THE LOSS OF EARNINGS CAPABILITY FROM DISABILITY/HEALTH LIMITATIONS: TOWARD A NEW SOCIAL INDICATOR

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Health problems and physical and mental impairments can restrict the kind and amount of work that individuals can perform. Several studies have estimated the loss in earnings experienced by disabled/ health-limited workers, but they do not examine the trend in this loss over time. The authors propose an alternative indicator of productivity loss that is more appropriate for intertemporal comparisons: "lost earnings capability"—the difference between the amount of money persons could potentially earn if they were free of disability/health limitations and the amount of money that they can actually earn given their limitations. The estimates indicate that the mean lost earnings capability per disabled/ health-limited person grew over the period from 1973 to 1988, while the population with disabilities/ health limitations fell. In 1973, lost earnings capacity totaled about 5.3 percent of Gross National Product (GNP); by 1988, the loss had fallen to about 4.5 percent of GNP as a consequence of the reduction in the number of people with limitations. Data are from the Current Population Surveys and the Survey of Income and Program Participation.

I. INTRODUCTION

People who are not fully physically or mentally capable of performing a job for which they are otherwise qualifed are designated in the literature as disabled or health-limited.[1] The establishment of disability status for purposes of determining

[1]For labor market analysis, disability is appropriately measured as the inability to carry out a specific task or job, and may take into account job requirements such as the stress level of a job. Hence disability is not simply a persistent abnormality of physiological function: it is based in part on job environment and in part on impairments and functional limitations (see Wolfe, 1984). Haveman, Halberstadt, and Burkhauser (1984) emphasize three issues in defining disability: (1) establishing the physical and mental characteristics on which ability is judged, (2) setting a norm for the able-bodied, and (3) defining the deviation from the norm required for classifying persons as disabled.

eligibility for public programs is based on reports of medical examinations.[2] In survey data, determination of the disabled or health-limited population is typically based on self-reported information.

A large number of working-age people in the U.S. are disabled or have health problems that limit the amount and type of work they can perform. The size of this population is difficult to determine, however, because different definitions of what it means to be health-limited or disabled yield different estimates. Some researchers define a disabled person as a recipient of benefits from one of the major disability income support programs, either Social Security Disability Insurance (SSDI) or Supplemental Security Income (SSI). In the early 1990s, 6.4 million people—over 4 percent of the population aged 18–64—received benefits from these two programs. Other researchers turn to surveys that ask people if their hours of work are limited by poor health. The Current Population Survey (CPS) indicates that in the late 1980s, over 6 percent of working-age people were unable to work, or were restricted to part-time or part-year work, for reasons of health.

We have estimated the size of the disabled/health-limited population using data from the Current Population Surveys and the Survey of Income and Program Participation (SIPP). According to our CPS-based estimates, 11.1 million people aged 18 to 64 were disabled in 1988. Most of our estimates based on SIPP data are even larger. (We will present a full set of estimates and describe our estimating procedures below.) With so many people restricted in their ability to work by disability/health-limitations, the loss to the nation in terms of potential forgone output is substantial. Moreover, disability/health-limitations entail other economic costs as well. Disabled and health-limited individuals require substantial medical attention, the cost of which is often funded by taxpayers, and they require the time and energy of relatives and other caregivers.[3]

An accurate estimate of the economic loss attributable to disabilities/health-limitations is important to have. When measured over time, such estimates serve to indicate the extent to which the nation's economic growth is depressed or augmented because of changes in disability/health conditions.

Among the studies that have measured the costs to the nation of illness and disability, those of Dorothy Rice and her associates stand out.[4] In their 1972

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[2]An individual's earning capability is also part of the determination. The largest of these programs—the Social Security Disability Insurance (SSDI) program and the Supplemental Security Income (SSI) program for disabled persons—employ a very strong version of this standard. Eligibility for benefits from these programs requires that persons be "permanently and totally disabled;" earnings of more than $500 per month are taken as evidence that this stringent standard is not being met.

[3]Aggregate economic losses attributable to disability/health problems include both internal and external costs. Internal costs to individuals result from health problems attributable to fully informed decisions by rational consumers. External costs arise if actions by some persons lower the health of others, or if market distortions result in inefficient decisions by individuals, the implications of which spill over onto others. Our measure of potential forgone output neglects both the value of the changed potential leisure time associated with the changed work time attributable to disability/health problems as well as any changes in the value of leisure time attributable to disability/health limitations.

[4]See Cooper and Rice (1976), Rice, Hodgson, and Kopstein (1985), and Rice, Kelman, and Miller (1991) for examples. Other recent works address the economic costs of new cases of illness or incidence of disease rather than all existing illness or disability (prevalence). See Hartunian, Smart, and Thompson (1981) for a review of earlier studies as well as their study of the economic costs of new cases of four specific diseases and Manning *et al.* (1989) for a study of the cost of poor health habits such as drinking and smoking. Incidence studies produce a present discounted value of the cost of illness (injury, drinking) based on the year in which the "incident" occurs.

estimates of the lost productivity due to ill health, Cooper and Rice (1976) found losses of $83.4 billion (1980 dollars), or 6.6 percent of aggregate national wages and salaries, and 3.5 percent of GNP. For the same period, they estimated person-years of work lost to be 5.4 million. In their 1985 study, Rice, Hodgson, and Kopstein estimated the loss of productivity due to these health constraints—characterized as "lost earnings" and lost household services—to be $67.8 billion in 1980, or nearly 3 percent of total national wages and salaries, and 1.7 percent of GNP. Person-years of work lost were estimated to have risen to 6.2 million. The decline in aggregate value along with an increase in lost work-time is largely unexplained.[5]

In this study, we propose a different indicator of the productivity-related losses associated with disability/health limitations. While the measure by Rice *et al.* concerns the *loss of actual earnings* due to illness and disability, our indicator measures the *loss of earnings capabilities* attributable to these limitations. Since the Rice *et al.* indicator measures how individual earnings respond to disability/health limitations, it reflects individual preferences for work versus leisure. Our indicator measures the capability of a person to earn income both with and without disability/health limitations, and hence purges the measure from dependence on the individual preferences of the non-disabled. In addition, our indicator captures the effects of a more comprehensive definition of limitations, measures the effects of limitations on both the quantity and price variables that compose earnings, and corrects other empirical weaknesses that plague the Rice *et al.* estimates. We estimate this productivity loss over time, hence allowing the inter-temporal comparisons indicated above.

II. Two Concepts of Productivity Loss

In this section, we describe our concept of productivity loss—lost earnings capability—and compare it to the lost earnings concept used by Rice *et al.*

A. *The Concept of Lost Earnings Capability (LEC)*

The concept of productivity-related losses is designed to capture the reduction in work force productive capability caused by disability/health limitations. We refer to this concept as "lost earnings capability" (LEC) and define it to be the difference between the actual earnings capability of the working-age population (reflecting actual limitations that constrain their capability to work) and the earnings capability of this population assuming the absence of such limitations. Hence, LEC is the lost capacity to produce social output due to disability/health limitations.

Consider the two parts of this definition. The *actual earnings capability* of members of the working-age population (AEC_i) is measured as the value of the

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[5]Rice, Hodgson, and Kopstein were not consistent in their methodology. In their 1985 study, they imputed the value of lost household production to employed persons in 1980, but in the 1976 analysis (by Cooper and Rice), they imputed it only to full-time housewives in 1972. The 1976 study applied full-employment rates from 1970, but the 1985 study applied the actual employment rates of 1980. The Rice methodology is more completely described in Section IIB below.

output (or gross earnings) that would be generated if they were to work the maximum number of hours per year permitted by their *actual disability/health conditions*, at a wage rate that reflects those conditions. It is potential earnings conditional on actual limitations.[6]

Potential earnings capability (PEC_i) is measured as the value of the output (or gross earnings) that working-age persons would generate if they worked to their capacity (full-time, full-year), *assuming no disability/health limitations*. In this case, capacity work reflects existing social norms, and is taken to be 2,000 hours per year. Hence, actual capacity hours reflect reductions of work time below the 2,000 hour norm attributable to disability/health limitations. The wage rate is estimated to be that which would be paid the individual (given his/her human capital characteristics) if no limitations were present.

Hence,

(1) $$LEC_i = PEC_i - AEC_i, \quad or$$

(2) $$LEC_i = w_i^P \bar{H}_i^P - w_i^A \bar{H}_i^A,$$

where w^P is the potential wage if healthy, $\bar{H}^P$ is potential capacity hours if healthy (2,000 hours), w^A is the actual wage at actual levels of disability/health limitations (if any), and $\bar{H}^A$ is actual capacity hours. We sum LEC_i over the set of working-age persons defined to have limitations to obtain aggregate lost earnings capability, LEC.[7]

B. *The Concept of Lost Earnings (LE)*

In contrast, the value of lost productivity attributable to illness and disability estimated by Rice *et al.* is the loss of earnings due to these conditions. Earnings loss is defined as the difference between an individual's estimated earnings in the absence of illness or disability, PE_i, and their actual earnings, AE_i.

(3) $$LE_i = PE_i - AE_i$$
$$= w_i^P H_i^P - w_i^A H_i^A,$$

where H_i^P is hours of work if healthy (i.e. with no illness or disability) and H_i^A is actual hours in the paid labor force.

However, in their estimation procedure, Rice *et al.*, do not, in fact, estimate (3). Their actual procedure is to multiply the total days of work lost (for each of a limited number of age-gender groups) by the mean earnings of the entire population of full-time, full-year workers. This procedure is equivalent to

(4) $$LE_i = w_i^F (H_i^F - H_i^A),$$

where w_i^F and H_i^F are the wage rate and hours in the paid labor force of full-time, full-year workers, respectively.

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[6]Viewed alternatively, with a change in sign, this value is the gain in aggregate work force productive capability if all existing disability/health limitations were eliminated.

[7]It should be noted that our estimate of the lost value of potential market work time due to disability/health conditions neglects the lost value of potential leisure time.

Three problems with this procedure should be noted. First, the calculation implicitly assumes that illness and disability have no effect on wage rates (i.e. $w_i^A = w_i^F$). This equality assumption affects their calculation at two points, and at both points the validity of the assumption is questionable.[8] For individuals who do not work in the paid labor force ($H_i^A = 0$), equations (3) and (4) are identical, if one assumes that the wages of individuals without illnesses or disabling conditions are equal to those of full-time, full-year workers ($w_i^P = w_i^F$). This assumption may or may not be true, and depends on the human capital characteristics and preferences of the two groups. The assumed equality also affects the calculation for people who participate in the paid labor force, and for them the assumption is quite surely wrong.[9] The second problem is a related one. Rice *et al.* ignore losses due to working part-time owing to disabilities. Only days lost are counted—and they are counted as full-time days lost.

The third problem is even more serious. Rice *et al.* assume that, in the absence of illness or disabling conditions, all workers would work full-time, full-year.[10] This assumption is clearly incorrect, in that many people work part-time or part-year for reasons other than illness or disability.[11] It should be noted that this full-time, full-year work standard which is the counterfactual for estimating lost productivity, is similar to the standard that we use in the calculation of LEC. However, in Rice *et al.*, comparison of the actual earnings of those with illnesses and disabling conditions (AE_i)—a figure which includes part-time and part-year work for reasons that are unrelated to health—with earnings based on this full-time, full-year capacity work standard yields estimates that are inconsistent with their definition.[12]

C. *LEC and LE Compared*

The measure of the "lost earnings" component of the costs of illness developed by Rice *et al.*, and estimated according to equation (4), differs in several ways from our measure of lost earnings capability (LEC), as described in equation (2).

First, whereas Rice *et al.* take the loss in earnings attributable to illness to be the principal indicator of concern, we focus on the loss in the capability to

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[8]A recent Rand study of the cost of accidental injuries (Hensler *et al.*, 1991) also assumes that injury does not influence a person's wage rate; however, the authors do this for measuring the value of sick leave rather than other reductions in labor market activity.

[9]While the wage rates of those with acute conditions are not likely to be adversely affected by their conditions, the wage rates of those with chronic or disabling conditions will be. Such conditions impose direct limitations on labor market opportunities and also serve as the basis of discrimination against people with disabilities. This problem may also create a downward bias in their estimate of the wage rate if healthy (w_i^F), in that full-time, full-year workers include individuals whose illnesses or disabling conditions affect only the type, if not the amount, of work that they perform.

[10]Rice *et al.* do not assume that if all people were healthy, they would work in the paid labor force, however. LE for each age-gender group is multiplied by the percentage of the age-gender group with positive earnings.

[11]Estimates from the CPS show that in 1991 8.1 percent of the paid labor force work part-time, full-year; 18.4 percent work full-time, part-year, and 10.8 percent work part-time, part-year. The percentages working part-time or part-year have been increasing over time.

[12]Hensler *et al.* use the wage rate of demographically matched labor force participants as the basis of their estimates of morbidity. A sensitivity test for those 65-plus and females suggested that this approach overstated the earnings loss by about 15 percent (pp. 186–87).

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earn. Each of these concepts has meaning and relevance; they are similar to the concepts of "industrial output" and "potential output of industrial capacity" in appraising the utilization and the level of a stock of physical capital. In much the same way that one stochastic phenomenon (say, a hurricane) reduces the flow of output and the capability of the stock of productive physical capital to produce output, another stochastic phenomenon (say, disability/health limitations) reduces both the flow of earnings and the potential earnings flow from the stock of human capital. Preference for one or another of these concepts depends upon the question one wishes to answer.

While the LEC measure is appropriate for making intertemporal comparisons of the effects of changes in health-related conditions, that of Rice *et al.* is not. Their measure confounds the productivity effects of changes in health status with the effects of changes in preferences involving paid market work and changes in work incentives.

An example will make this clear. Consider the effects on the two measures of the rapid increase in the work effort of women (thought of as an increase over time in H^P). If this increasing supply of female labor is associated with the displacement of women with disabilities from the paid labor force, the estimate of lost earnings (LE) would also increase over time. Since our measure of LEC abstracts induced labor market effects from changed preferences of the nondisabled, its pattern over time would not reflect the change in such preferences. Our estimates remove these effects from $\bar{H}^P$, not $\bar{H}^A$.

The use of LEC, then, standardizes the hours component of earnings capability for nondisabled individuals ($\bar{H}^P$) to 2,000 hours in all years. Hence, the effects of changing preferences and incentives regarding the decision to enter the paid work force are eliminated from the calculation of the economic loss attributable to changes in disability/health limitations. In effect, LEC provides an estimate of the effects of changes in the underlying prevalence of disability/health limitations free of these confounding effects.[13]

A second difference between the Rice *et al.* indicator and LEC concerns the phenomenon whose effect is being measured. While Rice *et al.* measure the earnings losses associated with days of work lost due to "illness," we measure the potential productive capability lost due to "disability/health limitations." This, again, is a matter of the question to which an answer is sought. While Rice *et al.* have evaluated the effects of a variety of particular diseases or disease categories, our estimates are of the productivity losses attributable to a comprehensive set of disability/health limitations.

The third difference is perhaps the most important. For those who are in the labor force, Rice *et al.* measure the loss in the quantity of work (days of work) attributable to illness, and then value this quantity change by the daily earnings

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[13]It should be noted, however, that we do not control for changes in the returns to the services of human capital of those in the paid labor force (w^P) or for changes in the preferences or human capital returns for persons with disabilities/health limitations. Moreover, to the extent that the wage rates we observe reflect prior labor force experience which itself is influenced by prior tastes, attitudes, and transfer programs, our estimates may to some extent reflect these point-in-time effects. Our wage rates do reflect changes in wages due to changes in discrimination, which are not productivity-caused changes in wages.

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of all full-time, full-year workers.[14] Our measure accounts for the effect of limitations on *both* the change in the quantity of work potential *and* the value of the potential work-time (the wage rate). In short, while our measure reflects the impact of health-related limitations on both the price and quantity variables, the Rice *et al.* measure captures the effect of limitations on only the quantity variable.

A further distinguishing characteristic of our empirical estimates is their use of very detailed information on individuals. As a result, we provide more accurate estimates of potential earnings than is possible by using comparison groups that only crudely resemble groups of persons with limitations. For example, Rice *et al.* assume that the actual earnings of health-impaired people are equal to the average earnings of full-time, full-year employed individuals in the same age-gender category.[15] To the extent that we employ more detail—including information on a variety of human capital, location, and demographic characteristics—our estimates will have smaller prediction errors than those using cruder comparisons.[16]

One final difference is in the adjustments made for unemployment by the two measures. Rice *et al.* multiply LE for each age-gender group by the percentage of the group with positive earnings; this is consistent with a measure of lost earnings. We multiply our measure of LEC by age-gender-education–specific unemployment rates. This is a consistent adjustment for the macroeconomic limitations on the ability of individuals to utilize their human capital (earnings capability), as opposed to labor supply decisions reflected in earnings. Neither we nor Rice *et al.* consider the macroeconomic effects of increases in the size of the work force.

III. Estimating Lost Earnings Capability: Empirical Procedures

To calculate lost earnings capability for each individual identified as limited because of disability/health reasons (LEC$_i$), two numbers are required—AEC$_i$ and PEC$_i$. Here, we briefly describe the empirical procedures followed in estimating these values; more detailed discussions are available from the authors.

A. *Estimates of LEC for 1973 and 1988, Using CPS Data*

Our estimates of AEC$_i$ and PEC$_i$ for 1973 and 1988 rest on estimated earnings functions fit separately over four gender-race subgroups. We rely on micro-data from the March 1974 (for income year 1973) and March 1989 (for income year

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[14]Rice *et al.* also adjust earnings for earnings supplements (i.e. fringe benefits) with a flat percentage multiplier across all groups. It is desirable, but not possible, to create individual level adjustments for the observations in our data since CPS did not collect the needed underlying data in 1973. Below, however, we show the implications of applying a flat multiplier similar to that of Rice *et al.* to our estimates.

[15]We would also note that the present discounted value of the loss calculated by Rice *et al.* implicitly assumes that the work choices made by a person over his/her lifetime correspond to the choices made by current cohorts of a particular age. In fact, both labor force participation rates and work hours of males and females have changed substantially over time.

[16]Rice *et al.* rely on the less detailed comparisons because of the limited information on age and sex available from death records, and the desire to use the same methodology to value both morbidity and mortality losses.

1988) Current Population Surveys (CPS) for our estimates. The dependent variable in these equations is the observed level of earnings (in logarithmic form) of the individuals in the sample with positive earnings. The independent variables include a rich set of human capital and demographic characteristics (such as age, education, location, and family status), hours worked in the year, indicators of disability/health status, and an estimated selectivity correction term.[17]

The coefficients of these estimated functions and each individual's demographic and human capital characteristics are then used to obtain an unbiased prediction of both potential earnings capability (PEC_i) and actual earnings capability (AEC_i) of an individual of a particular gender and race.[18] The value of predicted earnings for an individual with a specified set of human capital and demographic characteristics will vary with stipulated values of the health status and hours worked variables.

PEC_i is the amount that individuals with limitations could earn if they were free of the reported disability or health conditions. With the relaxation of the effect of the disability/health limitation on both the wage rate and hours worked, the predicted earnings of individuals are obtained by setting the health status variables in the relevant gender-race earnings equations at levels indicating no limitations, and the hours worked variable at 2,000 hours. This prediction uses the estimated coefficients from the relevant earnings equations together with the actual values of the individual's demographic and human capital characteristics.[19]

AEC_i is the amount that persons with disability/health limitations could earn if they worked at the maximum level permitted by their conditions, and at a wage rate that reflects that these conditions. For each person classified as limited by the work limitation criterion, we predict annual earnings from the relevant gender-race earnings equation, setting the health status variables at their actual levels and the hours worked variable at 2,000 hours. This yields the predicted earnings of these individuals if they were to work full-time, full-year, given the nature of their health-limiting conditions.[20] Since individuals with disability/health limitations are constrained from working 2,000 hours, we adjust downward the predicted annual earnings value using information in the survey regarding restrictions on individual work-time. The survey information used to adjust the predicted earnings level includes the individual's weeks unable to work because of limitations and the extent to which these limitations cause part-time rather than full-time

[17]This last term for each year is obtained from a reduced form probit estimate fit over all working-age people for each gender-race group, distinguishing those with positive earnings from those who do not work, and is introduced into the relevant gender-race earnings equation to correct for the potential bias in estimating an earnings equation using data only on individuals who work (i.e. individuals who have selected themselves into the work force). See Heckman (1979).

[18]Predictions from the estimated earnings equations are unconditional, using the coefficients estimated with the selectivity variables included in the equations but not the coefficients on the selectivity variables.

[19]This predicted value of potential earnings capability is then adjusted downward to reflect the constraint on full-time, full-year work imposed by involuntary unemployment, using information in the CPS regarding the number of weeks of expected unemployment for the individual, given his/her race-gender-education characteristics.

[20]This predicted earnings level is adjusted for involuntary unemployment using the same procedure as for PEC_i, described in note 19.

work.[21] This adjusted value, then, is our estimate of the predicted earnings of the person with disability/health limitations reflecting the effect of the limitations on both the implicit wage rate and the potential hours worked.

For each individual classified as disabled/health-limited, the difference between PEC_i and AEC_i is our estimate of the earnings potential which is lost because of the limitations—LEC_i.

B. *Estimates of LEC for 1984, Using SIPP Data*

In calculating PEC_i and AEC_i for 1984, we first estimate both an hours worked and a wage rate equation (both in logarithmic form) over males and females in the Survey of Income and Program Participation (SIPP) data. The independent variables in the hours equation are designed to measure alternative time demands, labor market conditions, human capital, other personal characteristics, exogenous incentives to work, and variables reflecting disability/health limitations.[22] This equation is estimated as a tobit specification, designed to take into account the fact that a number of individuals do not participate in the paid labor force. Independent variables in the wage rate equation (fit over those individuals with positive hours worked) include a rich set of human capital and demographic characteristics, labor market conditions, and the same disability/ health limitation variables as included in the hours equation. This equation also includes a selection control variable obtained from the hours equation (see Maddala, 1983, p. 240).

Again, PEC_i is the amount that individuals with limitations could earn if they were free of the reported disability or health conditions. The predicted value of PEC_i is the product of the predicted wage rate (setting the health variables at levels indicating *no* disability/health limitation) and 2,000 hours of work. The coefficient on the selectivity variable is not employed in the prediction.

AEC_i is again the amount that persons with limitations could earn if they worked at the maximum level permitted by their conditions, and at a wage rate that reflects these conditions. AEC_i is obtained by adjusting both the wage rate and hours worked for the presence of disability/health limitations. Predicted wages are estimated by using the coefficients from the wage equation, including those on reported disability or health. This predicted wage is then multiplied by an estimate of the number of hours that individuals could work, given the nature of their health-limiting conditions.[23]

LEC_i is estimated by subtracting actual earnings capability (AEC_i) from potential earnings capability (PEC_i).

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[21]For people who were defined as disabled/health limited due only to their receipt of a disability benefit, AEC_i is taken to be the level of their observed earnings. People classified as limited by the work limitations criterion, and who do not work at all because of their disability/health limitation are assigned a zero AEC_i.

[22]Both self-reported limitations and functional ability (activities of daily living, or ADLs) indicators are available in SIPP.

[23]Again, the unemployment adjustments are as described in note 19.

A. *Estimates of the Disabled/Health-Limited Working-Age Population*

The first step in estimating lost potential earnings is to identify the working-age population who are disabled/health-limited; it is this population that loses potential earnings. As suggested in Section I, identifying the population with limitations is problematic and requires establishing a standard that is both judgmental and operational. Obviously, different definitions will yield varying rates of disability prevalence, which in turn affect estimates of LEC.

We identify the working-age, disabled/health-limited population using three approaches: for the CPS, (1) a self-reported work limitation and program participation measure (see Wolfe and Haveman, 1990); for the SIPP, (2) self-reported health status, and (3) functional disability. We chose these approaches largely on grounds of empirical tractability—each uses information from household surveys that also contain sufficient demographic, labor force, and income information to estimate LEC for the nation's working-age population over time. Although the health/disability information available from the CPS is less detailed than from other data sets, the rich demographic and labor force information and its availability over many years led us to rely on it for our intertemporal estimates.

The more detailed health data in the third wave of the 1984 Panel of the SIPP[24] are used to examine the robustness of our CPS-based estimates of LEC, and to permit LEC estimates at a point in time based on a range of definitions—representing a range of norms—of the health-limited population. Using both data sets, then we can examine the changes in LEC over time and the sensitivity of LEC to a range of definitions of the disabled/health-limited population.

In working with the CPS, we identify the population with limitations from reponses to questions regarding the reasons for not working full-time, full-year and the sources of income. Our definition is based on (1) reported limitations in the time an individual works (work activity last year; working part-year or part-time hours last year) and (2) the receipt of transfer income from programs for people with severe and long-term limitations (Social Security Disability Insurance, Supplemental Security Income, Veterans' Benefits for disabled persons, and Workers' Compensation).[25]

Two weaknesses of our CPS definition of the population with limitations should be noted. First, the work-limited category is composed of people who *self-report* being unable to work full-time, full-year because of limitations. For some respondents, claiming limitations may be endogenous to a decision to not work made for other reasons. Second, our program participation measure assumes that the eligibility criteria for receipt of disability benefits were the same in both 1973 and 1988. To the extent that the stringency of these criteria differs between the

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[24]For this panel, SIPP interviewed a nationally representative sample of twenty-thousand households once every four months for 2.5 years, beginning in October, 1983. Labor force data were regularly collected for this sample, but only in 1984 were sufficiently detailed health data collected to permit an estimate of the extent of health/disability problems.

[25]A more detailed specification of these two criteria for identifying the population with disability/health limitations is available from the authors.

years, our estimates of the population with limitations—and aggregate LEC—will reflect these differences.[26]

Table 1 presents our CPS-based estimates of the working-age population with limitations for both 1973 and 1988. We classify 9.8 percent of the working-age population (ages 18–64) as having disabilities/health-limitations in 1973, and 7.6 percent in 1988. The prevalence of persons with disabilities has been consistently greater among working-age men than among women, but the pattern of decreasing prevalence since 1973 is consistent across genders. The number of persons with limitations in our CPS estimates is smaller than those calculated using other data sets, and the reduction in the prevalence of such persons over time is somewhat more pronounced.[27]

We employ data from SIPP to present four alternative estimates of the working-age population with disability/health limitations. These results are presented in Table 2. A commonly used measure of health status is self-reported health on a five-point scale of poor to excellent; we identify the population with limitations as those who self-report poor or fair health. We find those with fair or poor health are 11.8 percent of the population, 10.9 percent of men and 12.7 percent of women. Table 2 also reports the prevalence of persons with functional disabilities, measured as performing with difficulty one or more—and two or more—work-related Activities of Daily Living (ADLs).[28] Finally, we define anyone who meets *either* of these definitions as disabled/health-limited.

The prevalence of persons with limitations across these four definitions ranged from 6.9 percent to 19.6 percent of the working-age population in 1984. The variation in prevalence rates across these definitions, each of which has a legitimate basis, highlights the difficulty in clearly defining the population with limitations using any existing data set.

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[26]Wolfe and Haveman (1990) find that the proportion of the population counted as disabled by this definition has been relatively stable as programs have changed. See also Burkhauser, Haveman, and Wolfe (1993).

[27]A recent report by the U.S. Bureau of the Census (1989) estimates the disabled/health-limited working-age population from 1981 through 1988, also using the CPS. The population with limitations in this study is composed of those persons less than age 65 who respond positively to the question "Do you have a health problem or disability which prevents you from working or which limits the kind or amount of work you can do?," plus those who report receiving SSI or Medicare. The pattern over time in the prevalence of disability by this definition is similar to that in Table 1, and the prevalence rate for males in that report also exceeds that for females.

The National Health Interview Survey (NHIS) data, which are used by many researchers to measure both the extent of disability and changes in it over time (Chirikos, 1989), indicate that 13.6 percent of the population aged 18–64 had some activity limitation in 1973, and that this decreased to 12.8 percent in 1988. If the disabled are restricted to those with a "major" limitation, the percentages in the two years become 10.0 and 9.3. Much of the reduction is among individuals aged 45–64.

The largest difference between the NHIS and our CPS estimate is for women. Our CPS-based definition rests upon a limitation in the ability to work, while the NHIS definition includes any activity or major activity limitation. Hence, some women who may have a health/disability condition but who have never been regular labor force participants may be excluded from our CPS-based definition. Our SIPP-based estimates do not rely on a work-related definition, and they reveal higher levels of disability and health problems among women.

[28]These incorporate both ADLs and instrumental ADLs and they include difficulty in, for example, lifting ten pounds, seeing with the aid of corrective lenses, hearing normal-volumed conversation, and walking a quarter of a mile.

TABLE I

NUMBER AND PERCENTAGE OF WORKING-AGE PERSONS CLASSIFIED AS
DISABLED: 1973 AND 1988

	1973		1988	
	Number (in millions)	% of Population Group	Number (in millions)	% of Population Group
Total	11.2	9.8	11.1	7.6
Ages				
18–24	1.4	5.6	1.0	4.0
25–34	2.1	7.4	2.2	5.2
35–44	1.8	8.2	2.5	7.1
45–54	2.9	12.7	2.3	9.7
55–64	3.0	18.0	3.0	15.9
Gender				
Male	6.4	11.4	5.9	8.3
Female	4.8	8.2	5.2	7.1
Race				
White	8.6	8.9	8.2	7.0
Black	1.9	16.3	1.9	11.5
Hispanic	0.6	11.2	0.8	6.8

Source: Authors' calculations from the March 1974 and 1989 Current Population Surveys.

B. *Estimates of Aggregate Lost Earnings Capability*

Our CPS-based estimates of aggregate LEC for the U.S. economy are presented in the first two columns of Table 3. We estimate that aggregate LEC was $131.3 billion in 1973 and $128.4 billion in 1988. From this, we conclude that disabilities/health-limitations reduced aggregate earnings capabilities in the U.S. by about 5.3 percent in 1973 and 4.5 percent in 1988. The average (mean) loss of earnings capabilities per person with limitations remained virtually the same over this period; it was $11,700 in 1973 and $11,600 in 1988.[29]

Two offsetting factors account for the constancy of aggregate LEC over the 1973 to 1988 period. Although the total number of working-age (ages 20–64) people in the nation rose from 108 million to 145 million over the 1973–88 period (an increase of 34 percent), the proportion of them with limitations actually fell (see Table 1).

The second bank of four columns in Table 3 shows estimates of LEC in 1984, obtained by applying our estimation procedures to the working-age population with limitations in SIPP. Although SIPP is unable to provide evidence of the *trend* in lost productivity due to limitations, it contains detailed information on limitations that enable us to examine the value of LEC using a range of definitions of the population with limitations. Table 3 presents four LEC estimates, each based on a somewhat different definition of the population with limitations.

[29]All dollar figures are reported in 1988 dollars. If we apply a flat multiplier similar to that of Rice *et al.*, our estimates of aggregate LEC in 1973 and 1988 would increase to $150.6 billion and $156.3 billion, respectively. LEC per person with disability/health limitations would be $13,400 in 1973 and $13,900 in 1988. Since fringe benefits have grown faster than wages and salaries, these estimates are higher in 1988 and 1973.

TABLE 2

Number and Percentage of Working-age Persons with Health Problems/Disabilities, 1984, Various Definitions

	Poor or Fair Health or with 1+ ADL Limitations		With 1+ ADL Limitations		Poor or Fair Health		With 2+ ADL Limitations	
	Number (in millions)	% of Population Group	Number (in millions)	% of Population Group	Number (in millions)	% of Population Group	Number (in millions)	% of Population Group
Total	24.0	19.6	18.2	14.9	14.4	11.8	8.5	6.9
Age								
19–24	1.6	9.6	1.0	6.0	0.9	5.3	0.3	2.5
25–34	4.0	10.8	2.8	7.6	2.1	5.6	0.9	2.5
35–44	5.0	17.2	3.7	12.9	2.6	9.1	1.5	5.1
45–54	5.9	28.6	4.7	22.6	3.6	17.6	2.2	10.8
55–64	7.4	41.0	6.0	33.0	5.2	28.6	3.5	19.5
Gender								
Male	11.0	18.3	8.2	13.7	6.6	10.9	3.5	5.8
Female	13.0	20.9	10.0	16.1	7.9	12.7	5.0	8.0
Race								
White	18.6	18.0	14.4	14.0	10.6	10.3	6.4	6.2
Black	4.1	30.4	2.9	21.3	2.9	21.9	1.5	11.3
Hispanic	1.3	23.1	1.0	16.8	0.9	15.8	0.5	8.9

Source: Authors' calculations from SIPP, 1984 Panel.

TABLE 3

AGGREGATE LOSS OF EARNINGS CAPABILITY (LEC) DUE TO HEALTH PROBLEMS/
DISABILITIES: 1973, 1984, AND 1988
(in 1988 dollars)

			1984			
	1973	1988	Poor or Fair Health *or* with 1+ ADL Limitations	With 1+ ADL Limitations	Poor or Fair Health	With 2+ ADL Limitations
Percentage of population	9.8	7.6	19.6	14.9	11.8	6.9
Aggregate lost earnings capacity (in billions of dollars)	$131.3	$128.4	$284.5	$227.4	$191.9	$130.8
LEC as a percentage of the entire working-age population's EC	5.3%	4.5%	10.6%	8.5%	7.2%	4.9%
LEC per person with health problems/disability (in thousands of dollars)	:$11.7	$11.6	$11.9	$12.5	$13.3	$15.5

Source: Authors' calculations from March 1974 and 1989 CPS, and SIPP, 1984 panel.

The largest estimate of LEC—$284.5 billion, or 10.6 percent of the total earnings capabilities of the nation's working-age population in the absence of limitations—is for the 19.6 percent of this population who *either* reported poor or fair health on the five-point health scale *or* who reported one or more limitations in Activities of Daily Living (ADLs). This value is substantially larger than that estimated from the CPS data, and the reason for this difference is clear. The definition of the population of persons with limitations on which the SIPP estimate is based—anyone with a health compromise on either criterion—is far more inclusive than that used in the CPS calculations. More than twice the proportion of the working-age population were disabled/health-limited according to this SIPP definition (19.6 percent) as opposed to the CPS definition (9.8 percent in 1973; 7.6 percent in 1988).

The smallest SIPP estimate of LEC in Table 3 is for the 6.9 percent of the working-age population who reported limitations in two or more ADLs. This population, which included only those with quite severe limitations, yielded a very high average LEC of $15,500 and an aggregate LEC of $130.8 billion. This SIPP population comes the closest in size to the population of persons with disabilities defined in the CPS—6.9 percent versus 7.6 percent in 1988—and has an estimated LEC which is very close to that in the CPS—4.9 percent of estimated aggregate healthy earnings capacity as compared to the 1988 CPS estimate of 4.5 percent. The remaining estimates based on other definitions of limitations are in between these.

C. *Estimates of Lost Earnings Capability for Specific Groups*

Tables 4 and 5 present details of our CPS and SIPP estimates of LEC, breaking down the calculations into age, race, gender, and education groups.

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The results for the CPS calculations (Table 4) show that LEC per working-age person fell over the fifteen-year period from $1,100 to $900. This reflects both the small decrease in aggregate LEC and the increase in the size of the working-age population.

Our results on the composition of LEC indicate that mean levels generally increase with age. In 1988, those aged 18–24 who were disabled/health-limited had a mean LEC of $6,200 [implying a 48 percent loss of potential earnings capability (PEC)]; those aged 25–34 had a mean loss of $8,600 (or 51 percent); those aged 55–64 had a mean loss equal to $15,200 (or 78 percent). These percentage losses were greater in 1988 than in 1973 for all age categories except the youngest.

The value of LEC by gender indicates a greater total and mean LEC for men than for women with such limitations. This pattern is expected, and reflects the greater labor market experience and wage rates of men. The pattern is more complex than this observation, however; LEC as a percentage of potential earnings capability (PEC) is substantially greater for the average woman with limitations than for the average man. In 1973, for example, the mean LEC for women was $9,100, implying a 67 percent loss of potential earnings. For men with limitations, mean LEC was $13,600, implying a 48 percent loss of potential earnings capability. While the typical woman with limitations lost about two-thirds of her potential earnings capability because of the conditions, the typical male lost only about 50 percent. By 1988, the proportional loss of potential earnings across males and females with limitations had substantially converged—it stood at about 60 percent for men and 66 percent for women.[30] The relative loss to men with health limitations had clearly increased over this period.

The racial differences in average LEC as a proportion of potential earnings capability ranged from 66 percent for blacks with limitations to 51 percent for whites in 1973, and from 72 percent for blacks to 61 percent for whites in 1988. However, the absolute mean loss for whites was substantially larger than that for blacks.

The mean loss in potential earnings capability was greater for health-limited persons with more human capital, as measured by level of education. This was true in both 1973 and 1988, but the difference had grown over time. This pattern is consistent with the growing differential in earnings by education over this period across the entire population.

Lost earnings capabilities (LEC) per person with limitations was very large. Moreover, this average loss as a proportion of their potential earnings capability increased over time—from about 53 to 62 percent. For men, in particular, the ability of those with limitations to productively use their earnings capabilities declined from the early 1970s to the late 1980s. However, because LEC per disabled/health-limited person remained constant at about $11,700, this increase in loss as a percentage of potential earnings capability (PEC) was primarily attributable to the reduction in the estimated PEC of the disabled population from $22,113

[30]Although not shown in the tables, the factor that changed substantially over this period was the reduction in average male potential earnings capability (PEC), a pattern that reflects the erosion in the average real earnings of full-time, full-year employed males over this period.

to $18,660 (not shown in the tables). This reduction reflects the general deterioration of real earnings in the U.S. economy over this period, along with an erosion of the underlying human capital and changes in demographic characteristics (e.g., education, age) that determine earnings potential. Hence, the decline in aggregate LEC from $131.3 billion to $128.4 billion was due primarily to the decline over time in the number of individuals with limitations.

The 1984 results based on the SIPP (Table 5) confirm the robustness of the patterns of lost potential earnings observed in Table 4. For each of the four definitions of the population with limitations, mean LEC rises with age and education, and is greater for males than for females and for whites than for blacks and Hispanics. The patterns of LEC as a percentage of potential earnings capability are also replicated across the alternative definitions. The proportional losses rise with age, are higher for blacks and Hispanics than for whites, and decrease with years of education.

TABLE 4

Loss of Earnings Capability (LEC) Due to Health Problems/Disability,
1973 and 1988
(in 1988 dollars)

	1973			1988		
	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)
Total population	1.1	5.3	131.3	0.9	4.5	128.4
Population with disabilities	11.7	52.9	131.3	11.6	62.3	128.4
Age						
18–24	9.0	54.7	12.2	6.2	48.3	6.5
25–34	9.4	41.5	20.4	8.6	51.3	19.4
35–44	10.7	46.2	19.0	11.3	54.1	28.1
45–54	12.8	51.8	37.1	12.8	64.6	29.5
55–64	14.1	66.5	42.6	15.2	78.3	45.0
Gender						
Male	13.6	47.5	87.7	14.2	60.4	83.4
Female	9.1	66.6	43.6	8.7	66.0	45.0
Race						
White	12.3	50.9	107.0	12.4	60.7	101.8
Black	9.7	66.2	18.6	9.8	72.4	18.7
Hispanic	9.8	58.1	5.6	8.6	62.2	7.9
Education						
0–11	11.0	62.9	60.8	10.1	76.9	42.6
12	11.6	49.6	41.7	11.4	59.6	48.8
13–15	12.5	45.0	17.0	12.5	54.0	20.1
16+	15.6	39.8	11.8	18.3	54.0	17.0

Source: Authors' calculations from March 1974 and 1989 CPS.

However, there are two differences between the CPS and SIPP results concerning males and females. First, the estimates of the proportional losses for females are closer to those of males in the SIPP data than in the CPS estimates. Second, in the SIPP estimates a larger proportion of total aggregate LEC is lost by females than in the CPS estimates—about 43 percent versus about 34 percent. These differences are due to the varying information on limitations available in

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TABLE 5

Loss of Earnings Capability (LEC) Due to Health Problems/Disability, 1984, Various Definitions of Persons with Disabilities
(in 1988 dollars)

	Poor or Fair Health or with 1+ ADL Limitations			With 1+ ADL Limitations			Poor or Fair Health			With 2+ ADL Limitations		
	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)	Mean LEC ($ thousands)	LEC as % PEC	Aggregate LEC ($ billions)
Total population	2.3	10.6	284.5	1.9	8.5	227.4	1.6	7.2	191.9	0.8	4.9	130.8
Population with disabilities	11.9	59.4	284.5	12.5	61.9	227.4	13.3	69.4	191.9	15.5	81.8	130.8
Age												
19–24	6.9	52.1	11.3	7.0	52.9	7.1	7.7	58.9	6.9	9.4	76.9	2.9
25–34	9.1	53.6	36.6	9.5	54.6	26.9	9.9	62.9	20.8	12.7	78.5	11.8
35–44	11.2	55.4	56.0	11.7	56.7	44.0	12.3	66.4	32.5	15.3	78.9	22.5
45–54	12.9	59.8	76.3	13.4	62.1	62.5	14.2	70.5	51.6	15.8	82.6	35.3
55–64	14.1	65.1	104.2	14.5	68.6	86.9	15.5	73.2	80.1	16.6	83.4	58.4
Gender												
Male	14.9	58.2	163.7	15.5	59.8	127.9	17.3	69.5	113.2	20.4	81.4	70.6
Female	9.3	61.2	120.7	9.9	64.7	99.5	10.0	69.2	78.7	12.1	82.3	60.2
Race												
White/Other	12.8	58.7	236.9	13.3	60.8	190.9	14.7	69.5	155.2	16.7	81.4	107.6
Black	8.8	63.1	35.9	9.6	68.2	27.2	9.5	69.0	28.0	11.4	83.9	17.2
Hispanic	8.6	63.5	11.7	9.4	68.1	9.3	9.4	69.9	8.7	11.4	82.8	6.1
Education												
0–11	10.2	64.9	103.4	10.9	69.1	84.3	11.2	72.1	80.1	12.9	83.5	57.5
12	11.5	58.0	102.8	12.1	60.2	80.4	13.5	67.8	68.2	16.0	81.1	42.1
13–15	13.4	57.1	40.4	13.9	58.2	31.9	16.0	67.9	24.9	19.1	80.6	17.2
16+	19.6	52.9	37.8	19.7	53.3	30.8	25.9	66.9	18.7	28.9	78.6	14.1

Source: Authors' calculations from SIPP, 1984 Panel.

the two data sets and the resulting greater prevalence of limitations among females in the SIPP data.[31]

The pattern of decreasing estimates of aggregate LEC as more restrictive definitions of the population with limitations are used is replicated across age, gender, race, and education groups.

V. CONCLUSION

Our estimates of the loss in earnings capabilities and productivity in the mid-1980s attributable to the prevalence of disabilities/health-limitations in the U.S. working-age population (LEC) range from about $131 billion annually for a narrowly defined population of persons with limitations (composing about 7 percent of the working-age population) to about $285 billion annually for a broadly defined population with limitations (one including nearly 20 percent of the working-age population). These figures imply a loss ranging from about 5 percent to about 10 percent of the potential earnings capability (PEC) of the entire U.S. working-age population.

For the CPS definition (and for a population of persons with limitations comparable in number to that based on the SIPP definition of those with two or more ADLs), the aggregate loss of earnings capabilities (LEC) was about 4–5 percent of potential labor earnings—and hence productivity—in the mid-1980s. The presence of these limitations cost the average person with limitations about 59 percent of their potential earnings for the broader SIPP definition and about 82 percent for the narrow definition based on limitations in at least two ADLs. For the CPS definition, the percentage loss of potential earnings increased from 53 percent in 1973 to 62 percent in 1988.

We find that lost earnings capabilities due to disability/health limitations (LEC) in this country declined slightly from the early 1970s to the late 1980s, from 5.3 to 4.5 percent of the potential earnings capability of the working-age population. We attribute this decrease to the reduction in the number of persons with limitations, rather than a reduction in the lost earnings capabilities per person with limitations. This latter value (LEC) remained constant at about $11,700. The number of individuals identified in the 1988 CPS as limited lies close to that identified in the SIPP data using the definition based on the presence of two or more ADL limitations.[32] The SIPP results also provide insight into the link between limitations and the loss in potential earnings. They show a strong positive relationship between the loss of potential earnings capability and the size of the population with limitations. The full definition of limitations that includes all people that report poor or fair health or one or more ADL limitation suggests

[31]As noted above, the CPS limitation criterion relies in part on self-reported work limitations and in part on participation in disability-related transfer programs; as a result it probably underestimates the number of women who are classified as limited. Since the program participation component of the CPS criterion generally requires a prior work history, LEC as a proportion of potential earnings capability is greater for females than males using CPS. The SIPP definitions are independent of work-related considerations.

[32]It should be emphasized, however, that the two populations are probably quite different in the composition of their limitation characteristics. There is little reason that the CPS definition and the two-plus ADL definition should identify the same populations of persons with limitations.

an upper bound on the loss in potential earnings and productivity due to disability/health conditions.

We would again emphasize that our LEC measure is designed to increase the accuracy of estimates of market-valued productivity loss by measuring the full reduction in potential earnings capabilities due to disability/health limitations.[33] As a measure of the loss of economic productivity, our LEC estimates take into account far more detail on individuals and reflect a rather different concept of economic loss—loss in the value of potential human capital services, rather than the loss in earnings—than others available in the literature.[34] Our estimates are also available over time, hence allowing for intertemporal comparisons with both the number of individuals classified as disabled/health-limited and the volume of public transfers targeted at this population.

The decline in the calculated loss of earnings capabilities (LEC) is encouraging and suggests that the U.S. economy is, on average, less earnings-constrained by disability/health limitations today than fifteen years ago. However, for those with limitations, the absolute value of mean LEC has not declined. Indeed, relative to their potential earnings capability (PEC), the loss incurred by those with limitations has increased.

As disability transfer rolls grow, one has the tendency to think that either the health status of our country has deteriorated or that the disability transfer programs (Social Security Disability Insurance and Supplementary Security Income) have determined that more persons are eligible. Our LEC estimates offer an alternative view: (1) the proportion of our working-age population with health/ disability limitations has not grown, but (2) the LEC per disabled person has grown. This growth in LEC may explain the recent growth in disability transfer recipients: those persons with disabilities are doing worse in the labor market (their LEC as a percentage of PEC was greater in the late 1980s than in the early 1970s). To offset this loss, more persons with disabilities/health problems may be applying for and being declared eligible to receive SSDI/SSI benefits.

[33]Our mean loss in earnings capability (LEC) can be compared to the calculations of Chirikos (1989). Our calculated mean LEC among disabled/health-limited people is $11,600 for 1988. This is substantially larger than Chirikos' estimate of the mean loss of earnings due to health-related limitations of $6,500 (1988 dollars). (Chirikos' estimates are calculated from his Tables 1 and 2c). An average which excludes Chirikos' working youth population (ages 15–24) does not substantially raise the mean. A major cause of this difference is that the estimated earnings of persons with no limitations (the denominator of his ratio) do not reflect work hours that are at levels equal to their capabilities; for example, low labor force participation rates among women reduce Chirikos' mean. However, our mean LEC among males with limitations is $14,200 (not shown), about 131 percent of Chirikos' estimate of $10,800 of mean lost earnings for males with limitations.

[34]It should be noted, however, that all estimates of the work-related losses attributable to disability/health limitations, excluding Chirikos and Nestel (1985), rest on a static model of the determinants of potential earnings capability. In such models, the early presence of a disability/health limitation is not permitted to affect the values of background characteristics such as education that determine estimated potential earnings capability (PEC). Should early disability/health limitations reduce educational attainment below what it would be in the absence of the limitation, our estimate of LEC would be biased downward. Nor do these models include the effect of prior poor health on wages of those who currently are in good or excellent health. Only individual longitudinal data extending over several years could correct this problem.

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