Financial crisis, health outcomes and ageing: Mexico in the 1980s and 1990s

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Abstract

We study the impact of economic crisis on health in Mexico. There have been four wide-scale economic crises in Mexico in the past two decades, the most recent in 1995–96. We find that mortality rates for the very young and the elderly increase or decline less rapidly in crisis years as compared with non-crisis years. In the 1995–96 crisis, mortality rates were about 5 to 7 percent higher in the crisis years compared to the years just prior to the crisis. This translates into a 0.4 percent increase in mortality for the elderly and a 0.06 percent increase in mortality for the very young. We find tentative evidence that economic crises affect mortality by reducing incomes and possibly by placing a greater burden on the medical sector, but not by forcing less healthy members of the population to work or by forcing primary caregivers to go to work.   © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

What are the consequences of economic downturns for the well-being of populations and for public policy? Clearly, incomes fall, poverty increases, and standards of living decline for most. These alone justify government concern. But economic downturns may have a more lasting impact on other aspects of well-being, and specifically on health. Thus, social policy must be alert to economic crisis as well.

The impact of economic and financial crises on health is particularly important because economic crises have been both frequent and severe over the past three decades, particularly in developing countries (Glick and Rose, 1998; Corsetti et al., 1998). In Mexico, the case that we study in this paper, large economic crises occurred in 1976–7, 1982–3, 1986–7, and 1994–5. Much of Latin America experienced financial crises in the 1980s, and the mid-1990s saw a wave of crises throughout the developing world. Further, health effects in developing countries may be large because large segments of the population are vulnerable — for example, the very young, the old, or the poor.

Potential health and social impacts of crisis are extremely important for public policy. Countries experiencing economic crises have found that they reduce the ability to provide social services to the poor, just as the needs of the poor increase. Examining how and why health status is affected by an economic crisis is therefore an important step in designing appropriate public policies.

In this paper, we explore how economic crisis in Mexico affected health outcomes with a special focus on the elderly population. Mexico is a particularly important developing country for the study of the impact of economic downturn on health. First, as noted above, economic crises have been repeated and severe. Second, Mexico is undergoing a prolonged and protracted epidemiological transition, accompanied by population aging (Lozano and Frenk, 1999; Frenk et al., 1989). Third, Mexico is one of the only developing countries with time series information on health, health care and economic outcomes at the national and sub-national levels.

We analyze the effects of economic crisis, particularly the crisis of 1995, on mortality rates in Mexico. We note at the outset that mortality is only one measure of health status — and not likely to be the most responsive or easily observable indicator of the effect of economic crisis. Morbidity and other indicators of well-being may show more rapid changes. Still, we focus on mortality rates because substantially more data are available on mortality over time and by age group and region than is the case for any other measure of health status.

Our empirical analysis points to a strong conclusion: mortality rates have increased with economic crisis, among the elderly and possibly among the very young. We estimate that the mortality rate in 1996 among the population aged 60 and over was about 5–6 percent worse than expected based on pre-crisis trends. For children aged 0 to 4, mortality rates were approximately 7 percent above expected levels. This translates into about 7000 additional deaths among children

(0.06 percent of the 11 million children) and 20,000 additional deaths among the elderly (0.4 percent of the 5 million elderly). The increase in mortality rates associated with economic crisis is of particular concern because of the growing share of the aged in developing countries (World Health Organization, 1999a,b).

We consider four theories for why the crisis in Mexico affected mortality: first, that the crisis reduced income, which reduced resources for goods that improve or maintain health, such as out-of-pocket medical spending or nutrition; second, that the crisis reduced public sector funds for health systems, which affected groups particularly dependent on those systems; third, that the crisis caused more people to work, which resulted in health reductions for affected workers; and fourth, that the crisis affected the informal care that families can provide for children and the aged. We find strongest evidence for the first two of these theories and little evidence for the latter two. Specifically, we show that as the supply of medical resources in an area fell, mortality increased, and that as more women went to work in an area, mortality rose. We count this as reflecting income changes rather than changes in the ability of women to provide home services because the effect of womens' work on mortality is found even for women without any aged family members. There is some, but a weaker, correlation between the supply of public medical resources and mortality.

The paper begins, in the next two sections, by discussing the links between economic crisis and health, and the evidence from a number of developed and developing countries. The fourth section provides an overview of the nature of economic crisis in Mexico over the past three decades, recent demographic and epidemiological trends characterizing the health condition of the population, and the structure of the health care system in Mexico. The fifth section begins our empirical results by considering trends in national mortality rates by age and cause of death. The sixth section examines the reasons for higher mortality using cross-state evidence. The last section concludes.

2. Economic crisis, health and vulnerability

Economic crises are among the most severe and concentrated economic downturns. While economic crisis is rare in modern-day developed countries, it has become a repeated feature of the economies of many developing countries. In Latin America, particularly in the 1980s, many countries suffered periods of dramatically high inflation, increased unemployment, currency flight, devaluation, and declining purchasing power. In some cases recovery was relatively rapid, while in others downward spirals have left lasting effects.

We focus on the health impacts of economic crisis. Economic crisis might affect health in four ways. The first is a reduction in family income. Average family income declines in an economic crisis, and families must adjust to this in some way. Absent the ability to borrow the entire shortfall, consumption will decline with declines in income. The consumption decline may, in turn, adversely affect

health. Direct medical care spending is one use of funds that may be reduced — and this may be aggravated if coupled with price increases for particular products such as imported drugs. Other types of spending may also be cut back. For example, the quality and quantity of food consumption may fall with a resulting impact on nutrition, health status and well-being. Second, crises might affect health by reducing public sector resources. Loss of salaried employment often involves loss of the access to high-quality health services and increased reliance on private health care or lower-quality public services (Langer et al., 1991).[1] Further, since health is a large part of public sector spending and public sector deficits usually rise in an economic downturn, efforts to cut public deficits are likely to imply reductions in public medical services (Lara et al., 1997; Wibulpolpraser, 1999).

Third, additional family members may need to go to work in an economic crisis, and this could affect their health. Families often react to economic crisis, declining incomes of primary wage-earners, and declining purchasing power by sending more family members to work, particularly women and children and possibly the elderly, who may also delay retirement (González de la Rocha, 1995, 1998; Moser, 1995; Cunningham, 1998). Physically demanding labor, more common in developing than in developed countries, may reduce the health of affected people. Work is also associated with job stress, which may itself affect health, as some evidence from developed countries suggests (Bosma et al., 1997).

Finally, economic crises may lead caregivers to enter the labor force, reducing their ability to care for those who are more dependent. Family caregivers are particularly important in countries like Mexico, where nursing home and long-term care for the elderly is not publicly provided and private medical care is only accessible to the wealthy. Women who need to work, for example during times of crisis, will have less time to provide non-market goods to children and the elderly. If children need to work, they will also have less time to care for the elderly, and vice versa. There are also potential interactions among different members working. The entry of children into the labor force may generate unemployment among the elderly, for example.

Economic crisis may affect different groups in the population to a greater or lesser degree. Traditionally, policymakers worried about the impact of economic crisis on the poor and on children. Because incomes for the poor are low to begin with, further income reductions for poor people may have particularly large impacts on their health. Indeed, studies suggest that, rather than being insulated from the effects of economic crisis through limited participation, the poor are amongst the hardest hit (Levinsohn et al., 1999). The very young might also be vulnerable to crisis, since children are less able to withstand disease than are

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[1]In Mexico, as we note below, between 40 and 50 percent of the labor force, and their dependent family members, receive social security through their principal place of work. Only formal sector workers are covered. Thus, job loss, a move to the informal sector, or medium-run periods of unemployment imply loss of social security coverage for workers and families.

adults, and they cannot often work and support themselves. Families may also devote a smaller share of resources to dependent members when overall income is lower. As a result, numerous public health programs have been developed that focus on child and maternal health.

An often overlooked group in developing countries is the elderly. There are several reasons why the elderly might be particularly affected by economic crisis. First, their medical care costs are often high. Second, some forms of disease are not amenable to many health interventions leaving them particularly vulnerable to economic downturn. The omission of the elderly is in part because the age structure in developing countries was skewed to the young. But in recent decades, demographic and epidemiological transitions have occurred so that populations have aged substantially. Thus, the elderly now constitute another, large population group highly exposed to the mechanisms that generate vulnerability to economic downturn yet often without the social protection that may be available to other population groups such as the insured and children. We thus focus our analysis on the aged as well as the young and poor.

3. Previous evidence on health and economic crises

The relationship between economic conditions and health outcomes has been investigated in both developing and developed countries. The evidence is not uniform, with some studies finding an adverse effect of economic downturn on health and others finding the reverse. Indeed, Murray and Chen (1993) highlight a general declining trend in age-specific mortality rates in most countries that is highly resilient to shocks of all types.

Much of this literature has considered the relation between economic conditions and health in developed countries.[2] Brenner (1973) argues for an inverse relationship between mortality and economic fluctuations (as measured by unemployment rates), focusing in particular on the Great Depression. Brenner's methodology and findings have been disputed, however, and several authors suggest there is little evidence for or against such a relationship (Wagstaff, 1985; Stern, 1983; Gravelle et al., 1981; Mc Avinchey, 1988; Joyce and Mocan, 1993).

Indeed, some studies find the opposite relationship. Deaton and Paxson (1999), using data from a panel of aggregate birth cohorts spanning 1975 to 1995, find that cyclical increases in income raise mortality, which may be attributed to increased risk taking behavior. Ruhm (2000) also argues for the protective effect of recessions, basing his analysis on a fixed effects model of the effect of unemployment on age-specific, adult mortality using longitudinal, state-level data from 1972 to 1991 for the United States. Ruhm postulates that the time costs of

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[2]Our discussion here is somewhat brief. See our working paper (Cutler et al., 2000) for a more detailed discussion.

medical care and healthy lifestyles fall during recessions, and that there are possibly adverse health effects of employment.

It is unclear, however, whether data from developed countries — where incomes are high and social safety nets are reasonably well developed — are applicable to developing countries. Indeed, several strands of research suggest that economic downturns in developing countries may adversely affect health. Age-adjusted mortality in Russia rose by more than 30 percent between 1990 and 1994, the years of greatest economic crisis (Notzon et al., 1998; Leon et al., 1997; Alarcón, 1999). In Indonesia, use of public health care services declined among adults and children during the economic crisis of 1997, and there was a shift to use of private providers (Frankenberg et al., 1998). Data show increased self-reported health status over this period (potentially suggesting no adverse health impact) but also weight declines for all age groups, especially the old and the poor. Evidence from Thailand, which suffered a severe recession in 1997 (a decline in real GDP of more than 30 percent), shows an increased prevalence of underweight schoolchildren and low birth weight newborns, particularly among the poor, as well as increasing incidence of measles, malaria and diarrhea among children (Wibulpolpraser, 1999). Finally, the tightening of the US embargo on Cuba in 1992, coupled with the cutoff of aid from Russia, led to increases in mortality, particularly for the elderly.

Most relevant for this paper is evidence from Mexico. Data from the economic crises of 1982 and 1987 show that the combination of reduced family budgets and the withdrawal of subsidies on basic foodstuffs forced families to reduce both the quantity and quality of food consumption. (Cordera and González Tiburcio, 1991; Langer et al., 1991). Trends in infant mortality show a relationship to economic downturns (Langer et al., 1991). Between the crises of the 1980s, the infant mortality differential between rural and urban areas, families with more and less educated mothers, and between communities with better or worse housing, all increased. For example, infant mortality was 1.65 times as high in rural as in metropolitan areas prior to 1982. Between 1982 and 1986, the difference doubled so that the rural rate was approximately four times the rate in larger cities. Diseases associated with deteriorating socio-economic conditions gained relative importance as causes of death among infants. Messmacher (1999), using state-level data from 1993 to 1996 on mortality, state employment rates, and social security coverage at the state level, finds that homicide rates are significantly related to economic conditions. Still, no studies have systematically examined the link between economic crisis and health, or considered the mechanisms through which economic crisis affects health.

4. Economic crises, health conditions and the health system in Mexico

In Mexico, economic crises have been repeated and intense with intervening periods of mild economic recovery. Over the last three decades, there have been

four crises spanning the period of the late 1970s, the early 1980s, the mid- to late 1980s and the mid-1990s.[3] Three of these crises are evident in Fig. 1, which shows GDP growth since 1980. In 1983, the rate of economic growth was − 4.0 percent, in 1986 it again fell to − 2.6 percent, and in 1995 it was − 4.4 percent. Inflation and unemployment followed a similar pattern. For example, inflation went from 42 to 110 percent between 1982 and 1983, from 74 to 153 percent between 1986 and 1988, and from 7 to 41 percent between 1994 and 1996. Relative to 1981, the real minimum wage declined by 18 percent in 1983, by 13 percent in 1988 and by 12 percent in 1994. Similarly, unemployment spiked in 1983 and 1995.

The timing and severity of economic crises vary across and within states — a finding that is important for the regression results presented below. Some states suffered particularly large declines in GDP between 1993 and 1996, while others appear to have been more insulated. These differences are not clearly correlated with the extent of poverty in each state. For example, Chiapas, a poor state, suffered a less pronounced decline than did some richer states.

The impact of economic crisis on health outcomes is guided by the demographic and epidemiologic situation of Mexico. Mexico is well into its epidemiological
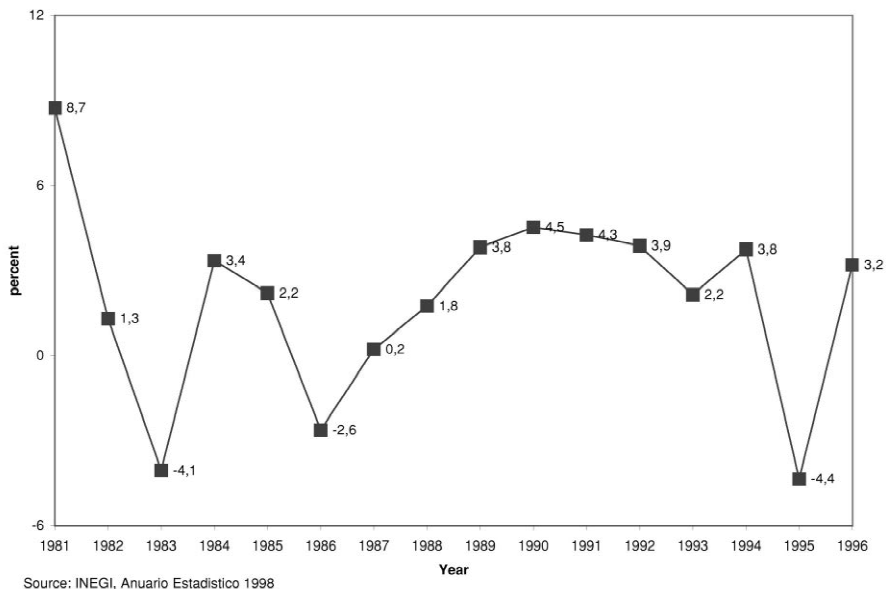

Source: INEGI, Anuario Estadistico 1998

Fig. 1. GDP growth since 1980 for Mexico.

[3] Throughout the paper, we date crises as starting in the year in which real GDP declined the most and ending in the year in which real GDP growth returned to pre-crisis levels. Thus, the crisis periods are 1983–84, 1986–89, and 1995–96. The results are relatively insensitive to the timing of the crises, with the exceptions discussed in the text.

transition but the process has been drawn out. Mexico faces the double burden of a backlog of infectious disease and nutritional deficiencies, traditionally associated with less developed countries, and a growth in chronic, non-infectious illness most associated with developed countries (Frenk et al., 1989, 1994). Indeed, the age distribution of the Mexican population has changed rapidly in recent decades. The ageing of the population will mean that while persons aged 65 and over represented approximately 3 percent of the population in the 1950s and 4–5 percent in the 1990s, they will represent 25 percent of the population in 2050 (Partida, 1999).

The increasing complexity of health care needs associated with aging place a heavy burden on a relatively extensive, but inefficient, health system (Frenk et al., 1994). The Mexican medical care system is segmented and fragmented. The poor and uninsured have the legal right to access the limited, public, health system in which the largest institution is the Secretariat of Health. The quality of these services is not uniformly high, however. The insured population working in the private sector has the right to use the more extensive health network of the Mexican Social Security Institute (*IMSS*), and public sector workers are covered by social security through *ISSSTE*. In 1994, 52 percent of the population was covered by social security, 37 percent had access to health care through the Ministry of Health, and 11 percent were without access to services (Poder Ejecutivo Federal, 1995; Frenk et al., 1999).

Because the quality of services provided is so variable, a large part of the demand for health care is met through out-of-pocket payments, even by those with insurance. About half of health spending is paid for out of pocket. The potential for such spending to get squeezed out in an economic crisis is one reason why crisis might affect health so greatly.

## 5. Economic crisis and age-specific mortality

We begin our empirical analysis by considering overall mortality rates in Mexico. The mortality data that we employ are based on national statistics and population estimates produced by the Mexican Secretary of Health (Secretaría de Salud), the national statistical agency (the *Instituto Nacional de Estadística, Geografia e Informática, INEGI*) and the National Council on Population (*Consejo Nacional de Población, CONAPO*).[4] We use information, by detailed age grouping, divided into major cause groupings: communicable, nutritional and reproductive; non-communicable; intentional and non-intentional injuries; and ill-specified. We focus on the data from 1980 on, as the quality of these data has been improved by adjusting for under-registration and misclassification of causes

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[4]More details about the data and alternative data sources are available in our working paper (Cutler et al., 2000).

(Frenk et al., 1994; Lozano and Frenk, 1999). We analyze trends in mortality data at the level of the nation as a whole from 1980 to 1996 and across states from 1982 to 1996.

Fig. 2 shows mortality by cause from 1980 through 1996, and Table 1 shows summary statistics. The top line in the figure is overall mortality, scaled to 100 in 1980, so that the trend can be interpreted in percent changes. The remaining lines in the figure are for mortality by different cause groups. Each of these lines is scaled to overall mortality in 1980, so the bottom three lines add to the top one.

Overall mortality declined by nearly 30 percent from 1980 through 1996, which corresponds to the longer-run trend associated with the epidemiologic transition. The decline in mortality has not been even over time, and matches the pattern of economic crises. Between 1980 and 1982, before the first crisis, mortality declined by 4.8 percent per year. Between 1982 and 1984, the years of the crisis, the mortality decline fell in half, to only 2.5 percent per year. Mortality statistics for the second crisis are more variable. In the 1984–85 pre-crisis period, the Mexican economy was still recovering, and mortality was falling only modestly (a decline of 1.5 percent per year). Mortality declined at a similar rate over the period of the economic crisis (1.6 percent per year from 1985 to 1989), suggesting no effect of the crisis on mortality. But annual data show this story is more mixed. Mortality declined rapidly in 1986 (5.5 percent) and then was flat through 1989. Because of the difficulty in measuring pre-crisis trends and dating the timing of the crisis exactly, we do not focus very heavily on this second economic crisis, and we sometimes treat the 1980s period as a whole. A sustained period of economic growth between 1989 and 1994 reduced mortality by 2 percent per year. Since
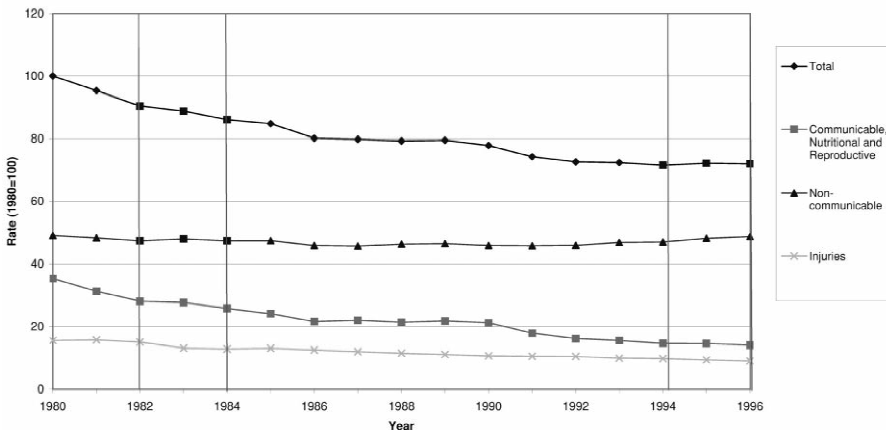
Source: Mexican Health Foundation based on Secretariat of Health and CONAPO.

Fig. 2. Mortality by cause from 1980 to 1996.

Table 1
Annual change in mortality by age and sex

Age group	Period					
	1980–82	1982–84	1984–85	1985–89	1989–94	1994–96
All						
Total:	−4.8%	−2.5%	−1.5%	−1.6%	−2.1%	0.3%
Men						
Total:	−4.4%	−3.3%	−1.7%	−1.5%	−2.1%	−0.2%
0–4	−8.9	−3.8	−7.0	−1.1	−7.0	−2.9
5–14	−7.8	−5.3	−1.3	−3.3	−7.3	−1.0
15–29	−2.5	−9.3	−1.7	−3.4	−2.2	−3.8
30–44	−3.2	−6.9	0.2	−4.5	−1.8	−4.6
45–59	−3.1	−4.2	−0.8	−2.3	−1.8	−2.3
60–69	−3.4	−1.4	1.1	−1.3	−2.3	−0.5
70–79	−2.2	0.2	−1.9	−1.3	−2.2	1.2
80+	−0.1	3.1	2.3	−0.2	−0.3	3.1
Women						
Total	−5.4%	−1.4%	−1.2%	−1.7%	−2.1%	0.9%
0–4	−9.2	−3.0	−7.1	−1.9	−7.2	−3.1
5–14	−10.1	−4.9	0.8	−2.3	−7.1	−0.1
15–29	−5.8	−7.2	−1.6	−5.2	−4.0	−2.6
30–44	−6.4	−5.5	0.4	−5.1	−3.2	−4.0
45–59	−2.7	−1.9	−0.5	−2.6	−1.7	−1.1
60–69	−4.0	−0.9	−0.1	−1.3	−1.4	0.7
70–79	−2.9	0.6	0.5	−1.9	−2.6	0.6
80+	−2.3	3.0	2.4	−1.3	−0.9	1.8

Source: Mexican Health Foundation based on Secretariat of Health (Secretaria de Salud, 1991–1996) and CONAPO (1995, 1998).

then mortality rates have increased. Mortality rose by approximately 1 percent in 1995 and fell by 1 percent in 1996, for a total change of 0.3 percent per year.

Data by cause do not suggest any one explanation for the slowdown in mortality reduction in recent years. Chronic and non-communicable disease mortality rose by about 3 percent between 1994 and 1996, and communicable disease mortality, which had been declining rapidly, declined much less rapidly. The lack of any one dominant cause of increased mortality suggests a systemic explanation more than a disease-specific explanation.

Table 1 also shows annual changes in mortality rates by age and sex. There is clear evidence that economic crisis is associated with increased mortality for the elderly, and possibly for the young. The figures and table suggest three age groupings of the population: infants and children (less than 15); the elderly (ages 60 +); and the middle aged (in between). Changes in mortality for infants and young children match well the pattern of economic crises. Mortality decline was rapid throughout the late 1980s and early 1990s, which corresponds to good

economic years (as high as 9 percent annual declines in mortality), and then slowed down in bad economic periods. Indeed, in some cases, such as the 1986–89 crisis and post-crisis period, mortality for infants actually increased, while in other cases, such as the 1995 crisis period, mortality rates declined but at a less rapid rate. Some of the leveling off may be the result of the fact that infant mortality had reached a low level by the mid-1990s so that additional gains were more difficult to attain. Note that child mortality fell less rapidly during the crisis years as well.

Similar patterns are true about the elderly. In this case, though, mortality actually increases during economic crises. For example, mortality for people aged 70–79 fell by about 2.5 percent per year between 1989 and 1994, but rose by about 1 percent per year between 1994 and 1996. The middle-aged population sees much steadier changes in mortality. In fact, the male population aged 15–29 and 30–44, the groups for which medical care utilization is likely to be lowest, actually experience larger mortality declines during years of economic crisis than during years of economic growth. The female population in this age group shows on average the same decline in mortality in good and bad economic years.

We examine the cause of increased mortality for infants and the elderly in Fig. 3. The majority of the increase in mortality is in non-communicable disease mortality. For the elderly, for all age groups, the pattern shows increases in mortality or slower declines in 1994–6 and 1980–9 than in 1989–94. Further, the 1994–6 mortality changes contrast markedly with the 1989–94 time period, and even the 1980–9 time period, where chronic disease mortality was falling for all of the elderly other than the oldest old. For infants, there are also increases or reduced declines in 1994–6. While disease-specific patterns have to be analyzed
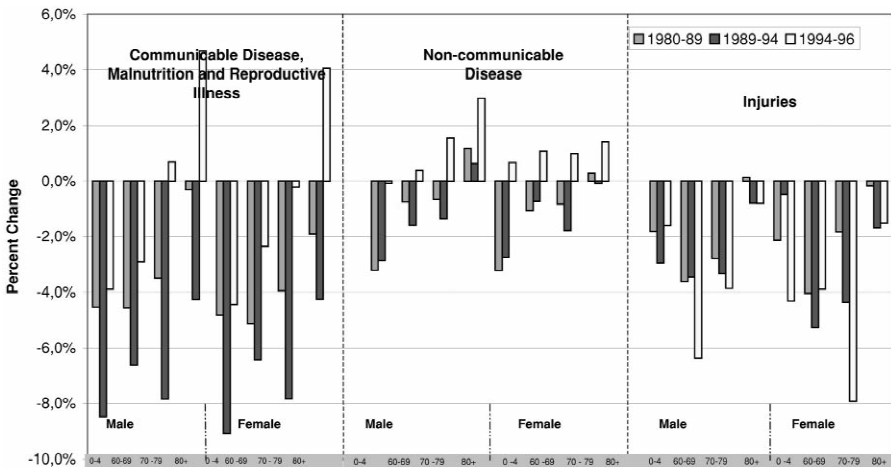

Fig. 3. Cause of increased mortality for infants and the elderly.

with caution due to reporting error and sample size issues, increases in chronic disease mortality among the elderly is seen for such causes as cardiovascular disease (including heart attacks and cerebrovascular disease) and chronic respiratory and obstructive pulmonary disease.

Communicable disease mortality rates increased in the 1994–96 period, particularly for the oldest elderly. For other age groups, and in the 1980–89 period, the rates declined less than between 1989 and 1994. The pattern for injuries does not demonstrate a clear relationship to cycles in economic growth among infants or the elderly.

The trends in mortality by age and gender can be used to generate a 'differences-in-differences' estimate of the effect of economic crisis on mortality (Table 2). Denoting the mortality rate as MR, the affected group as 'a', the unaffected group as 'u', and 't' as the time period which we are examining, our estimate is

$$D = [\text{ch}(\text{MR}_{a,t}) - \text{ch}(\text{MR}_{a,t-1})] - [\text{ch}(\text{MR}_{u,t}) - \text{ch}(\text{MR}_{u,t-1})].$$

We take as our potentially affected groups infants and the elderly. We use males aged 30–44 as the group whose health is least likely to be affected in the short term by economic crisis.[5] The time period t corresponds to years of crisis and $t - 1$ corresponds to the preceding years of economic growth.[6]

Table 2 shows the differences-in-differences estimates of mortality changes. As with any complete census, the standard errors are very small; the standard error for the difference-in-difference estimate D is never above 0.1 percent. Since all of the results are statistically significant, we do not report these values.

The results show large effects of crisis on mortality. In the 1982–84 crisis, the differences-in-differences estimates of mortality changes are generally similar across groups, at roughly 6 to 9 percent. The 1995–96 crisis witnessed increases in mortality of 5 to 7 percent.

The 1986–89 crisis had a smaller effect on mortality for most age groups, with the exception of infants. For the elderly, the excess change in mortality rates is 1 to 4 percent; for infants, the excess mortality change is 10 percent. As noted above, however, because of the short pre-crisis period we do not place particularly high weight on this experiment

Our differences-in-differences estimates are a function of changes in both the affected and unaffected groups. For example, mortality among the elderly rose by about 2 to 3 percentage points in the 1994–96 period, and mortality among unaffected males fell by about the same amount, for a net change of about 6

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[5] The results are qualitatively similar if we use males aged 15–29 as the unaffected group.

[6] We could alternatively estimate a regression model for mortality for different age groups and estimate the crisis impact relative to the entire time period. But the trends in mortality for different age groups appear to vary over time, so we do not follow this path.

Table 2
Differences-in-differences estimates of the effect of economic crisis on mortality

Age group	1982–84 crisis			1986–89 crisis			1995–96 crisis		
	Pre-crisis 1980–82	Crisis 1982–84	Diff-in-diff	Pre-crisis 1984–85	Crisis 1985–89	Diff-in-diff	Pre-crisis 1989–94	Crisis 1994–96	Diff-in-diff
Affected (M and F)									
0–4	−9.0%	−3.5%	9.2%	−7.1%	−1.5%	10.3%	−7.1%	−3.0%	6.9%
60–69	−3.7	−1.2	6.2	0.5	−1.3	2.9	−1.9	0.0	4.7
70–79	−2.6	0.4	6.7	−0.8	−1.6	3.9	−2.4	0.9	6.1
80+	−1.4	3.0	8.1	2.3	−0.8	1.6	−0.7	2.3	5.8
Unaffected									
Male, 30–44	−3.2	−6.9	–	0.2	−4.5	–	−1.8	−4.6	–

percentage points. We do not have any obvious explanation for why mortality among prime age males fell more during the economic crisis than prior to the crisis. But even if one omitted the comparison group, the qualitative findings would remain the same.

These changes in mortality are quantitatively significant. In 1990, there were approximately 11 million children and 5 million elderly in Mexico. Using the estimates in the last column of Table 2, we calculate that the number of additional deaths was about 7000 children aged 0 to 4 (compared to approximately 57,000 actual deaths) and 20,000 to 21,000 elderly aged 60 and over (compared to 192,000 actual deaths). By another metric, these deaths represent 0.06 percent of the young population and 0.4 percent of the elderly population. Overall, our results provide strong evidence that economic crisis is associated with increased mortality, and that both communicable and chronic disease mortality rose with the economic crisis.

One might wonder whether these mortality changes are simply higher mortality among those who were 'marginal survivors' and would have died in the next year or two without the crisis. If this were the case, the crisis would simply hasten death by a few months to a year, but not impact people with high long-term expected survival. We cannot address this issue for certain without longitudinal information on the characteristics of people who die. We suspect this is not the case, however, because the increase in mortality is observed for all causes of death. Marginal survivors, in contrast, might be expected to die of particular diseases to a great extent, such as pneumonia or influenza.

6. How economic crisis affects mortality

In this section, we analyze the reasons why economic crisis has such a large effect on mortality. Testing different explanations with time series data is difficult, since it is hard to capture all of the factors that change over time. We thus use data disaggregated to the state level to test the four explanations for the changes in mortality discussed above. We examine the years 1991, 1993, 1995 and 1996 in order to be able to match available time series on employment to data on mortality and the supply of health care services. There are 32 states in Mexico for a total sample, after missing data, of 124 observations. As noted above, there does not appear to be one single factor explaining differences in mortality trends across areas. For example, mortality increased, or the rate of decline slowed, in poorer areas such as Chiapas and Oaxaca (located in the south) as well as richer areas such as Nuevo Leon (located in the north) and Quintana (located in the southeast). Thus, it is particularly important to examine different explanations for mortality change.

We test the four theories of economic crisis presented above. The first explanation is the income theory: mortality increases because family income falls

and thus families have less to spend on goods that improve or maintain health. We test this theory in several ways. First, we examine changes in labor force participation across states. As the economy declines, fewer people with strong attachments to the labor force (for example, prime-aged males) will be able to work but more secondary workers (generally women, children and some elderly) will enter the labor force (Benería, 1992; Moser, 1995; González de la Rocha, 1995). While family income may recover or even increase when secondary workers enter the labor force, families who need to send women, the elderly or the young to work are likely to be those that have suffered a loss of income. We use as our first measure of economic crisis changes in labor force participation for prime-age males. We also measure the increase in labor force participation for women, children, and the elderly, as a sign of the extent of the crisis.[7]

The employment data come from the *Encuesta Nacional de Empleo* (National Employment Survey, NES), undertaken in the second trimester of 1991, 1993, 1995 and 1996 by the *Instituto Nacional de Estadística, Geografía e Informática* (INEGI, 1996, 1997, 1998) and the *Secretaría del Trabajo y Previsión Social*. The NES are nationally representative and include approximately 143,000 adults in 1991, 140,000 in 1993, 110,000 in 1995 and 365,000 in 1996. The 1991, 1993 and 1995 samples are designed only for disaggregation into less and more urbanized areas, while the 1996 sample is representative at the state level.

Table 3 shows summary statistics for the employment rates. The male labor force participation rate fell from 91 percent in 1991 to 89 percent in 1996. The decline is not large, but there was also a shift towards unemployment as rates among adult males went from in 3.6% in 1994 to 6.1% in 1995 and 5.3% in 1996 (INEGI, 1998). Over the same time period, female labor force participation rose from 37 to 43 percent. Participation among youth and among the elderly fell. Both the increasing trend for women, and the decline for children and youth are in line with longer run trends, although the crises were accompanied by increased unemployment among youth and perhaps increased participation of women.[8]

The second explanation is the public medical system theory: mortality increases because public sector spending on medical care falls absolutely, or relative to the need for public care. Public sector budgets declined in crisis years (Lara et al., 1997). In 1987, health spending reached a low of 2.7 percent of GDP. From 1990

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[7]We experimented with using data on GDP at the state level but found the employment data to be a better measure of economic crisis. Further, the GDP data are only available from 1993 at the state level.

[8]While we include overall trends in participation in our regressions, we note that this may not be the best measure of economic crisis. Employment declines among the elderly, for example, might result from either the healthiest and wealthiest choosing to retire, which would not have much effect on health, or from those with low family income not being able to find work, which might well affect health. Similarly, there may be shifts from the formal sector, with better working conditions and benefits, to the informal sector. With the available data, we cannot, however, match mortality to particular individuals, so we cannot examine how changes in employment for particular workers affect their health.

Table 3
Means of independent variables by state and year

Variable	Year			
	1991	1993	1995	1996
Male labor force participation rate (18–64)	91.49	90.97	89.92	89.48
Female labor force participation rate (18–64)	36.83	40.78	43.21	43.20
Elderly labor force participation rate (65+)	31.76	32.77	28.68	27.63
Child and youth labor force participation rate (12–17)	27.83	29.80	27.34	23.45
Doctors employed in the public sector per capita (*100)	1.15	1.18	1.25	1.27
Nurses employed in the public sector per capita (*100)	1.66	1.68	1.76	1.77
Public clinics (consulta externa) per capita (*100)	0.19	0.18	0.19	0.20
Public hospitals (total units − clinics) per capita (*1000)	0.114	0.112	0.112	0.110
Illiteracy rate, by state*dummy if year = 1995 or year = 1996	0	0	12.15	12.15
Proportion of economically active women (18–85) in families with an elderly member (65+)	0.65	0.69	0.80	0.69
Proportion of economically active women (18–85) in families without an elderly member (65+)	0.43	0.48	0.60	0.51

Notes: (1) figures calculated without expansion factors; (2) most cells include one observation for each state for a total of 32 observations in each year. Observations for the employment variables are missing for one state in 1991 and 1993.

to 1994 it rose steadily, to 3.8 percent of GDP. Between 1994 and 1996 per capita health spending fell by about 15 percent and as a proportion of GDP to 3.4 percent.

At the same time, there were important changes in per capita spending on the uninsured population through the PASSPA program (*Programa de Apoyo a los Servicios de Salud para Población Abierta*). The PASSPA program was implemented by the Mexican Secretariat of Health with financial support from the World Bank and was designed to offer additional, basic health services to the uninsured, rural populations of the poorest states. Between 1991 and 1994 the focus was on the states of Chiapas, Guerrero, Hidalgo and Oaxaca. (Gomez-Dantés et al., 1999). Total spending doubled from 0.26 pesos per capita in 1990 to 0.58 in 1994, while spending in other regions remained relatively stable. But

PASSPA spending fell in the economic crisis. Between 1994 and 1995, when spending declined in all regions, the sharpest fall was in the PASSPA states, 25 percent (Lara et al., 1997).

We measure the public sector's supply of medical resources using data on the distribution of public sector infrastructure (hospitals, clinics, doctors, and nurses) per capita.[9] These data are published by the Secretariat of Health and the Office of the President and refer only to the supply of public services (the Secretariat of Health, the IMSS, the ISSSTE, etc.). Thus, they are reasonably exogenous measures of the ability to receive care. The supply of doctors, nurses and clinics per capita in the public sector, measured as the number of units per 1000 population, increased up to the period of crisis and then leveled off (Table 3). Although not evident from the data included in the table, there was a slight worsening between 1994 and 1995 followed by a return to 1994 levels in 1996, and then a continued increase in the number of public sector physicians per capita in 1997 and 1998.

Further, the pattern varies across states. In some states, the number of public sector doctors per capita was rising throughout the period 1991 to 1996, while in others such as Mexico City there are declines over the period 1994 to 1996. Some of the increasing trend in the supply of physicians is associated with PASSPA states such as Chiapas. As changes in the supply of doctors, nurses, clinics, and hospitals across states are highly correlated (0.6 between changes in physicians per capita and both nurses and hospitals per capita, for example) we only include the per capita supply of physicians in the regressions. The results are very similar when using the other variables.

We are also interested in the ways that families responded to crises using out-of-pocket payments. Overall, out-of-pocket health expenditures declined during the crisis from 3.9 percent of GDP in 1994 to 3.1 percent of GDP in 1995. The declines are most substantial among families with elderly members as compared to families with young children. The decline is evident among middle-income and wealthier families in hospitalizations, and for families of all income levels for doctor visits and dental care. We experimented with a variety of measures of out-of-pocket medical spending in our regressions. Unfortunately, there is an endogeneity problem with including such variables: when people are sicker, they will spend more on medical care out-of-pocket. In our preliminary

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[9] We also looked at the demand for public health spending using data on the proportion of the population covered by social security (IMSS and ISSSTE). Social security coverage is a measure of formal sector, salaried employment, as well of health insurance coverage for workers and their families. IMSS coverage declined over the crisis period. Between 1994 and 1995, the proportion of the adult population with social security coverage declined from 18.5 to 17.2 percent. Most of the decline is among short-term contract workers who are highly vulnerable to lay-offs. Among this group, social security coverage declined by over 35 percent between 1994 and 1995. The social security coverage variable was not as strong a predictor of mortality as the employment and medical variables, however, so we do not report these results.

results, this appeared to be the case: medical spending was positively associated with mortality. The appropriate solution is to have an instrument for medical spending uncorrelated with sickness. We could not come up with such an instrument, however, so we omit this variable from the regressions.

The third theory is that mortality increases because workers who enter the labor force suffer health declines. We test this using the labor force participation rates for youth and the elderly. To the extent that these variables are significantly related to mortality, we would need additional analyses to determine whether that is because they proxy for income changes or because increased work among these populations is associated with worse health. Still, the available data are sufficient to show whether or not there is a relationship between mortality at a given age and the participation rates of the same age group.

The final theory is that mortality increases because caregivers have to enter the workforce and thus the supply of family-based health and care-giving services falls. We proxy for this with the female labor force participation variable. Again, there is an identification problem with this variable: if increased female labor supply is associated with higher mortality, we do not know whether this is because income is falling or because family care-giving has declined. We return to this issue below.

Equal sized income changes may not have the same effect on all areas. In poorer areas, a given reduction in income might have a larger effect on mortality than a similarly sized or even larger change in rich areas. We include a measure of the illiteracy rate in the state (correlated with overall poverty) to address this. The illiteracy rate is measured in 1995 and 1996. We interact this with a dummy variable for the crisis years to see how economic crisis differentially affects high versus low poverty areas. We do not have changes in illiteracy over time, but we suspect that illiteracy rates are highly correlated in periods 1 or 2 years apart. The mean state had an illiteracy rate of 12.2 percent.

Table 4 presents regression estimates for age-specific mortality rates, differentiating by gender for ages 15 to 29 and 30 to 44.[10] Each row is a regression for a separate age group. The dependent variable is the logarithm of mortality for the age group indicated. The independent variables are shown in the next columns.

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[10]We also estimated regression models for mortality at the level of the microregion (groups of counties or municipalities of at least 20,000 people) and the city. For the municipality-level regressions we had to rely on a sample of only 90 micro-regions that are included in all years of the survey and have more than 30 observations for adults in any year. The regions cover 83 percent of the urban population but only 15 percent of the rural population, making the sample less than ideal. The city sample is representative of 32 of the largest cities. In each case, the results were similar to the regressions at the state level. Female employment rates are positively correlated with mortality for aged 60–69 and 80 and over, as well as to some extent for children. Further, there is some support for the access to medical care variables. Changes in the number of physicians per capita are negatively correlated with mortality and tend to be significant for most age groups, suggesting the importance in changes in the supply of medical services for health outcomes.

Table 4
Regressions on age-specific mortality by state, 1991, 1993, 1995 and 1996

Age group	Physicians per cap (logarithm)	Labor force participation (*100)				Illiteracy (*100)	Summary statistics	
		Elderly 65+	Women 18–65	Youth 12–17	Men 18–65		R^2	N
0–4	**−0.25**	**−0.09**	**0.29**	**0.07**	**0.33**	**0.43**	**0.98**	124
	−1.54	−0.86	1.79	0.37	0.79	2.07		
5–14	**0.38**	**0.19**	**0.41**	**−0.16**	**0.49**	**−0.36**	**0.85**	124
	1.69	1.32	1.87	−0.63	0.87	−1.27		
15–29								
Women	**−0.21**	**0.10**	**0.31**	**0.02**	**−0.27**	**−0.10**	**0.88**	124
	−0.92	0.66	1.43	0.07	−0.48	−0.36		
Men	**0.01**	**−0.14**	**−0.05**	**−0.02**	**−0.28**	**−0.07**	**0.91**	124
	0.03	−1.11	−0.28	−0.10	−0.60	−0.29		
30–44								
Women	**−0.38**	**−0.11**	**0.13**	**0.02**	**−0.20**	**0.18**	**0.92**	124
	−2.55	−1.15	0.90	0.10	−0.53	0.97		
Men	**−0.12**	**−0.08**	**0.18**	**0.10**	**−0.27**	**0.17**	**0.92**	124
	−0.80	−0.77	1.18	0.59	−0.68	**0.91**		
45–59	**0.00**	**0.00**	**0.19**	**0.04**	**0.04**	**0.03**	**0.93**	124
	0.03	0.05	2.27	0.40	0.20	0.28		
60–69	**−0.05**	**0.22**	**0.13**	**−0.08**	**−0.21**	**0.49**	**0.95**	124
	−0.69	4.29	1.74	−0.96	−1.07	5.03		
70–79	**−0.01**	**0.03**	**0.11**	**0.01**	**−0.11**	**0.08**	**0.95**	124
	−0.16	0.51	1.36	0.14	−0.52	0.82		
80+	**0.05**	**0.07**	**0.16**	**−0.04**	**−0.25**	**−0.20**	**0.94**	124
	0.58	1.24	1.81	−0.44	−1.10	−1.84		

Note: all regressions include state and year dummy variables (not reported). Coefficient in bold; *t*-statistic below.

Each cell gives the coefficients and *t*-statistics for each variable (other than the state and year dummies).

The results suggest two conclusions most strongly. First, female labor force participation rates are positively related to mortality among children and the elderly. A 3 percentage point increase in female labor force participation — a rough estimate of the excess change from 1991 through 1996 — leads to an increase of 0.8 percent in mortality among children, 1.2 percent in mortality among youths, and about 0.4 percent in mortality among the elderly.[11] These

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[11]The female labor force participation rate (including all women aged 12 and over) roughly doubled between 1970 and 1990, reaching a level of just over 30 percent. This suggests a rate of increase of approximately 0.75 percent per year. Applying this rate over a 5-year period 1991–1996, and assuming that the rate of increase is the same for women 18–65 as for women aged 12 and over, would imply an increase of almost 4 percent as compared to the 7 percent observed in the data.

results are generally statistically significant at the 10 percent, and sometimes 5 percent, level.[12]

Second, changes in public sector medical resources have some affect on mortality, although the results are less strong than for female labor force participation. As the number of physicians per capita falls, mortality among the youngest age groups, and particularly among child-bearing women, rises. The coefficients suggest that a decline of 1 percent in public sector physicians leads to a 0.4 percent increase in mortality rates among child-bearing women and a 0.25 percent increase in mortality rates among children aged 0 to 4. We ran the regressions using each of the four measures of access to medical care (nurses, doctors, clinics, and hospitals), and found similar results with each. The public sector medical resource variables show no significant relationship with elderly mortality. This may be related to the stronger focus of public resources on care for the very young and for women of child-bearing age, as compared to offering care for the aged. The reverse correlation between public sector medical variables and mortality among 5 to 14 year olds is puzzling, but we do not place much weight on the result as there are some anomalies in the mortality rates for this age group that are likely to be related to sample size issues.

The other variables are generally not as consistently or statistically significantly related to mortality rates. When more elderly go to work, mortality rates among the elderly aged 60–69 rise. Still, this is not true for other age groups among the elderly, who are also likely to be under pressure to work. It may be the case that employment rises most among the youngest elderly, while the most elderly groups are less likely to go to work. But the data on labor force participation rates for particular groups of the elderly are too variable at the state level to test this theory well.

Male labor force participation rates have a negative effect on mortality (the expected sign) but are not statistically significant. Youth employment rates are not significantly related to youth mortality. The indicator of poverty, the proportion of adults who are illiterate, is positively and significantly related to mortality only for children aged 0 to 4 and for elderly aged 60 to 69 but is negatively related to mortality for people above age 80. This provides some evidence of a more pronounced reaction to crisis in poorer states. The investments made in the PASSPA program in the poorest states may have succeeded in moderating what could have otherwise have been a greater increase in mortality in the poorest states.[13]

Overall, the strongest conclusion is the link between female labor force

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[12]These results are robust to excluding the male labor force participation rate variable.

[13]We repeated the regressions using a composite indicator of poverty from the *Indicadores Socioeconómicos e Indice de Marginación Muncipal* produced by CONAPO in 1990 and partially updated for 1995. The results were similar: higher poverty rates predict higher rates of mortality in poorer areas for the elderly aged 60–79 and for adults aged 45 to 59, but not for other age groups.

participation rates and mortality for children and the elderly. This finding is consistent with two of our theories: that the overall size of the economic shock affects mortality and female labor force participation proxies for the size of the economic shock; and that when women go to work, they are less able to care for dependent children and elderly, who suffer adverse health consequences as a result. To differentiate between these two explanations, we separate out the female labor force participation rate into a rate for adult women living in families with at least one elderly member and a rate for women living in families without elderly members. If the caregiver hypothesis is correct, female labor force participation in families with elderly should impact elderly mortality rates. If the economic crisis effect is more apparent, this will not be the case.

The regression results differentiating between women in families with and without elderly are presented in Table 5. While the standard errors increase substantially in this specification, as one would expect given the correlation between these variables, the evidence is more consistent with the economic shock theory than with the female caregiver theory. Female labor force participation in families without elderly is positively and significantly associated with mortality for some elderly and adult groups. At the same time, female labor force participation in families with elderly is insignificant in all of the regressions and frequently the opposite sign. We therefore conclude that the effect of female labor force participation on mortality likely results from an income effect more than a caregiver effect.

7. Conclusions

Our analysis of economic crisis in Mexico finds very clear evidence that economic crisis is associated with higher mortality among vulnerable populations — children and the elderly. During crisis periods, mortality rates for these groups rise absolutely and relative to less vulnerable groups. The mortality change implied by economic crisis is large. We estimate mortality rate increases in the 1982–84 crisis of roughly 6 to 9 percent and during 1995–96 of 5 to 7 percent.

We provide tentative evidence that these effects are directly related to the magnitude of the economic shock. Areas where more women went to work, a sign of economic crisis, are areas where mortality rose the most. There is also some evidence that reductions in public sector medical services adversely affects mortality, at least for some groups.

In addition, our results raise important questions about the design of public safety nets for the poor. In contrast to research on developing countries, much research in developed countries focuses on the adverse impacts of safety nets on labor supply and savings. The positive role of safety nets in raising welfare among the poor has, surprisingly, not been studied as much in the developed world. Our results show that the positive aspects of social safety nets are extremely important.

Table 5
Regressions on age-specific mortality dividing female LFP by whether family includes elderly by state, 1991, 1993, 1995, 1996

Age group (years)	Physicians per cap (logarithm)	Labor force participation (*100)					Illiteracy (*100)	Summary statistics	
		Elderly 65+	Women 18–65		Youth 12–17	Men 18–65		R^2	N
			Families without elderly	Families with elderly					
0–4	**−0.24**	**−0.07**	**8.66**	**−7.57**	**0.08**	**0.21**	**0.44**	**0.98**	**124**
	−1.42	−0.62	0.76	−0.71	0.41	0.48	2.08		
5–14	**0.39**	**0.23**	**23.20**	**−9.72**	**−0.14**	**0.41**	**−0.34**	**0.85**	**124**
	1.72	1.52	1.51	−0.68	−0.54	0.70	−1.18		
15–29									
Women	**−0.20**	**0.12**	**18.87**	**−2.41**	**0.04**	**−0.31**	**−0.08**	**0.88**	**124**
	−0.88	0.78	1.23	−0.17	0.16	−0.53	−0.30		
Men	**0.01**	**−0.14**	**−4.61**	**−0.34**	**−0.03**	**−0.29**	**−0.07**	**0.91**	**124**
	0.03	−1.12	−0.37	−0.03	−0.13	−0.62	−0.31		
30–44									
Women	**−0.38**	**−0.10**	**12.54**	**−4.83**	**0.02**	**−0.20**	**0.19**	**0.92**	**124**
	−2.56	−1.04	1.24	−0.51	0.14	−0.52	1.02		
Men	**−0.12**	**−0.08**	**10.96**	**8.82**	**0.13**	**−0.23**	**0.19**	**0.93**	**124**
	−0.78	−0.78	1.06	0.91	0.76	−0.58	0.97		
45–59	**0.01**	**0.01**	**0.12**	**1.72**	**0.06**	**0.05**	**0.04**	**0.93**	**124**
	0.07	0.19	2.12	0.31	0.61	0.22	0.38		
60–69	**−0.04**	**0.23**	**0.02**	**−0.31**	**−0.07**	**−0.27**	**0.49**	**0.94**	**124**
	−0.57	4.35	0.37	−0.06	−0.83	−1.33	4.96		
70–79	**−0.01**	**0.03**	**0.08**	**4.36**	**0.03**	**−0.08**	**0.09**	**0.95**	**124**
	−0.16	0.53	1.45	0.85	0.33	−0.39	0.89		
80+	**0.05**	**0.09**	**0.13**	**−5.54**	**−0.04**	**−0.26**	**−0.19**	**0.94**	**124**
	0.58	1.48	2.09	−0.99	−0.38	−1.17	−1.74		

Note: all regressions include state and year dummy variables (not reported). Coefficient in bold; *t*-statistic below.

Economic crisis has very adverse outcomes in situations where the safety net is tattered at best. This raises issues such as what type of safety net is best, and whether countries that have more extensive safety nets suffer fewer negative health consequences from economic crisis. These are important topics for future research.

Beyond the macroeconomic point that economic crises do appear to have adverse health effects, our results have several implications for policymakers. First, they argue that public policy needs to consider the protection of the elderly as much as of children and women of child-bearing age. Owing in part to the historical age distribution in developing countries, social policies in these countries have been skewed towards providing safety nets for children and women of

child-bearing age. We found that the elderly constitute an additional vulnerable group in time of economic crisis, and that the supply of health services was not effective in preventing adverse outcomes for this group. This raises the issue about whether other types of social insurance systems would be important in stemming the adverse impacts of the elderly. Future research looking across countries with different social insurance systems could address this question.

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