Commentary

Years of Potential Life Lost (YPLL)—What Does it Measure?

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The concept of years of potential life lost (YPLL) involves estimating the average time a person would have lived had he or she not died prematurely. This measure is used to help quantify social and economic loss owing to premature death, and it has been promoted to emphasize specific causes of death affecting younger age groups. YPLL inherently incorporates age at death, and its calculation mathematically weights the total deaths by applying values to death at each age. The method of calculating YPLL varies from author to author, each producing different rankings of leading causes of premature death. One can choose between heart disease, cancer, or accidents as the leading cause of premature death, depending on which method is used. Confusion in the use of this measure stems from a misunderstanding of the value system inherent in the calculation, as well as from differing views as to values that should be applied to each age at death. (Epidemiology 1990;1:322–329)

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For decades, public health workers have been interested in quantifying the health of populations. Historically, mortality rates have been the central index of health status in a community. In recent years, attention has expanded to include measures that assess the impact of major causes of death on populations. Years of potential life lost (YPLL) is currently in vogue, with several impact measures arising from various modifications of this concept. In this paper, we explore the concept of YPLL, try to illustrate what it is measuring, and discuss the rationale for its use.

The concept of YPLL entails estimating the average time a person would have lived had he or she not died prematurely. This estimation inherently incorporates age at death, rather than merely the occurrence of death itself. Use of the YPLL measures has been promoted in an attempt to emphasize specific causes of death in proportion to their burden on society. Crude and specific mortality rates describe the amount of death in a population, but they fail to quantify the burden of loss resulting from this mortality. YPLL, in contrast, is presented as an index that focuses on the social and economic consequences of mortality. Most health care workers would consider prevention of premature death as an important goal. In terms of social and economic loss, this goal is the prevention of death before its "natural" time, so the individual can contribute maximally to society.

It was recognized early that evaluation of competing claims for allocation of health resources requires consideration not only of the number of deaths from each cause, but also their distribution by age. No single index is completely adequate in quantifying the social and economic impact of mortality in a society, but YPLL and future income sacrificed have been proposed as aids to be used in these estimations, since they focus on the burden of lost productivity (1–2). The competition for health resources often relates to programs directed at specific diseases, so a ranking of these diseases (causes of death) according to their impact on society's productivity can be useful.

In 1982, the Centers for Disease Control (CDC) (3) introduced a YPLL measure to its standard set of tables of reported diseases, with the justification that, "by displaying a variety of measures that gauge the importance and relative magnitude of certain public health issues, this table will call attention to those issues where strategies for prevention are needed. Publication of this table reflects CDC's increased responsibility for promoting action to reduce unnecessary morbidity and premature mortality. . . . To this end, the new table provides information regarding areas that provide the greatest potential for health improvement." In 1986, further discussion (4) declared that, "since most deaths occur among persons in older age groups, crude and age-adjusted mortality data are dominated by the underlying disease processes of the elderly. Alternative measures have been proposed to reflect the mortality trends of younger age groups. These measures provide a more accurate picture of premature mortality by weighting deaths occurring at younger ages more heavily than those occurring in older populations. . . . The major strengths of YPLL are that it is simple to compute and

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comprehend and it effectively emphasizes deaths of younger persons, in contrast to usual mortality statistics, which are dominated by deaths of the elderly."

What Does YPLL Measure?

The method of calculating YPLL varies from author to author. Each method is a function of age at death and the number of deaths at that age. The number of deaths at each age is multiplied by an indicator of years of potential life remaining for that age, and the terms are summed to get the total YPLL. This calculation is a weighted total of the number of deaths by age, with the weights for each age determined by the particular method of valuing potential remaining years of life. That is,

$$\text{YPLL} = \text{sum}[(\text{deaths at a given age}) \cdot (\text{weight for that age})] = \Sigma(d_i)(w_i).$$

This calculation is similar to that of an age-adjusted rate (which uses r_i rather than d_i). It is of interest to explore the weights (w_i) used in the various YPLL calculations. First of all, these measures use the number of deaths at each age (d_i), rather than mortality risk (or rate, r_i) at each age. The fundamental health characteristic of a population is its specific mortality rates (r_i). The number of deaths that occur in a population is a function of these rates, the population size, and its age distribution; therefore, all YPLL calculations reflect the age distribution of the population [ie, $d_i = (r_i)(n_i)$]. This inherent inclusion of age-specific populations (n_i) in the YPLL calculations make them applicable only to that population. In an impact evaluation, this specificity is what one desires, since the objective is to sum the burden of loss for each death in a given population. This loss is a function of the mortality risk at each age in the population, the size and age distribution of the population, the age distribution of the cause of death, and the value attached to death at each age.

We have categorized the various methods used to calculate YPLL in Table 1, which also defines notation and abbreviations. Dempsey (5) calculated life expectancy at birth, less age of death (PYPLL, with $N = L_0$). He was criticized by Greville (6), who calculated life expectancy at age of death (YPLL). Logan and Benjamin (7) calculated years of life lost to the age at which 90% of males and females died, respectively, according to the 1952 life tables (PYPLL, with $N = 85$ for males and $N = 88$ for females). They also calculated the years of life lost during "the working age period" (WYPLL, with $W = 15$ and $N = 65$). Stickle (2) used life expectancy at age of death (YPLL), but also extended the working years of life lost concept by calculating future income sacrificed, ie, the number of years of life lost times the average income for each year taken from a 1963 survey of personal income by age (VYPLL, with $I(j)$ = average annual income). Romeder and McWhinnie (8) calculated years of life lost from age 1 to 70, eliminating deaths in the first year and after age 70 (PYPLL*, with $N = 70$). Perloff et al (9) included deaths occurring under age 1, but calculated only "potentially productive years of life lost" (WYPLL, with $W = 15$ and $N = 70$). The CDC, in its MMWR tables introduced in 1982 (3), calculated years of life lost from age 1 to 65 (PYPLL* with $N = 65$), but changed in 1986 (10) to include infant deaths (PYPLL with $N = 65$). This change moved sudden infant death syndrome and prematurity into the ten leading causes of premature death in the MMWR tables.

The formula given for VYPLL is in fact a general formula from which any of the other YPLL calculations can be derived, each using different values for the function $I(j)$. For example, the YPLL formula uses $I(j) = 1$ for all j; PYPLL uses $I(j) = 1$ for $j < N$ and $I(j) = 0$ for $j \geq N$; PYPLL* is the same as PYPLL except that it uses $I(j) = 0$ for all j when $i = 0$; WYPLL uses $I(j) = 1$ for $w \leq j < N$ and $I(j) = 0$ otherwise; and the crude total deaths use this formula with $I(j) = 1$ when $j = i$ and $I(j) = 0$ otherwise. So the weights used in each calculation are

$$\text{weight}_i = n_i \left(\sum_{j=i}^{i+L_i} I(j) \right)$$

and the differences between methods are due solely to the different values of $I(j)$ assigned to each year of age. Note that only the YPLL formula values each year of life lost equally, while PYPLL, WYPLL, and VYPLL do not put equal value on each year of life lost. In addition, none of these methods takes into account the effect of competing causes of death. For example, PYPLL assumes that all individuals will live to age N, except those dying from the cause of interest.

Why Different Weighting Methods?

Authors have disagreed on what ages social and economic losses begin and end, as well as the value of productivity at each age. For example, some authors use life expectancy at birth (L_0) for N (currently 74.8; or 71.3 for males and 78.3 for females), while others have arbitrarily selected 65, 70, or some other age. The CDC (3,4) argued that, "If deaths of persons older than 65 years were included, greater weight would be given to

TABLE 1. Formulas for Alternative YPLL Summary Measures*

Abbreviation†	Name	Formula
YPLL (6, 2)	Years of potential life lost	$\sum_{i=0}^{\infty} d_i(L_i)$
PYPLL (5, 7, 10)	Premature (to N) years of potential life lost	$\sum_{i=0}^{N} d_i(N - i)$
PYPLL* (8, 3)	Premature (to N) years of potential life lost‡	$\sum_{i=1}^{N} d_i(N - i)$
WYPLL (7, 9)	Working (W to N) years of potential life lost	$\sum_{i=0}^{W-1} d_i(N - W) + \sum_{i=W}^{N} d_i(N - i)$
VYPLL (2)	Valued years of potential life lost	$\sum_{i=0}^{\infty} d_i\left[\sum_{j=i}^{i+L_i} I(j)\right]$
CRUDE (14)	Crude death rate	$\frac{\Sigma d_i}{\Sigma n_i} = \frac{\Sigma(r_i)(n_i)}{\Sigma n_i}$
ADJ (14)	Adjusted death rate	$\frac{\Sigma(r_i)(w_i)}{\Sigma w_i}$
CI_L (14)	Lifetime cumulative incidence rate	$1 - \exp\left(-\sum_{i=0}^{L} r_i\right)$

* Variables: i = age at death, L_i = life expectancy at age i, N = upper cutoff age, W = lower cutoff age, $I(j)$ = value at age j, d_i = number of deaths at age i, n_i = population at age i, r_i = death rate at age i (= d_i/n_i), w_i = weight for age i.
† Numbers in parentheses refer to referenced articles that use that method.
‡ Excluding infant deaths.

natural causes of death, and premature and preventable causes of death would no longer be distinguishable. . . . Thus, deaths in older age groups are underrepresented by the upper age limit of 65 years. However, this method preserves the emphasis on causes of mortality among younger persons." Another argument for excluding those over age 70 in YPLL calculations has been that diagnosis may be inaccurate in those ages, so deaths are more difficult to attribute to the proper cause and thus ought to be excluded from the calculations (8,9).

Some of the arguments for using 65 or 70 as a cutoff age relate to time of retirement when job productivity ceases. For example, Perloff et al (9) stated, "We decided to use seventy rather than sixty-five as the cutoff age because our analysis focuses on the loss of productive years, and many people in the sixty-five to sixty-nine age category are still economically active." The working years of life lost formula implements this argument by decreasing the weights during childhood, where potential productivity is future, not current. Again Perloff et al (9) explained, "We have decided to give the deaths of children this smaller weight because we thought it inconsistent to exclude the deaths of people over seventy because they were no longer economically active and, at the same time, to include in the weights for children the childhood years in which they are not economically active."

Some authors have chosen to exclude infant deaths, while others have not. Romeder and McWhinnie (8) reasoned that, "each infant death would account for

TABLE 2. Age-Specific Weights Used in VYPLL Calculation of Investment-Producer-Consumer Model

			0–19		20–64		65+			
Age at Death (1)	Mid-Age (2)	Life Expectancy* (3)	Received (4)	Didn't Receive (5)	Produced (6)	Didn't Produce (7)	Consumed (8)	Didn't Consume (9)	Net Investment† (10)	Potential Loss† (11)
0	0.5	75	0.5	19.5	0.0	45.0	0.0	10.5	0.5	15.5
1–4	3.0	73	3.0	17.0	0.0	45.0	0.0	11.0	3.0	20.0
5–14	10.0	66	10.0	10.0	0.0	45.0	0.0	11.0	10.0	34.0
15–24	20.0	56	20.0	0.0	0.0	45.0	0.0	11.0	20.0	54.0
25–34	30.0	47	20.0	0.0	10.0	35.0	0.0	12.0	10.0	33.0
35–44	40.0	37	20.0	0.0	20.0	25.0	0.0	12.0	0.0	13.0
45–54	50.0	29	20.0	0.0	30.0	15.0	0.0	14.0	−10.0	−9.0
55–64	60.0	20	20.0	0.0	40.0	5.0	0.0	15.0	−20.0	−30.0
65–74	70.0	14	20.0	0.0	45.0	0.0	5.0	14.0	−20.0	−34.0
75–84	80.0	8	20.0	0.0	45.0	0.0	15.0	8.0	−10.0	−18.0
85+	88.0	6	20.0	0.0	45.0	0.0	23.0	6.0	−2.0	−8.0

* Life expectancies taken at midpoint age from U.S. 1986 life tables (11).
† Net investment (10) = [received] + [consumed] − [produced] = (4) + (8) − (6).
Potential loss (11) = [net investment] + [didn't produce] − [didn't receive] − [didn't consume] = (10) + (7) − (5) − (9) = $\Sigma I(j)$.
(Note: negative investments and negative losses are gains to society.)

almost 70 years lost giving a weight double that of a death between ages 30 and 40. This appears to be an overestimation of the value accepted by society for such a loss in light of the fact that a 'very early death is often replaced' by another birth. Therefore, from the point of view of social criteria, infant mortality is less disrupting than mortality of older children and adults." Initially, CDC (3) stated that, "If deaths of persons younger than one year were included, causes of death affecting this age group would be weighted heavily and would therefore contribute a disproportionately large share of potential years of life lost." But, as mentioned above, in 1986 CDC (10) changed its method from PYPLL* to PYPLL, which includes infant deaths. Perloff et al (9) stated, "We did not want to exclude deaths under the age of one because infant mortality results in a considerable number of lost years of life, and because we felt it illogical to exclude infant deaths from a discussion of premature deaths." No one has yet included lost productivity from stillbirths, miscarriages, or abortions in any YPLL computations.

The historical example that addresses lost economic productivity most fully is that of Stickle (2), where he calculated "future income sacrificed." Although his methods are not described in detail in his paper, it is clear that he utilized a formula similar to that given in Table 1 for VYPLL. His values for the function $I(j)$ were determined from a survey of personal monetary income by age and sex. Perhaps the following model will be useful as an example that directly addresses the value function.

Investment-Producer-Consumer (IPC) Model

Consider dividing the lifetime of each individual into three segments: Investment years (ages 0–19), Producer years (ages 20–64), and Consumer years (ages 65+). For simplicity, consider the value for each year to be equal. During the investment and consumer years, the individual is receiving from society (negative value), while during the producer years the individual is giving to society (positive value). We then calculate the VYPLL weights for each age as shown in Table 2, which illustrates this model using 1986 U.S. life expectancies (11). The net investment made by society is the amount received by the individual during years 0–19 and 65+, less the amount produced during age 20–64. The total potential loss to society is the net investment at death plus the amount that would have been produced, less the additional amount that would have been consumed, up to life expectancy. If an individual lives to the average life expectancy of 75, the net contribution to society is −20 + 45 − 10 = +15 years. An infant who dies at birth, then, results in a *net loss* of 15 years, while an individual dying at age 20 results in a *net loss* of 54 years (+20 + 45 − 11 = 54), and at age 50 a *net gain* of 9 years (+20 − 30 + 15 − 14 = −9), while dying at age 65 gives a *net gain* of 42 years (+20 − 45 − 17 = −42), and at 80 a *net gain* of 18 years (+20 − 45 + 15 − 8 = −18). As can be seen from these calculations, the worst case of social and economic loss is death at age 20 (after full investment, but before any productivity) and best at age 65 (after maximum productivity, but before entering consumerism stage). Although this is an

TABLE 3. Total YPLL for 12 Causes of Death* in the U.S. in 1986, Using the YPLL Formulas from Table 1 and 1986 Life Expectancies

Method	Heart	Cancer	CVD	Accidents	COPD
YPLL	9,295,896	7,391,289	1,640,579	3,451,137	967,090
PYPLL(85)	8,387,691	7,840,850	1,337,160	3,939,854	928,078
PYPLL(75)	3,923,651	4,178,200	590,600	3,106,919	396,878
PYPLL(65)	1,558,251	1,832,725	246,170	2,364,644	128,548
PYPLL*(65)	1,494,912	1,826,468	239,139	2,306,013	124,678
PYPLL*(70)	2,220,772	2,631,713	339,699	2,651,358	193,878
WYPLL(15–65)	1,538,070	1,818,665	243,780	2,295,125	126,740
WYPLL(15–70)	2,268,840	2,624,395	344,885	2,645,015	196,240
CRUDE	765,490	469,376	149,643	95,277	76,559
CI(75)†	15.34%	14.15%	2.45%	2.56%	2.07%
CI(55)†	1.96%	2.32%	0.31%	1.74%	0.13%
VYPLL(IPC)	−14,792,439	−10,206,502	−2,608,096	1,173,576	−1,744,728

* Disease groupings correspond to those used by MMWR (10) and/or NCHS (12), as follows (ICD-9 codes): Diseases of the *Heart* (390–398, 402, 404–429), Malignant Neoplasms, including neoplasms of lymphatic and hematopoietic tissues (*Cancer*) (140–208), Cerebrovascular Diseases (*CVD*) (430–438), *Accidents* & Adverse Effects (E800–E949), Chronic Obstructive Pulmonary Diseases and Allied Conditions (*COPD*) (490–496), Pneumonia and Influenza (*P/I*) (480–487), Suicide/Homicide and Legal Intervention (*S/Hom.*) (E950–E978), *Diabetes* Mellitus (250), Chronic *Liver* Disease and Cirrhosis (571), Certain Conditions Originating in the *Perinatal* Period (760–779), Congenital *Anomalies* (740–759), Sudden Infant Death Syndrome (*SIDS*) (798.0).

† Cumulative incidence calculations [(CI = 1 − exp(−Σr$_i$)] represent the average risk of death due to the specific cause from birth to age 55 or 75, respectively, assuming no deaths from other causes.

artificial example, with a value scale chosen somewhat arbitrarily, it illustrates a process of defining social and economic loss in a way that can incorporate investment and consumerism concepts.

Illustration of Differences Between Calculation Methods

The weights for each age group using various YPLL measures can be derived using the formulas in Table 1 and life expectancies from the desired population. Table 3 uses these weights to calculate the total YPLL by each method for twelve causes of death in the United States using 1986 life table and final mortality data (11,12). Table 4 ranks the top ten causes of death by each method.

We see in Tables 3 and 4 that the relative ranking of causes of death is changed when one uses a different YPLL method. Comparing the number of crude deaths (which emphasizes deaths in the elderly) with the PYPLL(65) method used by CDC (which emphasizes deaths in the young), one sees the leading cause of death change from heart disease to accidents. In fact, one can choose between heart disease, cancer, or accidents as the leading cause of death, depending on which method one chooses for calculation. Looking at the VYPPL (Investment-Producer-Consumer) model, one sees that heart disease and cancer drop from the list entirely, as do five of the other causes of death that also have negative VYPLL (ie, net gain, rather than loss). We are left then, in this model, with the main causes of death in the young working ages (accidents and suicide/homicide) and the early deaths (perinatal, congenital anomalies, and sudden infant death syndrome). With this model those diseases largely attributable to aging drop from the top rankings because of the negative weights in the older age groups.

Using the U.S. 1986 final mortality statistics from NCHS (12), we calculated VYPLL using the Investment-Producer-Consumer model for each of the 72 cause-of-death categories that had more than 1000 deaths. Of these, only nine produced positive VYPLL values; they are given in Table 5. This analysis illustrates that external causes of death, rather than deaths from disease, have by far the largest impact by this measure (79% of the positive VYPLLs), followed by causes of death in infancy and early childhood. The remaining causes of death (including subcategories of cancer, heart disease, etc) all have negative VYPLL, indicating no net productivity loss.

Discussion

YPLL is generally used to emphasize deaths at younger ages, which is an important consideration when one notes that 71% of deaths in the United States in 1986 occurred at age 65 or greater. From the formulas in Table 1, we see that the younger ages always receive the highest weights for YPLL, PYPLL, PYPLL*, and WYPLL. If the objective is simply to emphasize deaths at younger ages, however, then the more straightforward approach is to present the specific mortality rates for those ages rather than use a YPLL measure.

YPLL is not an inferential statistic; it is an impact

P/I	S/Hom.	Diabetes	Liver	Perinatal	Anom.	SIDS
787,710	1,998,984	529,499	574,094	1,378,232	802,517	395,850
617,672	2,336,330	528,887	668,035	1,552,806	906,196	445,991
316,507	1,831,560	271,737	426,555	1,368,921	783,291	393,211
176,087	1,361,150	121,172	231,600	1,185,046	664,606	340,431
133,323	1,343,219	121,043	230,310	9,469	132,868	0
174,833	1,566,604	170,643	311,550	10,274	149,793	0
163,350	1,349,365	120,910	231,170	919,120	532,255	263,900
208,175	1,574,140	170,520	312,510	1,011,055	590,400	290,290
69,812	52,635	37,184	26,159	18,391	12,638	5,278
0.92%	1.59%	1.00%	1.02%	0.49%	0.35%	0.14%
0.16%	1.13%	0.15%	0.33%	0.49%	0.30%	0.14%
−1,035,036	775,715	−743,539	−447,150	286,075	166,096	81,809

measure quantifying the burden of social and economic loss from premature mortality within a given population. Some inappropriate uses of YPLL include descriptive and analytic analysis of specific causes of death. For example, an analysis using YPLL of subgroups of congenital anomalies is inappropriate since most of those subgroups have the same ages at death and thus the differences in YPLL reflect primarily differences in the numbers of deaths (13). Another inappropriate use of YPLL is in etiologic assessment, where death risk (or rate, r_i) is the variable of interest, not an impact measure like YPLL. YPLL should never be used as a substitute for careful examination of the age-specific rates to determine time-trends and other variability that might reflect etiologic characteristics.

YPLL inherently incorporates values attached to each age at death. The quantification of the value of life in each age range is difficult, since it involves synthesizing widely differing value systems and quantifying inherently qualitative issues. There are good arguments for emphasizing each age group. For example, infants and children should be emphasized because of their innocence, dependence, and future potential; young adults should be emphasized because they are in the workforce, are often parents of young children, and have been trained for lifelong productivity; older adults should be emphasized because they have valuable work experience, are often breadwinners for large families, and continue in the workforce; seniors should be emphasized because of their valuable wisdom from long life experience, and retirees should be emphasized as a reward for lifelong productivity.

The important point here is that utilization of any YPLL method (including crude or adjusted death rates) inherently weights the age-specific deaths. By using these summary measures, one is placing values on the different ages at death. In practice, it seems that authors are often unaware of what value scale is being used, or even that a value scale is inherent in their calculations. The method used to calculate YPLL determines both the total number of years of potential life lost and the relative rankings for each cause of premature death.

Romeder and McWhinnie (8) state that "the concept of potential years of life lost . . . originated with the primary objective of comparing the relative importance of different causes of death for a particular population." If one can manipulate the leading causes of premature death so easily by changing the method of YPLL calculation, then of what use is it in helping to set health priorities? In using a summary measure of deaths to rank different causes, one must first address the value scale for age at death, then implement a weighting method that utilizes those values.

Value Scale: Equality Versus Lost Productivity

Owing to the scarcity of health care resources and the need to ensure maximal societal benefit from their use, health planners assign priorities for the allocation of resources to those causes of death that they believe have the largest impact on society. Mooney and McGuire (1) identified four criteria commonly used in determining allocation of resources: equality, future contribution, past contribution, and individual need. The crude number of deaths, used most often to rank the leading causes of death, treats each death equally. This index emphasizes causes of death in the elderly because that is where most deaths occur. A second method of equality is to count each year of age equally, since each individual passes through each year of age once. This measure is the cumulative incidence of death (14) from birth to life expectancy (L_0), which estimates each individual's average lifetime risk of dying from a specific cause. Cumulative incidence provides more "equality" than does crude deaths because it addresses each individual's average lifetime risk, rather than the current age-mixture of deaths in the population.

TABLE 4. Top Ten Ranking of 12 Causes of Death* Using the Various YPLL Methods

RANK	YPLL	PYPLL(85)	PYPLL(75)	PYPLL(65)	PYPLL*(65)	PYPLL*(70)
1	Heart	Heart	Cancer	Accidents	Accidents	Accidents
2	Cancer	Cancer	Heart	Cancer	Cancer	Cancer
3	Accidents	Accidents	Accidents	Heart	Heart	Heart
4	S/hom.	S/hom.	S/hom.	S/hom.	S/hom.	S/hom.
5	CVD	Perinatal	Perinatal	Perinatal	CVD	CVD
6	Perinatal	CVD	Anom.	Anom.	Liver	Liver
7	COPD	COPD	CVD	SIDS	P/I	COPD
8	Anom.	Anom.	Liver	CVD	Anom.	P/I
9	P/I	Liver	COPD	Liver	COPD	Diabetes
10	Liver	P/I	SIDS	P/I	Diabetes	Anom.
RANK	WPYLL(15–65)	WPYLL(15–70)	CRUDE	CI(to 75)	CI(to 55)	VYPLL(IPC)
1	Accidents	Accidents	Heart	Heart	Cancer	Accidents
2	Cancer	Cancer	Cancer	Cancer	Heart	S/hom.
3	Heart	Heart	CVD	Accidents	Accidents	Perinatal
4	S/hom.	S/hom.	Accidents	CVD	S/hom.	Anom.
5	Perinatal	Perinatal	COPD	COPD	Perinatal	SIDS
6	Anom.	Anom.	P/I	S/hom.	Liver	
7	SIDS	CVD	S/hom.	Liver	CVD	
8	CVD	Liver	Diabetes	Diabetes	Anom.	
9	Liver	SIDS	Liver	P/I	P/I	
10	P/I	P/I	Perinatal	Perinatal	Diabetes	

* Disease groupings correspond to those given in Table 3.

TABLE 5. Ranking of Causes of Death* with Positive VYPLL, Using Investment-Producer-Consumer Model

Rank	Cause of Death	ICD Codes	VYPLL
1	Motor vehicle accidents	E810–E825	1,048,643
2	Homicide/legal intervention	E960–E978	512,811
3	Suicide	E950–E959	262,904
4	Other conditions—perinatal	760–766, 770–779	212,972
5	Congenital anomalies	740–759	166,096
6	Other accidents/adverse effects	E800–E807, E826–E949	124,933
7	Sudden infant death syndrome	798.0	81,809
8	Birth-related conditions	767–769	73,103
9	Other external causes	E980–E999	44,497

* Disease groupings correspond to those used by NCHS (12).

The YPLL concept assigns priority to causes of death according to future contribution lost. This approach emphasizes causes of death occurring in younger age groups because of their larger potential for future contribution. The YPLL formula in Table 1, however, is the only one that assigns equal value to each year of life lost. The other formulas assign different values to years of life lost at different ages; this is a productivity assessment that attaches value to each age according to someone's concept of potential contribution to society. Society recognizes that potential contribution and invests in the upbringing and education of children so it can reap the benefits of productivity during their adult years. This investment was emphasized by Dickinson in 1948 (15), and restated by Stickle (2) in 1965 as follows, "It may be argued that the concepts of life-years lost and future income sacrificed do not take into account sufficiently the social and economic consequences of deaths during the middle years of life. These deaths often involve heads of families and other individuals from whom the yield of investments in education and training has not been fully realized." The VYPLL formula allows weighting along these economic lines, as illustrated with the Investment-Producer-Consumer model.

Conclusion

YPLL has been promoted as "simple to compute and comprehend" (4), but it is neither simple to compute nor to comprehend. The divergence in computational methods reflects either a lack of understanding of the underlying value scales or disagreement about the values to be utilized. Comprehension of the concept becomes clear only after recognizing that YPLL is a method of assigning social value to each age at death. The difficulty in assigning those values is clear, and YPLL is a complex measure incorporating subtle value judgments that are often inapparent to the casual observer. The YPLL concept can be beneficial only if used in the correct context with an appropriate and explicit value scale.

It is important to emphasize that YPLL addresses only the impact of social and economic loss from early death, and not the cost of death, preventability of death, or morbidity associated with specific causes of death. Medical and other economic costs related to death from specific causes are not included in any of the YPLL measures, nor are any quality-of-life values. A thorough economic analysis must address all of these issues to evaluate the full economic impact of specific causes of death (16). For example, the economic impact of a sudden death at age 45 from an accident or heart attack may differ greatly from the same individual's death at the same age from long-standing cancer or organ disease. The medical costs involved in the terminal care, the disability, and other quality-of-life issues will be quite different depending on the cause and circumstances of the death.

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