid-life health is the focal outcome. Our study sheds light on the relationship between early-life nutritional deficiency and later health in China, a large, poor country in the midst of famine (Ashton et al., 1984), and in recent decades as it has experienced dramatic increases in the overall health and economic standing of its citizenry (Chen et al., 2010). This study also serves as an important step in assessing the healthcare needs of individuals born during the famine, who are now moving through retirement.

The paper is organized as follows. We first review empirical evidence from the Dutch and Leningrad famine studies. Next, we provide historical accounts and empirical findings of the 1959–1961 Chinese Famine. This is followed by a description of the data, sample, measures, and analytical strategies. Adopting a difference-in-differences approach, we estimate famine effects on health and socioeconomic outcomes in midlife, first by gender and then by gender and family background. We conclude with a discussion of key findings.

2. Background

2.1. Early life as a critical period: evidence from the Dutch and Leningrad famines

Inspired by the life course framework—timing of lives, in particular—the "critical period" model suggests that the same life event may have different implications for individual development depending on when each experienced the event (Kuh et al., 2003). Under-nutrition *in utero*, for example, is hypothesized to be particularly devastating with lasting effects on health in later life (Barker, 1995, 1998, 2007).

The Dutch hunger winter (1944–1945) and the siege of Leningrad (1941–1944) are two extensively studied famines that provide key evidence for the "critical period" model, but with conflicting findings. Surviving adults prenatally exposed to the Dutch famine had higher mortality up to age 50, worse self-rated health, higher coronary heart disease risk, reduced glucose tolerance, higher BMI, and increased risk of psychological disorders (Brown et al., 2000; Neugebauer et al., 1999; Ravelli et al., 1999; Roseboom et al., 2000a, 2000b, 2001a, 2001b, 2003). In contrast, the Leningrad famine did not see significant long-term effects: intrauterine malnutrition was not associated with glucose intolerance, dyslipidaemia, hypertension, or cardiovascular disease in adulthood (Stanner et al., 1997; Stanner and Yudkin, 2001). The Leningrad famine not only lasted longer than the Dutch famine, but was preceded and followed by relative shortages of food. Under the influence of mortality selection, therefore, estimates of the impact of the Leningrad famine based on data of survivors may be biased toward zero (Roseboom et al., 2000a). These different findings indicate a complex interplay between historical events, social forces, and biological mechanisms, and highlight the importance of examining the famine effects in the unique Chinese context.

2.2. The 1959–1961 Chinese Famine and its short- and long-term health consequences

As one of the largest human catastrophes, the 1959–1961 Chinese Famine has received much scholarly attention. Lin and Yang (2000) argued that the Chinese Famine was jointly determined by urban-biased policies and the decline in food availability. To extract as much agricultural surplus as possible to facilitate the heavy industry-oriented development strategy, rural residents were forced to deliver quotas at prices set by the government, thus bearing most of the brunt of food supply reduction (Coale, 1981; also see Fig. 1). Following previous studies (Chen and Zhou, 2007; Huang et al., 2012; Li et al., 2010; Meng and Qian, 2009; Mu and Zhang, 2011), we focus on the rural sample in our analysis. Key to our research, exposure to the famine—determined by birth date and province of birth—is exogenous, enabling us to better identify the famine effect.

Earlier studies on the Chinese Famine revealed a sudden increase in mortality during the famine years (Fig. 1). The estimated total number of premature deaths during the famine ranged from 16.5 to 30 million (Ashton et al., 1984; Banister, 1987; Coale, 1981; Peng, 1987; Yao, 1999). Retrospective data also revealed a sharp increase in miscarriages and stillbirths during that time (Cai and Wang, 2005).

In terms of long-term effects of the Chinese Famine, an analysis of the 1988 Chinese national fertility survey showed no differences in mortality up until the late 20s and early 30s among the 1954–1958 pre-famine cohort, the 1959–1962 famine cohort, and the 1963–1967 post-famine cohort (Song, 2009), which might be partially explained by mortality selection at