Aggregate Economic Losses from Disability in the United States: A Preliminary Assay

THOMAS N. CHIRIKOS

University of South Florida

DISABILITY POLICY MAKERS SHOULD TAKE A broad view in formulating intervention strategies, but they rarely do. A primary reason is that the knowledge base or literature that supports their efforts tends to be highly segmented, each part focusing narrowly on a demographic subgroup that is similarly handicapped or served by a specific type of public insurance scheme. One part of the disability literature is riveted on the dramatic postwar rise in work disability of middle-aged adults and the concomitant growth in income transfers, especially the development of the Social Security Disability Insurance program (Burkhauser and Haveman 1982; Stone 1984). Another literature has developed on the enormous increase in the number of disabled elderly persons over 65 years of age and the prospect that scarce resources will have to be reallocated across generations to provide long-term care for ever greater numbers of these persons as mortality risks at older ages continue to fall (Crystal 1982; Torrey 1982). Yet another literature is accumulating on the rapidly expanding number of lifelong profoundly disabled persons, particularly very young disabled children, and the corresponding need for educational and health service programs to care for them over their lifetimes (Ireys 1981; Newacheck, Budetti, and Halfon

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1986). Despite their common links, these disability issues are rarely viewed integrally or as constituent elements of a common policy problem. With exceptions such as Colvez and Blanchet (1981), Wilson and Drury (1984), and Kenney (1987) that examine all age/sex categories, even the descriptive epidemiology of rapid growth in disabling health conditions across demographic subgroups is typically considered piecemeal and without much concern for the structural interrelationships in prevalence patterns attributable, say, to significant mortality improvements at very young ages (Lubitz and Pine 1986). With the possible exception of Mushkin's (1979) work, the more significant questions of how the social costs imposed by recent trends in the disablement of these various subgroups compare or add up is rarely addressed at all. But an overall accounting of the epidemiology and economic impacts of disability is a sine qua non in formulating rational and workable policy. Additional research that integrates the disparate strands of the disability literature in this regard is especially needed.

This article estimates both the aggregate economic losses exacted by functional disablement in the United States in 1980 and the extent to which this toll changed over the period from 1960 to 1980. The analysis pulls together what is known about the size and composition of the entire disabled population as well as the direct and indirect economic consequences of various handicaps to compute these social costs. The analytic results contribute not only to the needed integrated view of the disabled population, but also provides two kinds of strategic information about the disability problem for policy makers:

1. By a line of reasoning long familiar to economists, aggregate economic losses gauge the overall value of resources that can be allocated to interventions designed to reduce the incidence and prevalence of disabling conditions; they also provide guidelines for setting the level of transfer payments to the irreversibly disabled. Put somewhat differently, aggregate economic losses measure the total social benefits that disability programs can achieve and, thereby, index the relative priority of such endeavors in public budgets. In somewhat more practical terms, per capita losses reflect the expected value of preventing (or delaying for one year) a prevalent case of disablement, and per capita figures may be used in benefit-cost studies of disability programming proposals. Per capita and total losses may also be compared to the level and rates of change in spending on disability transfer

programs to cast some light on the fraction of the economic burden of disability that is relieved by such expenditures.

2. Because the aggregate cost computations are built up from more disaggregate estimates of various economic tolls exacted from different disability subgroups, the analytic results also provide some basis for establishing priorities among alternative disability interventions aimed at different groups of disabled persons. In an era of limited resources, policy makers need to know which rehabilitation investments yield the highest returns. Variations in economic losses across demographic subgroups attributable to differences in prevalence rates, severity levels and direct:indirect cost ratios clearly influence these investment returns. Equally significant is that redistributive or ameliorative policies can be judged as equitable only if, say, the fraction of disability costs defrayed by public transfers is roughly equal across disability subgroups or if there is some prior agreement about precisely how unequal these fractions should be. Scarce resources allocated to disablement may be used unfairly and unwisely if one disabled subgroup successfully presses its claims at the expense of all others in the absence of such an accounting. While social judgments about the resources to be devoted by society to relieve the burden imposed by disabling health conditions can only be determined through the political process, knowledge of the distribution of that burden serves usefully in allocating those resources to where they can do the most good. Estimated losses by sex and age categories, degree of severity and type are thus compared in this study to draw inferences about the efficiency and equity of the mix of disability programs presently carried out in the United States.

The quantitative work in this article is characterized as a preliminary assay, primarily because the current knowledge base on the economic consequences of poor health has not yet developed fully enough to support more definitive estimates. Viewed from this vantage point, the enumeration of disability losses is simply a heuristic device for summarizing the available literature on the economics of functional disability and appraising its value to the policy process. Its preliminary status notwithstanding, the assay is able to highlight some key economic questions that must be addressed by those charged with the responsibility of designing policy in this area. Although these eco-

nomic aspects are neither the only nor necessarily the most important considerations in formulating disability policy, few would deny that they have a legitimate role to play in any debate about the future direction of that policy. Of course, the analysis also provides some methodological guidance for more disaggregate studies of the economic burden imposed by specific disabling conditions or the benefits to be achieved by particular rehabilitation or prevention programs. In both cases, future research needs are identified by the readily observed shortcomings of the analysis.

The plan of the article is as follows. The first section discusses the concept of economic losses from disability in greater detail and then briefly describes the methods used to prepare estimates of the aggregate of such losses at a point in time. A somewhat more extensive variant of the standard human capital approach is used as an analytic framework in this article to account for the influence of disablement on the economic welfare of the families or households of disabled individuals. Prevalence estimates of the disabled population classified by age, sex, and degree of severity as well as the aggregate disability losses incurred by that population are then presented for 1980, the most recent year for which sufficient data were available to prepare such figures. This section discusses some of the literature on the direct and indirect economic effects of disability upon which the estimates are based. The next section carries out a simulation of temporal trends in the aggregate costs of disability in an attempt to ascertain the extent to which such losses may be growing over time. The final section appraises the weaknesses of the estimates, discusses some substantive and methodological conclusions of the analysis, and sketches the direction that future research on this topic should take.

Analytic Framework

Concept of Disability Losses

How economic losses from disability are defined depends in the first instance on how disability itself is defined. This study draws on the increasingly standard pathology/impairment/disability triad in conceptualizing disability as departure from normal role functioning attributable to a health-related condition (Nagi 1976). This framework not only permits consistent treatment of functional incapacity at various stages of the life cycle, but it can be operationalized with available

national data. Disability costs are conceptualized in turn as the value of reduced household consumption resulting from the inability of at least one member of that household to perform normal role functions, net of any transfer payments stemming from the disability itself (Inman 1987). Households with impaired members do not incur disability losses unless role dysfunction is in evidence.

When dysfunction occurs, economic losses may arise in several ways. In the simplest case, a disabled adult is expected to decrease the amount of time committed to market work and/or face lower wage rates so that market earnings are reduced. (This is called a primary loss in the analysis below.) The likelihood of this reduction is unambiguous; the magnitude, however, depends on the severity of the disabling health condition, the direct effects of that condition on time spent at market work, and the indirect effects on that time stemming from wage changes. Other adult members of a household with a disabled person (of any age) may also reduce their time commitment to market work in order, say, to provide additional care in the home for the disabled person. The likelihood of these adjustments are theoretically ambiguous; but a set of plausible hypotheses for empirical testing follows conveniently from the standard family labor-supply model widely used by labor economists over the recent past (Killingsworth 1983). This model is predicated on the basic notion that (given asset income) opportunity costs of time dictate whether individuals reallocate time spent in market and home activities when they are, or a member of their family is, disabled. In general, disablement is expected to raise the value of time spent by family members in home production, thereby reducing hours of market work and the ability to consume market goods. The economic welfare of a household dependent on market earnings, then, may be reduced by disability, irrespective of whether the disabled member is a working adult. (This reduction is referred to as a secondary loss in the analysis below.)

Consumption losses also arise by the need to purchase goods and services to deal with the disablement. Such purchases are generally, although not exclusively, medical care services and appliances needed after the acute phase of the health impairment to maintain the disabled person. It must be noted that the gross value of these goods and services is the relevant yardstick for disability losses, not the net or out-of-pocket price. In the cases of expenditures for travel to care facilities, home remodeling, special diets, and the like, there is, of

course, no difference between gross and net outlays. For medical care, out-of-pocket or co-insurance payments could be used, but the total gross value is the more appropriate figure for social accounting purposes. Yet, to the extent that family budgets prior to any disability episode include spending for routine, acute care, only net medical care purchases attributable to the disability—i.e., the difference in medical care utilization before and after the disabling condition occurs—should be included in consumption losses. Note that these purchased goods and services and time spent in home production may be substitutable to some degree. Paid help to care for the chronically disabled person in the home may be substituted for the unpaid home time of family members. In the extreme case, the very severely disabled person or the disabled single householder is institutionalized and all health maintenance is, in effect, purchased in the market.

There are obvious similarities between the disability loss concept and other frameworks used to quantify the social costs of health problems. Cost-of-illness (COI) studies using the so-called human capital approach are a case in point (Rice, Hodgson, and Kopstein 1985). Earnings reductions of disabled individuals are virtually identical conceptually to the indirect output losses estimated in the COI framework, although because COI studies allocate costs to specific disease entities, these output losses include both acute (short-term) and chronic (long-term) earnings reductions attributable to the disease. Only chronic reductions are relevant to the notion of disability losses. Expenditures on medical care services, of course, are included in COI studies under the rubric of direct costs. As in the indirect case, all medical care expenditures allocated to a given disease are included; non-health care expenditures, however, are typically excluded. A major difference, though, is that COI studies always account for mortality costs, i.e., the discounted present value of earnings lost through premature death. This cost component would be easy to add, but it has been excluded in this study on the grounds that disability policies are designed fundamentally to improve the quality of life, taking life expectancy as a given. (Omitting mortality costs requires only that prevalence accounting is used in estimating disability losses.) Because mortality costs are excluded, because both primary and secondary earnings losses are estimated, and because health care spending is taken net of such expenditures by the nondisabled, I have deliberately avoided references in this article to the aggregate "cost" terminology

commonly used in COI studies. Disability losses conceptualized in this fashion should be roughly similar to, but lower than, COI cost estimates. Since even COI computations are usually considered understated by their failure to account for the "pain and suffering" costs of health problems, the calculations presented below must be considered *minimal* economic effects of disablement at a point in time.

Estimating Disability Losses: Methodologic Overview

Three kinds of quantitative information are needed to prepare estimates of aggregate disability losses as conceptualized above: (1) disability prevalence figures divided by level of severity and sociodemographic characteristics that may contribute significantly to variations in losses across disability subgroups; (2) estimates of reduced market time by both chronically disabled persons and members of their households, together with data on the economic value or opportunity costs of that time; and (3) estimates of the dollar value of net differences in medical care utilization and other types of household spending imposed by the disability. Clearly, no available data set can provide the requisite information completely, so the only viable option involves piecing together items from different data sets and/or analyses in the published literature. A detailed account of these sources and methods exceeds the space limitations of the article so the following summary points must suffice:

1a. Information from the National Health Interview Survey (NHIS) published in *Vital and Health Statistics*, series 10, various numbers, especially 12, 137, and 144, supplemented by U.S. Bureau of the Census (1973, 1984) data on institutionalized persons were used to produce consistent estimates of the size and composition of the disabled population for 1960 and 1980. More specifically, NHIS estimates of the number and percentages of noninstitutionalized Americans reporting themselves as either incapable of performing *major* activities or limited in the amount or kind of *major* activity they can perform because of a chronic health or physical condition are counted as disabled persons. For adults of working age, major activity refers principally to market work, although inability/limitations in performing housework are also tabulated. For children, abilities to attend school or engage in play are used as disability criteria. The interpretation

of major activities in the case of elderly persons is substantially more ambiguous; self-reports here probably refer to some mixture of capacities for market work, housework, and activities of daily living. Given these differences, disability prevalences (and corresponding losses) are divided by sex and six different age groupings. That NHIS data are self-reported bears repeating. Such figures necessarily differ from the number of disability program beneficiaries or the number of disabled yielded by other objective classification criteria. Self-reporting of disability may also be biased upwards by the economic and labor force status of respondents (Chirikos and Nestel 1984; Parsons 1982); we return to this point below.

1b. Surveys of the noninstitutionalized population provide only a partial count of the number of disabled persons. Accordingly, the number of individuals institutionalized for putative health reasons are added to the number of NHIS noninstitutionalized disabled to round out the enumeration of the disabled population. Included here, among others, are individuals institutionalized in nursing homes, psychiatric hospitals, chronic disease hospitals, and homes/schools for the physically and mentally handicapped. The number of institutionalized disabled persons is, of course, added to the population denominator used in computing prevalence rates. (The population denominator that is used, then, is essentially the resident, civilian population adjusted for individuals in correctional institutions.) Institutionalized persons are categorized along with all noninstitutionalized individuals reporting themselves unable to perform major role responsibilities as *severely* disabled; all other disabled persons, i.e., those noninstitutionalized persons reporting limitations in the amount or kind of major activity performed, are categorized in this article as *moderately* disabled.

2. Estimated disability losses attributable to primary and secondary reductions in market time were prepared by various means, generally by applying expected reductions in annual hours of work by the disabled and members of their households in each sex/age group to age- and sex-specific expected wage rates. Expected reductions of hours were gleaned from a reasonable detailed review of the multivariate results in published econometric studies on the relation between poor health and labor supply as well as recent descriptive studies on informal care givers: among others, studies by Berger (1982), Berger and Fleisher (1984), Chirikos and Nestel (1981, 1983, 1984, 1985), Feller

(1983), Inman (1987), Lambrinos (1981), Lui, Manton, and Lui (1985), Luft (1975), Parsons (1977), Passmore et al. (1983), Salkever (1982a, 1982b, 1984), Scheffler and Iden (1974), and Stone, Cafferata, and Sangl (1986) were consulted for these purposes. Sex- and age-specific expected wage rates for valuing lost market time were computed from census data (U.S. Bureau of the Census 1982) scaled by the Bureau of Labor Statistics employment/population ratios and, where applicable, household status rates assembled by the author. The use of average wage rates to value reduced market time may appear to overstate (primary) disability losses because the impaired health and human capital characteristics of disabled persons are ordinarily thought to force them to work for lower wages. Yet, in contrast to labor supply per se, statistically significant effects of chronic health conditions on wage rates are not always detected in the econometric literature (Chirikos and Nestel 1985). Furthermore, a recent study by Johnson and Lambrinos (1985) suggests that a significant portion of the observed wage differential of handicapped persons stems simply from discriminatory employer practices rather than any putative difference in marginal productivity. (Lower wages may also be due, of course, to the added costs to employers of hiring and training disabled workers as well as to other forms of labor market discrimination based upon race and/or sex.) There is, in other words, sufficient controversy and uncertainty about the wages facing disabled workers that using (age/sex specific) mean wages to value lost time simplifies the estimation procedure.

3. Since net medical care spending and other decrements to household consumption attributable to chronic disablement have not been studied extensively, only relatively crude estimates of these losses based on available survey results could be prepared. NHIS figures on use of physician and hospital services by nondisabled and disabled persons classified by severity level form the primary basis for estimating net differences in disability-related consumption in 1980. NHIS differences in physician visits and hospital stays were valued at mean 1980 charges reported in the National Medical Care Utilization and Expenditure Survey (Garfinkel, Wheeless, and Corder 1985). Results of that survey were also used to estimate spending on ambulatory care other than physicians, drugs, and appliances/special aids. The estimate of this latter category was buttressed by information from the National Health Care Expenditures Survey (Berk, Cafferata, and Hagan 1984),

but it is still only a rough approximation. Expected charges for the institutionalized disabled were computed by annualizing mean monthly charges by age and sex reported in the *1976 Survey of Institutionalized Persons* (U.S. Bureau of the Census 1978), correcting for price differences in 1980 by means of the (all items) Consumer Price Index, and adjusting for the medical care utilization patterns of institutionalized persons. Results from the *1982 Long-term Care Survey* (Liu, Manton, and Liu 1985; Stone, Cafferata, and Sangl 1986) were used to piece together estimates of paid household work, and some ad hoc studies such as Bloom, Knorr, and Evans (1985) on children with cancer were used to fashion rough estimates of nonhealth care spending for travel, diets, etc., attributable to disablement. Various other studies on health care use by special disabled groups were also consulted for these purposes, e.g., Butler et al. (1985) and Newacheck (1987).

Estimated disability losses of each type for each sex/age grouping were then applied to disability prevalence data to compute aggregate economic losses from disablement. (Illustratively, if the mean annual reduction in primary market time of a particular sex, age, and disability severity group was determined, say, to be 250 hours, the mean hourly wage rate of the group was $6.00, the employment/population ratio was 0.85 and prevalence was 400,000 persons, aggregate losses for this group would be 510 million dollars, and so forth.) Because the estimation procedure is fairly crude, aggregate figures on losses were rounded liberally to the nearest million dollars. In the narrative below, most estimates are rounded even further to billions of dollars.

Aggregate Disability Losses in 1980

Disability Prevalence

Table 1 presents estimates of the size and composition of the disabled population in 1980 used in computing aggregate economic losses from disability in that year. As can be seen, about 26 million Americans were disabled by the criteria used in this study; about 10 million of these persons were disabled severely enough either to have been institutionalized or to have been completely unable to perform major

TABLE 1
Composition of the Disabled Population, 1980

Age groups	Male				Female			
	Number (000)	Prevalence rate per 1,000			Number (000)	Prevalence rate per 1,000		
		All disabled	Severely disabled	Moderately disabled		All disabled	Severely disabled	Moderately disabled
Working	*7,229*	*103.0*	*48.9*	*54.1*	*6,764*	*90.8*	*13.6*	*77.2*
Youth 15–24	737	37.3	11.9	25.4	605	29.7	5.9	23.8
Adults 25–44	2,151	73.1	26.6	46.5	2,079	66.4	8.1	58.3
Adults 45–64	4,341	207.2	115.0	92.2	4,080	178.7	28.0	150.7
Dependent	*5,321*	*149.0*	*92.6*	*56.4*	*6,388*	*161.9*	*56.9*	*105.0*
Children <15	605	23.7	2.6	21.1	463	18.9	2.1	16.8
Elderly 65–74	2,855	423.3	272.8	150.5	2,779	317.2	69.5	247.7
Elderly >74	1,861	538.0	404.2	133.8	3,146	503.3	253.7	249.6
All groups	*12,550*	*118.5*	*63.6*	*54.9*	*13,152*	*115.4*	*28.6*	*86.8*

Source: Author's estimates based on NHIS and Census data (see text).

role activities even though they lived in the community. This means that roughly one in nine Americans of either sex was disabled in 1980, with one in 16 men and one in 35 women categorized as severely disabled. As might be expected, these figures differ somewhat from other available estimates of the numbers of disabled persons, but they fall within reasonable limits of those other estimates. To illustrate, I have shown elsewhere (Chirikos 1986) that NHIS estimates of major activity limitations for the noninstitutionalized population aged 18 to 64 lie between fairly high Social Security Administration figures and lower Census Bureau estimates. Prevalence rates of severely disabled elderly persons given in table 1 are tolerably close to recent findings on functionally impaired persons (Soldo and Manton 1985; Macken 1986). Disability figures on children under 15 are more problematic, but they appear to be plausible when compared to other available estimates (Gortmaker and Sappenfield 1984; Newacheck, Budetti, and Halfon 1986; Ireys 1981).

Given these considerations, table 1 contains several unexpected results. It shows substantial sex differences across age groups and severity levels, even though men and women are about equally likely to be disabled overall. Perhaps as a function of the ambiguities in NHIS questions about major activity limitations, fewer females than males of working age are classified as disabled or as severely disabled. Note, for example, that some 2.4 million men aged 45 to 64 or more than one-half of all disabled men in this age group are estimated to be severely disabled. In contrast, only one in seven women aged 45 to 64 is severely disabled. Roughly similar differentials are detected in the dependent age disabled, although in this case disabled females outnumber their male counterparts in both absolute and relative terms. Only 2.3 million of the nearly 6.7 million disabled females of nonworking age are severely incapacitated, while 3.3 of the 5.3 million disabled men of those ages are so classified. Interestingly, more boys (under 15) are disabled than girls in both severity categories of disablement. The more moderate character of female disability overall has, of course, been confirmed by other investigators, e.g., Verbrugge (1989). The finding is considered noteworthy here because of the bearing it has on the estimated level and composition of total economic losses from disablement in 1980.

Disability Losses

Tables 2a and 2b set forth the estimated aggregate losses from disability in 1980 for each sex by detailed age groupings and type or source of economic loss, viz., primary and secondary reductions in market time and consumption losses due to medical care and other spending—labelled simply net consumption. Given the detail in these tables, table 2c summarizes aggregate losses by working and dependent age groupings, sex, and disability severity categories. These tables show that aggregate losses from functional disability in the United States in 1980 totalled almost 177 billion dollars. About two-thirds of this amount was accounted for by the total cost of male disability or the combined losses of male and female disablement during the working ages of 15 to 64 years. Viewed from another vantage point, about one-half of this amount was accounted for by net consumption losses of all disabled subgroups. Similarly, about 10 percent of the aggregate losses were accounted for by the value of secondary time reductions in market work.

Primary Market Time. As anticipated, reduced market time of the disabled themselves accounts for a major portion of aggregate economic losses, with severely disabled men aged 45 to 64 showing disproportionately the highest losses both because of their greater earning power and very high prevalence rates. Although primary reductions in market time of the severely disabled should, in principle, be the easiest component of disability losses to estimate, the figures presented here are somewhat imprecise for at least two reasons. One is that severely disabled individuals who report that they are unable to engage in market work may, in fact, be gainfully employed. Institutionalized individuals, of course, are arbitrarily assumed to be unable to engage in market activity (certain sheltered work programs to the contrary notwithstanding). The noninstitutionalized segment of the severely disabled, however, may actually have positive earnings for some portion of the year they report complete inability to engage in work. If this group is indeed assumed to be incapable of work for the entire year, a "high" estimate of primary losses is yielded for the severely disabled, viz., about 58.5 billion dollars for (all) men and about 8 billion dollars for women. If descriptive information on the annual earnings losses of workers prevented either from working altogether or working at a regular job from the *1978 Survey of Disability and*

TABLE 2a
Aggregate Disability Losses in 1980, Males by Age Group and Severity Level
(millions of dollars)

Age groups	Total	Severely disabled			Moderately disabled		
		Market time		Net consumption	Market time		Net consumption
		Primary	Secondary		Primary	Secondary	
Working	*82,680*	*45,376*	*1,841*	*18,534*	*8,854*	*1,299*	6,776
Youth 15–24	4,198	976	25	1,840	389	48	920
Adults 25–44	23,102	10,845	487	5,219	3,590	583	2,378
Adults 45–64	55,380	33,555	1,329	11,475	4,875	668	3,478
Dependent	*32,460*	*4,041*	*5,440*	*15,781*	*456*	*1,138*	5,604
Children <15	2,630	—	86	736	—	403	1,405
Elderly 65–74	18,408	3,525	3,312	7,715	421	528	2,907
Elderly >74	11,422	516	2,042	7,330	35	207	1,292
All groups	*115,140*	*49,417*	*7,281*	*34,315*	*9,310*	*2,437*	*12,380*

Source: Author's estimates (see text).

TABLE 2b
Aggregate Disability Losses in 1980, Females by Age Group and Severity Level
(millions of dollars)

Age groups	Total	Severely disabled			Moderately disabled		
		Market time		Net consumption	Market time		Net consumption
		Primary	Secondary		Primary	Secondary	
Working	*28,925*	*3,971*	*206*	*6,744*	*5,099*	*331*	*12,574*
Youth 15–24	2,528	284	8	852	303	11	1,070
Adults 25–44	9,015	1,232	57	1,615	1,890	120	4,101
Adults 45–64	17,382	2,455	141	4,277	2,906	200	7,403
Dependent	*32,713*	*377*	*3,144*	*17,172*	*223*	*4,341*	*7,456*
Children <15	1,576	—	76	415	—	310	775
Elderly 65–74	11,450	306	1,315	4,014	206	1,610	3,999
Elderly >74	19,687	71	1,753	12,743	17	2,421	2,682
All groups	*61,638*	*4,348*	*3,350*	*23,916*	*5,322*	*4,672*	*20,030*

Source: Author's estimates (see text).

TABLE 2c
Summary of Aggregate Disability Losses, 1980
(billions of dollars)

Categories	Total losses	Market time			Net consumption
		Total	Primary	Secondary	
All age groups	*176.7*	*86.1*	*68.3*	*17.8*	*90.6*
Working (15–64)	111.5	66.9	63.2	3.7	44.6
Dependent (0–14; 65+)	65.2	19.2	5.1	14.1	46.0
Both sexes	*176.7*	*86.1*	*68.3*	*17.8*	*90.6*
Male	115.1	68.4	58.7	9.7	46.7
Female	61.6	17.7	9.6	8.1	43.9
All disability types	*176.7*	*86.1*	*68.3*	*17.8*	*90.6*
Severe	122.6	64.4	53.7	10.7	58.2
Moderate	54.1	21.7	14.6	7.1	32.4

Source: Tables 2a and 2b.

Work (Lando, Cutler, and Gamber 1982) is used as a guide, a "low" estimate is obtained: about 40 billion and 4 billion dollars for severely disabled men and women, respectively. Earnings losses midway between these "high" and "low" estimates probably better represent the real market time reductions of the severely disabled. Accordingly, primary earnings losses reported in tables 2a and 2b for each sex/age group were arbitrarily adjusted or scaled to this mid-point assumption. Although the results appear reasonable, estimates of primary market time losses of the severely disabled must be investigated in more detail in future research.

Estimates of reduced market time of the severely disabled may also be biased because they do not explicitly take account of eligibility conditions and disincentive effects of disability transfer programs. For example, reciprocal relations between receipt of disability income and restrictions on the amount of market work that can be performed is left unaccounted. More significant perhaps is that the role played, if any, by disability transfers in inducing individuals to declare disablement and/or drop out of the labor force is not taken explicitly into account either. Despite a growing literature on this topic (Parsons 1982, 1984; Haveman and Wolfe 1984; Yelin 1986), there is yet little agreement on the magnitude of these effects, so no adjustments to estimated disability losses could be made. This issue is discussed further in the final section of the article.

Estimates of the primary economic losses of the moderately disabled draw more directly on recent empirical studies of the effects of disability status on hours of work. These estimates may nonetheless be understated. The main reason is that only reduced market time has been valued. Reduced wage rates of moderately disabled individuals who remain on the job—sometimes called debility costs—are not fully incorporated in the aggregate loss figures. (The influence of wage rates on labor supply, however, are considered explicitly in most of the empirical studies on this topic.) But two potential biases in empirical studies of the effects of disability status on labor supply may counteract the extent to which estimated losses are too low. One is that economic status and the opportunity cost of time, all else being equal, influence the likelihood that individuals with impaired health will report disablement (Chirikos and Nestel 1984; Chirikos 1986; Chirikos and Nickel 1986). Lower-wage workers are more likely to be counted as disabled, and their earnings losses are likely to be overstated. The

second kind of bias results from differences in measured labor supply effects between disability status per se and chronic health conditions. Chirikos and Nestel (1984) provide convincing evidence on adult men and women that disability status overstates labor supply reductions relative to a measure of impaired health. It is, of course, unclear whether these opposing effects necessarily cancel out any downward bias in the estimated magnitude of aggregate losses due to primary reductions in market time.

Secondary Market Time. Perhaps the most interesting result of the computations is the estimated 18 billion dollars arising from secondary reductions in market time by members of households with a chronically disabled person. It is unclear whether this total or its distribution across sex/age groups is understated, although the fairly limited definition of secondary losses implies that only some fraction of reduced economic well-being of the family has been counted. Estimated secondary losses of disabled children that draw principally on Salkever's (1982a, 1982b) multivariate results, for example, value only lost labor market time of the parents. Breslau (1983), among others, shows that intrahousehold time allocations of mothers of disabled children are also subject to significant changes that influence the well-being of the family unit. The estimated secondary losses of the dependent elderly also appear to be reasonable, although the computations were based primarily on descriptive data that inadequately control for key covariates. More multivariate work on secondary losses of the sort conducted by Muurinen (1986) and of the trade-offs between informal and formal care rendered to the disabled elderly such as the study by Greene (1983) are needed.

Secondary market time reductions of married adults are also plausible, but there is at least one feature of the available empirical findings upon which these estimates are based that warrants comment. Convincing evidence is found that the disablement of husbands reduces the labor market commitment of wives, but female disability usually does *not* change the labor market behavior of husbands; consequently, secondary disability losses are attributed disproportionately to men rather than to women. To illustrate, Parsons (1977) found only inconsistent and ambiguous evidence that spouse disability affects male labor supply; empirically, work-limiting health problems of spouses were generally not statistically significant predictors of annual hours worked by married males. Parsons found that married women increase

slightly their hours of market work when their husbands are disabled; however, this estimate too was only at the borderline of statistical significance. Chirikos and Nestel (1983) failed to detect significant effects of female disability on husbands' market time, although the empirical results differ somewhat when alternative health measures are utilized. Berger and Fleisher's (1984) longitudinal analysis showed that spouses may increase market work when males are disabled, but if disability transfers are available, spouse market time declines to provide more valuable care in the home. Berger's (1982) more complete cross-sectional regressions used in estimating secondary losses show that, controlling for nonemployment income and predicted spouse wage, males' labor supply is reduced by a small (and statistically insignificant) amount when spouses are disabled, but that females' labor supply is substantially and significantly reduced when male disablement occurs. Clearly, additional analysis is needed of the intricate decision processes influencing family labor supply when disability occurs.

Net Consumption. It bears repeating that less attention was given in this study to refined estimates of consumption losses incurred by the disabled, mostly because the subject has not been extensively studied. Values shown in the tables, accordingly, are imprecise; some items could only be valued crudely and others have been omitted altogether. Net amounts spent on aids/special equipment, as noted above, may be substantially underestimated. Other costs have been omitted because there was no firm basis upon which to prepare an estimate. Expenditures for special education, for example, are treated arbitrarily as internal transfers within public school systems, and thus excluded; more detailed analysis might have tested that assumption. The estimates also exclude the possibility of secondary effects on the health care utilization of family members attributable to stress and other coping problems in households with disabled persons. A substantially higher loss than the estimated 90 billion dollars in 1980 would thus be yielded if these items were taken into account.

Two additional concerns about estimated net consumption losses should be mentioned. One is that the trade-off between formal and informal care is surely more complex than the amounts imputed to net consumption losses suggest. Recall that paid helpers in the home were included in net consumption losses, while unpaid family help would be valued as secondary reductions in market work. A weak

pattern of comparatively higher net consumption losses coupled to lower secondary losses is detected in tables 2a and 2b, suggesting some degree of substitution between these modes of delivering home care. Additional analyses drawing on more detailed information about intrahousehold time allocations are thus indicated. The other concern is the extent to which medical care spending by the disabled contributes to reducing the length or severity level of disability episodes and, indeed, the extent to which such spending by the nondisabled keeps them from being counted in the disabled population in the first place. A careful review of the rehabilitation literature was obviously beyond the scope of the present article, but such a review is indispensable in interpreting net consumption losses and, perhaps, further subdividing those losses by their impact on disability durations.

Trends in Aggregate Disability Losses

The aggregate disability losses for 1980 presented in the preceding section are, of course, a function of estimated average costs for each sex/age group and the point prevalence of each of those groups. Ideally, changes in each of these components would be estimated for several different years in order to trace trends in aggregate disability losses over time. Trend analysis of this sort would provide much useful information in designing disability policy. In the absence of aggregate loss estimates for at least one other point in time, such a study of trends cannot be carried out here. Some insights, however, can be obtained by simulating changes in the composition of the disabled population over time to ascertain whether growth has been more rapid for disability subgroups with higher than average economic losses and, accordingly, whether aggregate losses are increasing more or less rapidly than the overall size of the disabled population itself. This strategy is pursued in this section by first calculating changes in the disabled population over time and then weighting these changes by the average losses of each subgroup—in effect, by constructing a current-period (Paasche) index of changes in disability losses over time.

Table 3 sets forth continuously compounded percentage growth rates between 1960 and 1980 for each sex/age group of disabled persons, the earlier year chosen arbitrarily like the latter for reasons of data availability. The annual percentage change in the number of

TABLE 3
Annual Percentage Growth in the Disabled Population, 1960–1980
(continuously compounded annual growth rates)

	Male				Female			
		% Growth in prevalence rate				% Growth in prevalence rate		
Age groups	% Growth in number	All disabled	Severely disabled	Moderately disabled	% Growth in number	All disabled	Severely disabled	Moderately disabled
Working	*2.6*	*0.9*	*2.8*	*−0.3*	*2.8*	*1.2*	*−0.2*	*1.5*
Youth 15–24	3.4	0.3	−1.2	1.6	2.8	0.1	−3.0	1.4
Adults 25–44	2.2	0.8	2.5	0.0*	2.3	1.0	0.9	1.3
Adults 45–64	2.7	1.8	4.2	−0.2	3.0	1.9	1.3	2.0
Dependent	*2.3*	*2.2*	*3.1*	*1.1*	*3.4*	*2.8*	*2.4*	*3.1*
Children <15	3.4	3.9	−2.2	5.6	3.6	4.1	−1.8	5.6
Elderly 65–74	2.4	0.6	2.2	−1.5	3.4	1.0	0.4	1.2
Elderly >74	1.8	−0.1	0.7	−1.3	3.3	−0.5	−0.1	0.0*
All groups	*2.5*	*1.4*	*2.7*	*0.2*	*3.1*	*1.9*	*1.2*	*2.1*

Source: Author's calculations based on NHIS and Census data (see text).
* Less than 0.1 percent.

disabled men and women is presented first, followed by the annual percentage growth in disability prevalence rates by level of severity. Comparing these rates provides some insights about the sources of change in the disabled population, i.e., whether changes stem from growth in the number of persons in given demographic subcategories (prevalence constant), from increasing prevalence rates, or from some combination of the two. (These computations, of course, are predicated on the simplifying assumption that year-by-year changes in prevalence rates over the period of 1960 to 1980 did not fluctuate dramatically. Trend analyses such as Verbrugge [1984] show that there was some unevenness in the rates of annual change in disability prevalence over this period, but the observed patterns do not appear to have been sufficiently unstable to affect the findings of this relatively crude simulation exercise.) Thus, the number of disabled men grew over the period of 1960 to 1980 at an average annual rate of 2.5 percent, of which more than one-half or 1.4 percent per year was accounted for by the increasing likelihood that men of all ages would be disabled. Since the prevalence rate of moderately disabled men grew at only 0.2 percent annually, while the rate for the severely disabled grew substantially at 2.7 percent per year, the composition of male disablement clearly shifted toward more severe cases. To complete the logic, severe cases of disability are shown above to be more costly on average than moderate cases; the expectation then is that aggregate disability losses for men grew comparatively faster than the disabled population of men.

The computed growth rates presented in table 3 are surprising in some respects. To begin with, rates of change differ considerably across disability subgroups. The highest growth rates in the numbers of disabled occurred in children under 15 years, even though the population under 15 *declined* in absolute terms at roughly 0.5 percent per year over this period. Furthermore, there was a dramatic shift away from severe forms of childhood disability, attributable at least in part to reduced institutionalization and legislative initiatives in the rehabilitation area in the 1970s. Similar trends are observed for youths aged 15 to 24. In contrast, there was almost no change in the prevalence rates of disability in the dependent elderly; indeed, the rates for persons over 74 years of age may actually have declined slightly. The rapid growth in the number of disabled elderly, there-

fore, is almost exclusively a function of population growth stemming from improved mortality experience over this period.

Given these changes, we turn finally to estimates of the rates at which aggregate losses may have increased over time. These estimates, in effect, link changes in the size and composition of the disabled population to the "simulated" cost estimates for 1960 that weigh 1960 prevalence by 1980 average costs. Table 4 sets out the simulated total losses in 1960 by disability subgroups and, correspondingly, the annual average percentage change in losses between 1960 and 1980.

As can be seen, intertemporal changes in size, composition by severity level, and costs combine to present a substantially different picture than the one above based on demographic changes alone. Overall, aggregate costs of male disability grew more rapidly than the number of disabled men; aggregate costs of female disability, however, did not. Because disabled men incur higher costs, the weighted growth rate of aggregate costs exceeds the weighted growth rate of the total disabled population. As expected, there were differences between sex/age groups. For instance, despite the rapid growth in disabled persons under 15 years of age, the shift in severity level coupled to the cost differential attributable to the degree of severity yield only comparatively small changes in aggregate costs for this group. The cost-specific estimate of losses for children under the age of 15 was about 3.1 billion in 1960; this grew at a rate of about 1.5 percent per year to 4.2 billion in 1980. In contrast, aggregate losses of adult men aged 45 to 64 and elderly women aged over 75 years grew at dramatically higher rates. Aggregate losses for these men are estimated to have been 25.2 billion in 1960, but 55.4 billion in 1980. The aggregate losses of almost 10 billion dollars for elderly females about doubled to 20 billion in 1980. At these growth rates, aggregate losses of adult men and elderly women would be expected to double again before the year 2000.

Discussion

The estimates of aggregate economic losses presented above are in the nature of "back-of-the-envelope" calculations—rough approximations designed to yield some limited policy insights. Before turning to the

TABLE 4
Changes in Aggregate Disability Losses, 1960–1980

Age groups	Male		Female	
	Simulated total losses in 1960 (billions of dollars)	% Growth in losses 1960–1980*	Simulated total losses in 1960 (billions of dollars)	% Growth in losses 1960–1980*
Working	*41.5*	*3.4*	*18.9*	*2.1*
Youth 15–24	3.1	1.5	2.0	1.1
Adults 25–44	13.2	2.8	6.7	1.5
Adults 45–64	25.2	3.9	10.2	2.7
Dependent	*19.5*	*2.5*	*16.7*	*3.3*
Children <15	2.0	1.4	1.1	1.6
Elderly 65–74	10.2	1.8	6.0	3.2
Elderly >74	7.3	2.2	9.6	3.6
All groups	*61.1*	*3.2*	*35.7*	*2.7*

Source: Author's calculations derived from tables 1–3 above (see text).
* Continuously compounded annual growth rates.

major conclusions of the study, it should be noted that the figures on aggregate disability losses were compared to some closely allied estimates in the literature, particularly COI studies, to appraise just how rough they really are. Perhaps surprisingly, the estimates reported here accord reasonably well with these other available estimates. For example, the estimated value of lost primary market time is quite similar to the magnitude of "morbidity costs" incurred by similar sex/age groups around the same point in time estimated by Salkever (1984) and by Rice, Hodgson, and Kopstein (1985). It is, of course, more difficult to find comparisons for the estimates of secondary market time and net consumption losses because of the unique way they were defined in this analysis. Salkever's (1985) estimate of the costs of chronically disabled children is perhaps the only result similar enough to compare. He concludes that this cost was well in excess of three billion dollars in 1980, whereas the estimate presented above was 4.1 billion. Berkowitz and Hill's (1986) estimate of the amount spent on medical care and on related services such as vocational rehabilitation by noninstitutionalized disabled persons aged 18 to 64 in 1980 is quite close to the net consumption loss of about 45 billion calculated above for the working-age population. These comparisons suggest minimally that the computed disability losses are plausible, albeit imprecise and probably understated.

On this assumption, several substantive conclusions can be drawn from the analysis. The first is that the estimates provide proof, if any were actually needed, that disability exacts an enormous toll from the American economy. As a point of reference, the total loss of 177 billion dollars represented about 6.5 percent of the gross national product in 1980. This loss may be thought of as a tax of about $800 levied on each and every American in 1980. It may also be thought of as a potential bonus to the economy of some $6,880 for each prevalent case of functional disablement that could have been prevented or postponed in that year. Since the estimate of aggregate losses was prepared very conservatively, the magnitude of these potential benefits is no doubt even substantially greater. Disability losses, moreover, appear to have grown disproportionately over the period of 1960 to 1980, and they probably have continued to increase relatively faster than the disabled population itself since then. The functional disablement of the population must accordingly be considered a very high priority issue for public policy.

The analysis also provides considerable evidence that disability exacts different tolls from prevalent cases of either sex at different points in the life cycle as well as, of course, different tolls between the sexes. Briefly put, when total losses for each sex/age group in tables 2a and 2b are divided by the corresponding number of disabled persons in table 1, we see that the lowest average loss for disabled males is only one-third the highest value of males; the lowest average loss for females is only about one-half of the highest average female loss; and the lowest female loss is only one-quarter of the most substantial loss by males. The extent to which these differentials are artifacts of the estimation procedure must, of course, be studied in greater depth in the future. Yet, an even more significant result is that these cost differentials appear to be positively correlated with the size and rate of increase in various disability subgroups. In particular, adult men aged 45 to 64 not only incur the highest average (total) loss as expected, but they are the largest (absolute) single group of disabled, they have very high rates of severe disability, and their numbers are growing over time more rapidly than any other segment of the entire disabled population.

Viewed from this perspective, the priority accorded the issue of work disability of mature men, and especially the controversy about the inducements of disability insurance programs on early withdrawal from the work force, seems well founded. There can be little doubt that disability transfers expanded greatly over the period covered by this study. Berkowitz and Hill's (1986) series on disability expenditures showed a real growth between 1970 and 1980 of about 6.4 percent per year, whereas estimated disability losses of this group increased at only 3.4 percent annually. Few deny that there is a connection here; the controversy centers on the magnitude of the effect—the extent to which, among other things, the availability of transfer income influences the proportion of any population group reporting itself work-disabled. An earlier analysis of historical changes in work-disability prevalence (Chirikos 1986) suggests that, *at most,* only one-third of the computed annual growth rate in (noninstitutional) adult disability could have resulted from such economic inducements. If this result is used to adjust for the policy effects on changes in the prevalence of adult male disablement between 1960 and 1980, prevalent cases fall only by about 570,000 persons and, correspondingly, aggregate disability losses drop by about 7.3 billion

dollars. These are hardly inconsequential amounts, but they suggest that other forces or determinants of this large pool of work-disabled males must also be present. Accordingly, detailed analyses of the health and physical conditions of men in the 45-to-64 age bracket must be given high priority on the disability research agenda.

That 40 percent of the aggregate disability toll is accounted for by the economic losses of disabled persons of dependent ages is nonetheless an equally important result of the estimates given above. How much of the growth in these losses may have been influenced by the expanding system of transfer income is unclear. It has no doubt been influenced by the increasing availability of medical care insurance, but this is probably not a major determinant. The more intriguing feature here is the 14 billion dollar estimate of secondary market time losses for the dependent disabled. To place the figure in context, it exceeds the amount spent on workers' compensation in 1980 and is tenfold greater than the amount spent on vocational rehabilitation in that year. Programs targeted at reducing losses, such as respite care for spouses of the disabled elderly or parents of chronically disabled children, assume special priority in this regard. The interrelation between these losses and the receipt of transfer income as well as the substitutability between net consumption and secondary time losses must also be studied in more detail.

This preliminary assay of aggregate disability losses also underscores some methodological or analytic issues deserving more attention by researchers in the disability policy area. As might be anticipated, one priority item is improved data on the prevalence and incidence of functional disability. Put simply, available national data on the size and composition of the disabled population are not altogether adequate for policy purposes. These data allow virtually no flexibility in classifying disability by alternative criteria or degree of severity, and they leave unenumerated those correlates that help characterize the etiology and outcomes of disability episodes. Policy makers and analysts especially need more detailed information on self-reported prevalent cases, including an expanded account of the major activities that are limited or prevented altogether by impairments arising from chronic disease and physical injury; the duration of those limitations and the extent to which they are exacerbated by short-term, acute health conditions; and the nature of existing impairments, their durations and the extent to which they have progressively limited or prevented

performance of major social roles over time. Collecting these data would permit not only a more refined statistical profile of disability prevalence by severity level, but also some basis for characterizing the incidence of disablement. This statistical profile must be buttressed, of course, by more detailed probes of disability consequences or sequelae, including the magnitude of market time reductions and consumption losses. Given the magnitude of secondary losses in market time estimated in the present analysis, data should be collected regularly on family adjustments to disability. In the absence of these marginal additions to national data sets, policy makers will continue to encounter difficulty in judging the overall dimensions of the disability problem or monitoring the impact of policy changes on that problem.

Adding to the stock of policy-relevant information should not be achieved at the expense of analyzing historical trends in disability prevalence. In these terms, the NHIS data set is the natural locus of such new data gathering. This survey should be redesigned to collect more detailed information on disability characteristics. While special supplements and even special surveys using NHIS sample frames are useful in this regard, more attention must be given in the continuing interview survey to questions about the causes and correlates of chronic activity limitations. Because the length of survey instruments is limited, the time may be at hand to supplant some of the current battery of NHIS questions on acute health conditions with more detailed probes of chronic health factors. The NHIS should also give some consideration to selecting a subsample of households with a disabled member (of any age) to be followed longitudinally. Such panel information would permit not only more detailed examination of the socioeconomic impact of disability as described below, but also the analysis of transitions between institutionalized and noninstitutionalized status—events that are difficult to study effectively when the sample is restricted, as the NHIS is now, to only the noninstitutional population.

The ability to piece together crude estimates of disability losses or even more refined estimates based on new data collection is not tantamount to understanding the decision mechanisms that influence the magnitude and distribution of these losses. More basic research must be done on the factors that contribute to reduced market time of both the disabled and members of their families. Further analysis of the

determinants of health care utilization by the disabled as well as other decrements to consumption of disabled households must also be carried out. This research effort should use longitudinal data as noted above, and it should put the accounting of economic losses on the basis of incident rather than prevalent cases. Among other things, this framework would facilitate the analysis of disability durations. The empirical literature on disability is mostly cross-sectional in nature, and implicitly treats disability status as permanent. The durations of many disability episodes, however, are finite, and the length of time individuls are disabled doubtless varies systematically with differences in rehabilitation activities, family adjustments, demographic characteristics, and so forth. Longitudinal analyses of disability durations can help sort out the net effects of these factors; a recent study by Chirikos and Nestel (1988) illustrates such an analysis and the methodological techniques for conducting it. The results of longitudinal studies can be used to calculate the economic losses associated with the incidence of disability episodes. These losses may be deployed, in turn, as more comprehensive benefit measures in cost-benefit studies of rehabilitation and other disability interventions that reduce durations in disability states by given amounts. Indeed, the concept of disability losses developed in the present article may be coupled to longitudinal data on the experience of disabled persons and their families in adjusting labor market efforts and the use of medical care to that disability to evaluate the efficiency of alternative rehabilitation activities and the adequacy of various income transfer schemes. A full complement of such evaluations should be carried out over the next few years to ensure a more suitable knowledge base for disability policy making.

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Address correspondence to: Professor Thomas N. Chirikos, USF Public Health, MHH104, 13301 Bruce B. Downs Blvd., Tampa, FL 33612-3899.