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# Health Consequences of Childhood and Adolescence Shocks: Is There a "Critical Period"?

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Individual health is not only determined by genetic factors, but also by negative or positive events during the life course. For example, children exposed to natural disasters or violent conflicts are more likely to have poor health as adults. Positive external factors, such as nutritional programs, will, instead, improve individual health in the long-term. In turn, health can directly affect education and income opportunities, with macroeconomic consequences for economic growth. In particular, this Roundup investigates the following question: is there an age when shocks or interventions can have a magnified effect? In other words, is there a time while growing up when individual health is more responsive to external events? This is a relevant question, since timing represents a crucial dimension of health interventions. Available evidence identifies several sensitive periods, providing useful lessons for health policy with important economic implications.

Recent economic literature stresses that individual health is a multi-faceted concept incorporating multiple capabilities ([Conti and Heckman, 2013](#)). Capabilities represent the capacities to function in economic and social life, including physical, mental, and cognitive conditions. Genetically determined capabilities also depend on external factors intervening throughout the life course. These can be positive, such as individual or parental investments in health, or negative, such as violent conflicts or extreme climatic events. The effects of these events depend upon the age at which they are experienced. The timing of events is important: in some cases there is a narrow, critical, window of opportunity during which an intervention can produce long lasting effects, while in other cases, there is a longer period of time during which interventions can be made ([Conti and Heckman, 2013](#)). These periods of time may vary as a function of the type of shock or intervention, as well as depending on which capability is affected. Empirical studies find several sensitive periods, opening new spaces for health policy. Recent studies emphasize the importance of remediation interventions that are productive at different developmental stages. These findings are particularly relevant for developing countries, where people have fewer opportunities to protect themselves from shocks of various natures. However, as stressed by the above cited study, these are also relevant for industrialized economies with increasing inequality in family environments, such as the United States. Supplementing disadvantaged families with appropriately timed remediation interventions can effectively foster social inclusion and economic growth.

## Fetal and infant life

According to the “fetal origins hypothesis,” unmet nutritional needs during gestation cause persistent biological changes that manifest in the form of poorer adult health. For instance, individuals experiencing fetal malnutrition are more likely to become overweight, to suffer from cardiovascular problems, and to have diabetes. Differently, shocks experienced in later periods have milder and less persistent effects. [Almond and Currie \(2011a\)](#) review the literature supporting this hypothesis, which was proposed by, among others, [Barker \(1995\)](#). The hypothesis is confirmed by economic studies focusing on various types of shocks, both in developed and developing countries. For instance, [Almond \(2006\)](#), analyzing the long-term effects of the 1918 influenza pandemic in the US, finds that the cohort of adults who were *in utero* during the pandemic had increased rates of physical disabilities and lower educational attainment compared to the neighboring cohorts. According to [Lee \(2014\)](#), the cohort of South Korean adults who were *in utero* during the Korean War (1950-53) had significantly poorer health and lower education attainment than other adult cohorts.

There is also evidence of positive long-term effects of health interventions targeting women of child bearing-age. For instance, [Field et al. \(2009\)](#) test the effects on cognitive capabilities of a large-scale iodine supplementation program implemented in Tanzania from 1986 through 1994. The study finds substantial positive effects of the program for children who received iodine supplements during their first gestational trimester. In particular, treated children complete from 0.35 to 0.56 additional years of schooling compared to untreated peers. Hence, the study shows the importance of micronutrients during the first trimester of pregnancy, which appears to be a sensitive period for cognitive development.

Other studies maintain that the period following weaning from breast milk is the most critical, as maternally provided protection winds down ([Almond and Currie, 2001b](#) review the literature on human capital development before age 5). For example, [Maccini and Yang \(2009\)](#) find that positive rainfall shocks experienced in the first year of life significantly improve women’s health outcomes in rural Indonesia. No effects are detected for the cohorts who experienced the shock *in utero* or after the first year of life. Using a sample of young adults aged 17-27 years in 2004, [Dercon and Porter \(2014\)](#) estimate the long-term effects of the 1984 Ethiopian famine, finding that individuals who were 12-36 months old at the peak of the famine have significantly worse health outcomes compared to the neighboring cohorts. No significant effects are found for the cohorts of individuals who experienced the famine during the gestational period.

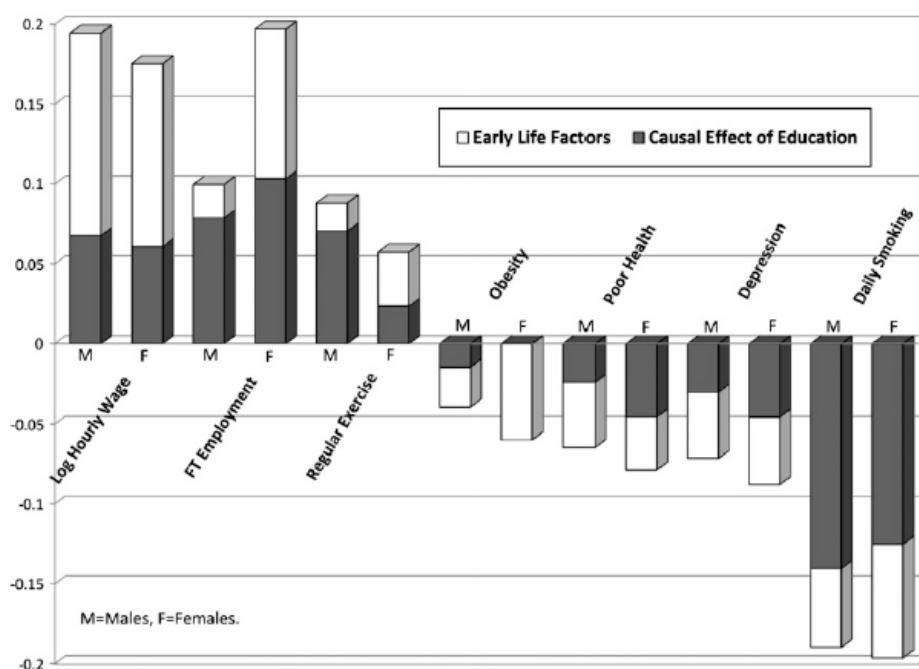
The literature also documents positive effects of health interventions that are directed at children younger than 5 years old. [Maluccio et al. \(2009\)](#) focus on a program providing highly nutritious supplements to a sample of children in rural Guatemala from 1969 through 1977. Using data collected from adults 25 years after the intervention ended, the authors find positive and substantial effects for those adults exposed to the program between 0 and 36 months of age. Positive effects were found, in particular, for completed grades of schooling, reading comprehension tests, and non-verbal cognitive ability tests. Given their low implementation costs, these types of programs represent cost-effective solutions to remediate nutritional and cognition deficits. The Perry Preschool Project (PPP) and the Carolina Abecedarian Project (ABC), administered in the 1960s and 1970s in the US, represent other examples of successful nutritional and educational interventions targeting children younger than 5 ([Conti and Heckman, 2013](#)).

## Late childhood and adolescence

The so called “developmental approach” to adult health maintains that individual health can also respond to external events experienced after infancy. This approach focuses on finding cost-effective remediation interventions. This literature also emphasizes the importance of preventive measures to improve health ([Conti and Heckman, 2013](#)). This view is supported by a growing number of studies. For instance, [van den Berg et al. \(2014\)](#) analyze a sample of individuals who immigrated to Sweden from poorer countries and relate their age at immigration to their adult health outcomes. This study finds that individuals who migrated at later ages have worse health outcomes, compared to siblings who immigrated at an earlier developmental stage. Moreover, the period around age 9 is a sensitive period for physical, cognitive and mental health. This result is consistent with the medical literature, which explains that at around age 9 the body creates reserves to be used for the adolescence growth spurt. This study does not detect any sensitive period around birth. The authors suggest this result could be due to the study design, which does not allow a clear isolation of the gestational period. [Akresh et al. \(2012\)](#) study the impact of the Nigerian civil war (1967-1970) on the health of a sample of women aged 15 to 49. Their estimates indicate that women who were exposed to the conflict as children or adolescents, up to 13 years of age, have significantly worse health outcomes compared to other cohorts. Differently, the cohort of adults who were exposed *in utero* bear no significant consequences of the war. The striking finding of this study is that the negative health effects of the conflict are relatively stronger for women exposed in adolescence than those exposed during childhood.

The literature is also starting to document positive effects of health programs directed at adolescents ([Conti and Heckman, 2013](#)). In this respect, education represents a primary example of possible intervention. [Conti et al. \(2010\)](#) assess the causal effect of education on health for a sample of British adults. In particular, the study disentangles the impact of education from that of early-life factors, such as family background characteristics, cognitive, non-cognitive, and health endowments developed by age 10. They find that education has a strong causal effect on health. Still, early-life factors explain at least half of the differences in health across adults. This can be seen from Fig. 1, which decomposes the contribution of early life factors and education to a series of health and socioeconomic outcomes.

Fig. 1. Differences in outcomes due to early-life factors and education, by gender



Source: [Conti et al. \(2010\)](#), [Conti and Heckman, \(2013\)](#)

### Conclusions

The evidence from both the economics and the medical literature does not provide a univocal answer to the question of what is the age at which shocks are more damaging or health investments more productive in the long-term. Indeed sensitive periods can vary as a function of the type of shocks, and depending on which health aspect is considered. However, while early research focusses on pregnancy and early childhood as critical periods, the newest evidence points to the possibility of influencing individual health trajectories also later in life, mainly at the on-set or first years of adolescence. From the perspective of policy makers, this represents an exciting development, because it allows space for remediation for individuals who have passed their childhood. However, while later interventions may be effective, early-life conditions are still likely to persist to a relevant degree. Therefore, researchers recommend early interventions. Besides having a higher probability of success, early interventions, such as pre-school programs, appear to be much more cost-effective than later remediation interventions, such as rehabilitation programs or treatments for chronic illnesses. Finally, the best strategy appears to be prevention and not remediation.

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