

Years of Potential Life Lost and Valued Years of Potential Life Lost in Assessing Premature Mortality in Slovenia

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Aim. To determine the leading causes of death that contribute most to premature mortality in Slovenia; to classify premature mortality according to the cause of death, age, and sex; and to determine the age point before which premature mortality becomes a potential loss to the society.

Method. Potential economic losses to society were estimated by use of years of potential life lost (YPLL), with a cut-off point at 65 years, and valued years of potential life lost (VYPLL) methods. We calculated the sex-, age-, and underlying causes of death-specific YPLL and VYPLL for residents of Slovenia who died at age younger than 65 years, using Slovene sex-specific life expectancy for 1998/1999 and age-specific weights of investment-producer-consumer model.

Results. In 1998, 4,558 YPLL per 100,000 population were lost to Slovenia. We found bimodal age distribution of YPLL, with the first peak in the 20-24 year age group and the second in the 45-49 year age group. Men to women rate ratio was 2.5. The leading causes of YPLL were external causes of death, followed by malignant neoplasms, and cardiovascular diseases. External causes, including suicides and traffic accidents, were the leading causes of death in men, whereas malignant neoplasms, including breast cancer and digestive cancer, were top-ranking causes in women. Among those, only external causes of death produced positive VYPLL, indicating a net loss to the society.

Conclusion. In Slovenia, YPLL peaked in the 20-24 and 45-49 year age groups. Only external causes of death, most of which were preventable, accounted for the net economic loss to Slovenian society. We believe that YPLL and VYPLL, as specific mortality measures, can be reliably used in the evaluation of leading causes of death before age 65 and potential economic loss to the society caused by those deaths, and that they should be taken into account when setting public health priorities.

Key words: *age distribution; cause of death; life expectancy; mortality; public health; sex; Slovenia; statistics*

Mortality data have widely been used for assessing the health status of a population, as they represent the only continuous source of health information and reflect the most serious negative aspect of health (1). Mortality rates specific for sex, age, cause of death, place of residence, and other characteristics of the decedent or age-adjusted rates continue to be the cornerstones of mortality analysis traditionally used to examine the relative importance of the various causes of death acting upon a population (2). Since most deaths occur in older age groups, these measures are heavily weighted toward the mortality experience of the elderly. From a public health perspective, serious attention must also be directed toward the prevention of premature deaths, ie, deaths that occur earlier than the age of the average life expectancy of the population or before some selected age. Quantifying health status in human populations by means of years of potential life lost has recently received attention.

Years of potential life lost is a sophisticated measure of the impact of premature mortality on a population (3). The advantage of years of potential life lost

over the more familiar mortality measures is that years of potential life lost allows to selectively evaluate leading causes of death in younger age groups, because they are calculated as the sum of the differences between some predetermined minimum or desired life span and the age of death of individuals who died earlier than that predetermined age, which is usually 65 years (4,5). As such, it could guide national and regional public health administrators to define priorities and allocate resources to creative ways for preventing deaths of that particular younger population (6).

Our aim was to determine the leading causes of death that contribute most to the premature mortality (before the age of 65 years) in Slovenia, to show the age distribution of years of potential life lost, and to calculate the difference in years of potential life lost distribution by causes between men and women. Another goal was to determine the age point before which potential premature death of an individual was a total loss to a society, by the use of valued years of potential life lost.

Table 1. Age-specific weights used in calculation of valued years of potential life lost for Slovenia in 1998 according to Investment-Producer-Consumer model

Demographic data			Lifetime segments (years) according to economic productivity ^a						Net investment ^c	Potential loss ^d
age at death (years)	mid-age (years)	life expectancy (years) ^b	0-19		20-64		≥65			
			received	did not receive	produced	did not produce	consumed	did not consume		
< 1	0.5	75	0.5	19.5	0.0	45.0	0.0	10.5	0.5	0.0
1-4	3.0	74	3.0	17.0	0.0	45.0	0.0	11.0	3.0	0.0
5-9	7.0	71	7.0	13.0	0.0	45.0	0.0	12.0	7.0	27.0
10-14	12.0	66	12.0	8.0	0.0	45.0	0.0	13.0	12.0	36.0
15-19	17.0	61	17.0	3.0	0.0	45.0	0.0	13.0	17.0	46.0
20-24	22.0	56	20.0	0.0	2.0	43.0	0.0	13.0	18.0	48.0
25-29	27.0	51	20.0	0.0	7.0	38.0	0.0	13.0	13.0	38.0
30-34	32.0	46	20.0	0.0	12.0	33.0	0.0	13.0	8.0	28.0
35-39	37.0	41	20.0	0.0	17.0	28.0	0.0	13.0	3.0	18.0
40-44	42.0	37	20.0	0.0	22.0	23.0	0.0	14.0	-2.0	7.0
45-49	47.0	32	20.0	0.0	27.0	18.0	0.0	14.0	-7.0	-3.0
50-54	52.0	28	20.0	0.0	32.0	13.0	0.0	15.0	-12.0	-14.0
55-59	57.0	24	20.0	0.0	37.0	8.0	0.0	16.0	-17.0	-25.0
60-64	62.0	20	20.0	0.0	42.0	3.0	0.0	17.0	-22.0	-36.0

^aLifetime segments: investment years (aged 0-19), producer years (aged 20-64), and consumer years (aged ≥65) (4).

^bLife expectancies taken at midpoint age from Slovene 1998/1999 life tables.

^cNet investment = (received) + (consumed) – (produced).

^dPotential loss = (net investment) + (did not produce) – (did not receive) – (did not consume). Note: negative investments and negative losses are gains to society.

Methods

We estimated social and economic losses due to premature mortality in Slovenia in the year 1998, using two different methods: years of potential life lost (YPLL) and valued years of potential life lost (VYPLL). We took mortality data of all deceased residents of Slovenia in 1998 from the Mortality Database at the Institute of Public Health, Slovenia (7).

By years of potential life lost method we point out diseases that contribute most to premature mortality, which is of great importance for setting up priorities for prevention. The method of calculating years of potential life lost varies from author to author, depending on the cut-off age for premature mortality (65 or 70 years of age, or even life expectancy). Each method is a function of the age at death and the number of deaths at that age (4). 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 years of potential life lost. This calculation is a weighted total of the number of deaths by age, with the weights for each age determined by a particular method of valuing potential remaining years of life. Deaths at younger ages receive a greater weight in computing years of potential life lost than do deaths at older ages (4).

We used the following formula to calculate years of potential life lost:

$$\sum_{i=0}^N d_i(N - i)$$

where *i* = age at death, *d_i* = number of deaths at age *i*, and *N* = upper cut-off age.

A cut-off point in our analysis was set at the age of 65.

Last economic productivity is addressed fully by valued years of potential life lost calculation (4). For the purpose of our analysis, we used the following formula:

$$\sum_{i=0}^{\infty} d_i \left[\sum_{j=i}^{i+L_i} l(j) \right]$$

where *i* = age at death, *L_i* = life expectancy at age *i*, *l(j)* = value at age *j*, and *d_i* = number of deaths at age *i*.

The value of *l(j)* is addressed by investment-producer-consumer model (4). According to economic productivity, the lifetime of each individual is divided into three segments: investment

years (aged 0-19), producer years (aged 20-64), and consumer years (aged >65). We considered the value of each year to be equal. During investment and consumer years the individual is receiving from society (negative value for society), whereas during the producer years the individual is giving back to society (positive value for society) (4). We calculated the valued years of potential life lost weights for each age group in Slovenia 1998/1999 (Table 1), using life expectancies model (8). The net investment made by society is the amount received by the individual during years 0-19 and over 65, less the amount produced during age 20-64. The total potential loss to society is the net investment at death plus the potential years in which deceased would not have been a producer, less the additional amount of years in which he or she would not have been a consumer, up to life expectancy year. If an individual lives to the average life expectancy of 75, the net contribution to society will be -20+45-10 = +15 years. An individual who dies at age 22, results in a net loss of 48 years (+20-2+43-13). The worst case of social and economic losses for the society is death at age 20 (after full investment, but before any productivity) and the best at age 65 (after maximum productivity, but before retiring). We used this model with a cut-off point at age 65.

Six leading causes of premature death in Slovenia were analyzed and classified by International statistical classification of diseases and related health problems, 10th revision (ICD-10) (9). Within these, we dealt with 3-5 leading blocks of underlying causes of death. Sex differences were also investigated. Years of potential life lost before age 65 and valued years of potential life lost were expressed as an absolute number, and as a rate per 100,000 population under 65 years of age.

Results

In 1998, 87% of Slovenian residents were younger than 65 years of age. Among them, 77,862 years were lost due to premature death, and 85% of all premature deaths were due to the following diseases and states, listed in descending order: external causes of morbidity and mortality (V01-Y98); malignant neoplasms (C00-C97); diseases of the circulatory system (I00-I99); diseases of the digestive system (K00-K93); symptoms, signs, and abnormal clinical and laboratory findings (R00-R99); and diseases of the respiratory system (J00-J99). Only 15% were attributed to all other causes by ICD-10 classification (Table 2). The years of potential life lost rate of external causes of morbidity and mortality (V01-Y98) was 32% higher than that of malignant neoplasms (C00-

Table 2. Years of potential life lost (YPLL) before age 65 by six leading underlying causes of death in Slovenia in 1998

Cause of death (ICD-10) ^a	YPLL	Rate ^b
External	25,557.5	1,496.2
Malignant neoplasms	17,399.0	1,017.6
Cardiovascular diseases	11,667.5	683.0
Diseases of gastrointestinal tract	5,727.5	335.3
Symptoms and signs not included elsewhere	4,235.5	247.9
Diseases of respiratory tract	1,562.5	91.5
All other causes	11,712.0	685.6
YPLL, all causes	77,861.0	4,558.1

^aInternational classification of diseases and related health problems, 10th revision (9).

^bRates were computed per 100,000 population under the age of 65.

C97), and 54% higher than that of cardiovascular diseases (I00-I99).

Sex Distribution of Premature Deaths

Years of potential life lost differed by sex, both in terms of number and relative ranking of causes of premature death.

In 1998, premature deaths due to all causes led to 55,471 years of potential life lost for men and 22,391 for women. Within these, six leading causes of death made up 47,778 years of potential life lost for men and 18,372 for women. The sex- and age-specific rates per 100,000 corresponding population were 6,453 and 2,638, respectively (men to women ratio 2.4), and for six leading causes of death were 5,558 and 2,165, respectively (men to women ratio 2.1) (Fig. 1). Within six leading causes of death, external causes of morbidity and mortality (V01-Y98) by far exceeded other causes in men, but malignant neoplasms (C00-C97) were the main killer in women under 65 years of age.

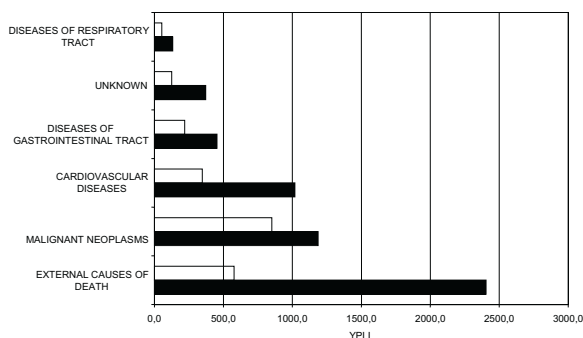


Figure 1. Years of potential life lost rate (YPLL) in men (closed bars) and women (open bars) by six leading causes of death in Slovenia in 1998 (per 100,000 population).

External causes of death were the most important contributor to years of potential life lost in men, accounting for 20,666 years of potential life lost, and the second most important in women. Within external causes of death, suicide was the leading cause of years of potential life lost in both sexes (Table 3). The sex-specific rate ratio of years of potential life lost due to suicide was 4.2 in favor to women. Traffic accidents ranked third as a cause of years of potential life lost among men and seventh among women. The rate of years of potential life lost due to traffic accidents for men was 2.1 times the rate for women.

Malignant neoplasms were the leading cause of years of potential life lost in women, accounting for 7,213 years of potential life lost, but they ranked second as a cause of years of potential life lost in men, in whom years of potential life lost rate due to malignant neoplasms was 28.6% higher than in women (data not shown).

The types of cancer differed by sex. In every sex-unspecific cancer site, years of potential life lost rates for men were higher than for women. The major contributor to premature mortality due to malignant neoplasms of both sexes were malignant neoplasms of the digestive system (C15-C26), which were responsible for 4,155 years of potential life lost or slightly less than one-fourth of the total years of potential life lost due to cancer. Lung cancer (C30-C39) was the next leading cause, with 3,860 years of potential life lost. Female breast cancer (C50-C50), responsible for 1,820 years of potential life lost, ranked second as a cause of total years of potential life lost in women and was leading cancer in women (Table 3).

Cardiovascular diseases were the third most frequent cause of death, responsible for 11,668 years of potential life lost. Men had 294.3% higher rate than women (Table 3).

The major contributor to years of potential life lost was ischemic heart disease (I20-I25), accounting for 4,703 years of potential life lost and ranking second as a cause of years of potential life lost in men and eighth in women. The rate ratio of men to women was 2.1. The next leading causes were cerebrovascular diseases (I60-I69) and other heart diseases (I30-I52), which accounted for 3,270 and 2,295 years of potential life lost (ranking seventh and eighth), respectively. Years of potential life lost rates for men were 84.3% higher than for women for cerebrovascular and 218.8% for other heart diseases.

As a cause of years of potential life lost, diseases of gastrointestinal tract were ranked fourth, accounting for 5,728 years of potential life lost. The rate for men was twice the rate for women. The major contributor to years of potential life lost were liver diseases (K70-K77), which accounted for 4,795 years of potential life lost and ranked fifth as a cause of years of potential life lost for men and third for women. Men to women rate ratio was 2.1 (Table 3).

Age Distribution of Premature Deaths

Age distribution of years of potential life lost showed bimodal curve, with the first minor peak at 20-24 years of age and the second at 45-49 years of age. The years of potential life lost curve for men was higher than that for women (Fig. 2).

Age distribution of years of potential life lost due to various causes of death gave better insight into the relative importance of each. In men, external causes of death (V01-Y98) started increasing at school age and continued to increase until the age of 25, when the line, after a slight decrease, showed a plateau until the age of 40. Diseases of circulatory system (I00-I99) and cancer (C00-C97) showed the opposite picture by slightly increasing line after age of 34 and reaching the pick value at the age of 50 (Fig. 3). In

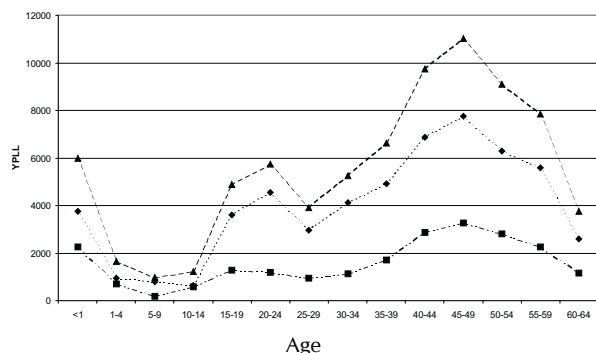


Figure 2. Age distribution of years of potential life lost (YPLL) in Slovenia in 1998 due to six leading causes of premature deaths classified according to International classification of diseases and related health problems, 10th revision (ICD-10) (9). Men – diamonds, women – squares, total population – triangles.

women, external causes of death (V01-Y98) were also a problem in the period from school age to the age of 25, but not as pronounced one as in men. According to years of potential life lost, the most pronounced problems in women between 30 and 50 years of age were malignant neoplasms (C00-C99) and, far less, cardiovascular diseases (I00-I99) (Fig. 4).

Valued Years of Potential Life Lost

The number of valued years of potential life lost for all causes of death in 1998, calculated on the basis of investment-producer-consumer model, showed negative value of -61,950 valued years of potential life lost. Within this amount of valued years of potential life lost, the number for six leading causes of death was -40,081.

Premature deaths from external causes of death were responsible for larger number of productivity years lost in working period. The second, by far less important, were malignant neoplasms, thus resulting in total positive value of valued years of potential life lost (Fig. 5). The age point at which total positive valued years of potential life lost turned to negative valued years of potential life lost was at age group 45-49 years.

Premature deaths from external causes of death were responsible for 7,331 valued years of potential

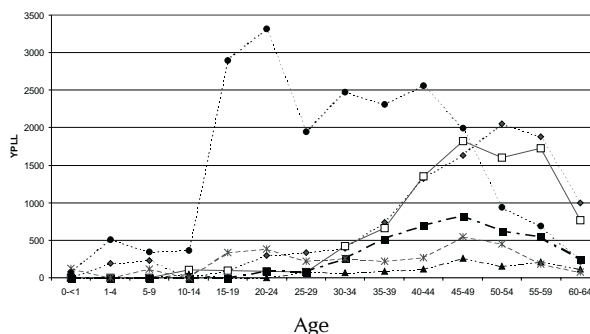


Figure 3. Age distribution of years of potential life lost (YPLL) for men in Slovenia in 1998 due to six leading causes of premature deaths classified according to International classification of diseases and related health problems, 10th revision (ICD-10) (9). Malignant neoplasms – diamonds, cardiovascular diseases – open squares, diseases of respiratory tract – triangles, diseases of gastrointestinal tract – closed squares, signs and symptoms not classified elsewhere – asterisks, external causes of death – circles.

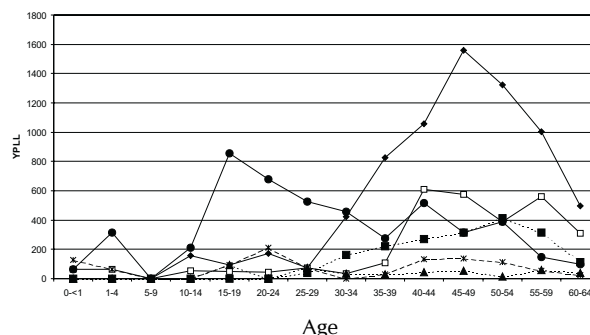


Figure 4. Age distribution of years of potential life lost (YPLL) for women in Slovenia in 1998 due to six leading causes of premature deaths classified according to International classification of diseases and related health problems, 10th revision (ICD-10) (9). Malignant neoplasms – diamonds, cardiovascular diseases – open squares, diseases of respiratory tract – triangles, diseases of gastrointestinal tract – closed squares, signs and symptoms not classified elsewhere – asterisks, external causes of death – circles.

life lost. Positive value of valued years of potential life lost in this group of premature deaths was found in men victims of motor vehicle accidents, suicide, and accidental drowning, and in women pedestrians, vic-

Table 3. Sex distribution of leading causes of years of potential life lost (YPLL) before age 65 in Slovenia in 1998 (per 100,000 population)

Cause of death	ICD-10 ^a	Men		Women			
		rank	YPLL	rate	rank	YPLL	rate
Suicide		1	8,982.5	1,044.9	1	2,112.5	248.9
Ischemic heart diseases	I20-I25	2	3,897.5	453.4	8	775.0	91.3
Traffic accidents		3	3,537.5	411.5	7	915.0	107.8
Neoplasms of respiratory and intrathoracic organs	C30-C39	4	3,130.0	364.1	9	697.5	82.2
Liver diseases	K70-K77	5	3,022.5	351.6	3	1,677.5	197.7
Neoplasms of gastrointestinal tract	C15-C26	6	2,505.3	291.4	4	1,630.0	192.1
Cerebrovascular diseases	I60-I69	7	2,120.0	246.6	6	1,150.0	135.5
Other diseases of heart	I30-I52	8	1,747.5	203.3	10	548.0	64.6
Neoplasms of lips, oral cavity, and pharynx	C00-C14	9	1,092.5	127.1	13	90.0	10.6
Chronic diseases of lower respiratory tract	J40-J47	10	495.0	57.6	12	175.0	20.6
Influenza and pneumonia	J10-J18	11	467.5	54.4	11	1,677.5	197.7
Breast cancer	C50	12	35.0	4.1	2	1,820.0	214.5
Gynecological cancer	C51-C58				5	1,182.5	139.4

^aInternational classification of diseases and related health problems, 10th revision (9).

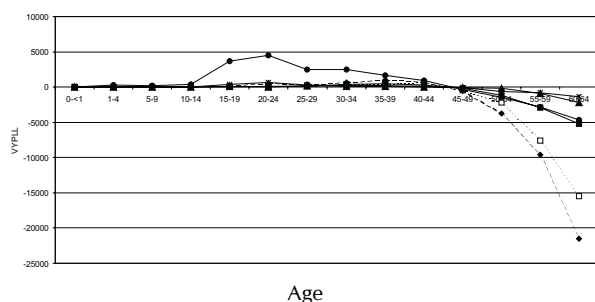


Figure 5. Valued years of potential life lost (YPLL) in Slovenia in 1998 due to the six most frequent causes of premature deaths classified according to International classification of diseases and related health problems, 10th revision (ICD-10) (9). Malignant neoplasms – diamonds, cardiovascular diseases – open squares, diseases of respiratory tract – triangles, diseases of gastrointestinal tract – closed squares, signs and symptoms not classified elsewhere – asterisks, external causes of death – circles.

tims of motor vehicle accidents, and suicides (Table 4). The greatest differences between men and women were found for motor vehicle accidents and suicides (Table 5).

Discussion

Years of potential life lost is a mortality-based indicator generally used to point out deaths at younger age. For example, 27% of the deceased in Slovenia in 2000 were younger than 65 years (10). Most these cases should have been avoidable, ie, deaths from specific diseases (within selected age groups), for which mortality should be wholly or substantially omitted or postponed if appropriate medical care were sought and provided in a good time (11).

Despite the fact that in Slovenia every death is medically certified and the underlying cause of death

Table 4. Sex distribution of valued years of potential life lost (VYPLL) due to premature deaths from external causes of death in Slovenia in 1998

No. of VYPLL	Pedestrians	Falls	Motor vehicle accidents	Suicide	Accidental drowning
Men	-34.0	-547.0	2,499.0	2,778.0	207.0
Women	96.0	-204.5	727.0	474.0	-116.0
Total population	62.0	-751.5	3,266.0	3,252.0	91.0
Per 100,000 men	-396.0	-64.0	291.0	323.0	24.0
Per 100,000 women	1,131.0	-24.0	86.0	56.0	14.0
Per 100,000 total population	4.0	-44.0	188.0	190.0	5.0

coded according to the ICD-10 classification, deviations in interpretation of coding rules always exist, even among the nine physicians in regional institutes of public health, who are in charge of coding. Furthermore, there are differences in medical training of medical practitioners who fill out the death certificates as well as in diagnostic possibilities of health institutions in the country. Concerning the place of death, about 48% of total number of deaths take place in hospitals and about 52% at home, with 10% of the deceased examined post mortem. In 1998, 3.1% of causes of death were listed under the Chapter 18 of the ICD-10, and there were 4.5% of premature deaths due to symptoms, signs, and ill-defined conditions. The proportion of deaths for which a specific diagnosis could not be offered was relatively low, but we believe that the percentage of ill-defined premature deaths should be even further diminished.

Another mortality-based indicator is valued loss of productive years due to premature mortality (4). The current losses appropriately reflect the burden of diseases and external causes of death in the population.

The relative ranking of causes of death changes with the use of different years of potential life lost methods (Table 5). Comparing the crude mortality rate, which emphasizes deaths in the elderly, with the years of potential life lost method, which emphasizes deaths in the young, we can see that the leading causes were shifted from cardiovascular diseases to external causes of death. In the valued years of potential life lost (Investment-Producer-Consumer) model, cardiovascular diseases and malignant neoplasms dropped to the bottom of the scale, because of the negative weights in the older age groups. Similar results in disease ranking according to different methods of years of potential life lost were also found by other researchers (12,13).

The results of years of potential life lost, especially the age distribution, only show that weights decrease toward the older age groups, which is why the total corresponding number of years of potential life lost also decreases. They do not show the decrease in mortality toward age 65, as could be misinterpreted from Figures 2-4.

When estimating mortality burden by years of potential life lost method in the adult age group (20-64) in Slovenia for 1998, we found that in the analyzed age group the external causes of death and malignant neoplasms overtook cardiovascular diseases,

Table 5. Ranking of causes of death by various methods of calculating years of potential life lost (YPLL)

Rank	Crude mortality rate	YPLL (65) ^a	YPLL (75) ^a	VYPLL ^b
1	Cardiovascular diseases	external causes of death	malignant neoplasms	external causes of death
2	Malignant neoplasms	malignant neoplasms	external causes of death	symptoms and signs not included elsewhere
3	Diseases of respiratory tract	cardiovascular diseases	cardiovascular diseases	diseases of respiratory tract
4	External causes of death	diseases of gastrointestinal tract	diseases of gastrointestinal tract	diseases of gastrointestinal tract
5	Diseases of gastrointestinal tract	symptoms and signs not included elsewhere	symptoms and signs not included elsewhere	cardiovascular diseases
6	Symptoms and signs not included elsewhere	diseases of respiratory tract	diseases of respiratory tract	malignant neoplasms

^aCut-off age point.

^bValued years of potential life lost.

which are the most frequent cause of death in total population. Except suicide, which ranked the first as the cause of death in both sexes, different diseases and states were important in men vs women. According to the age distribution of years of potential life lost by sex, external causes of death were the most important in young men, diseases of circulatory system and malignant neoplasms in middle aged men, and malignant neoplasms in middle aged women. The turning point for total population was located at 45-49 year age group, where positive values of valued years of potential life lost turned to negative ones. At that point, the burden to the society ceased to exist.

Results from Belgium (13), Israel (14), and Puerto Rico (15) showed that total number of years of potential life lost was lower in women than in men and that malignant neoplasms were the most important cause of years of potential life lost in women. Ischemic heart disease, cancer, and accidents of all types were equally responsible for most premature deaths in man in Israel (14), whereas homicides and liver cirrhosis were significant sources of years of potential life lost among men in Puerto Rico (15). When 0-65 years of potential life lost, 1-70 years of potential life lost, and 0 to life expectancy years of potential life lost methods were compared, tumors remained at the first place among Spanish Catalan population in all three cases (16).

In our analysis, most deaths caused by external causes of death occurred in younger age groups, thus resulting in a high number of positive valued years of potential life lost. The same findings were reported by Chinese, Canadian, and American researchers (17-21). Most cases of deaths from preventable causes (external causes of death), which contributed the most to positive valued years of potential life lost, tended to occur earlier in adulthood (between age 20 and 44) than did deaths from ischemic heart diseases and neoplasms. However, this was not the case with other causes of death. The onset of diseases that caused premature deaths from all other causes of death was shifted to the second half of productivity period, thus resulting in negative valued years of potential life lost. Negative values indicated no loss to society.

The valued years of potential life lost method in our analysis showed that only some of the external causes of death resulted in positive valued years of potential life lost, indicating that only few premature deaths represented economic loss to the society. As already mentioned, economic loss to the society is heavier if a person dies at age 20, after the society has made full investment into the person's education and before it gained anything back through the person's productivity. Society makes investment into each individual directly or indirectly via parents or guardians (education, schooling or professional training, living). The curve of valued years of potential life lost has a positive value from birth till the age of 45; afterward it is getting negative. In this period, one is giving back to society the money received during investment period, plus contributing to the society with extra work. Potential loss diminishes with each year of produc-

tion until the age of 45. From the age of 45 to the age of 65, one is working for his or her retirement. Premature deaths in production period are thus resulting in great number of productivity years lost. The conclusion is that an individual has to produce for 25 years to give back what he or she received from the society. If an individual dies, or does not enter into production period because of some other reason (illness or injury), this results in a great economic loss for the society. An individual who dies at the age of 22 has been receiving from society for 20 years (burden for society). Assuming that this person has worked for two years before dying, his or her contribution to the society (giving back what he or she has received during investment period) is only 2 years of production (benefit for the society). If that person had not died prematurely, he or she could have contributed with his or her work to society for another 43 years. In that period, the person should have partly produced for society and partly for his or her potential pension, which the person should have received if she or he had lived until the age of 75 (life expectancy).

According to valued years of potential life lost, only premature deaths from external causes of death (V01-Y98) had by far the largest impact on Slovene society in 1998. The remaining causes of death (including subcategories of cancer, cardiovascular diseases, diseases of gastrointestinal tract, and diseases of respiratory tract) had all negative valued years of potential life lost, indicating no net productivity loss.

Accurate measuring of the impact of premature deaths from various diseases and states in people at working age is important for allocating limited resources that aim to reduce the burden of such diseases on society. The list of health problems that emerged from the valued years of potential life lost analysis often included problems that national health institutions were not accustomed to work with, such as homicide, suicide, falls, and motor vehicle accidents.

Years of potential life lost measure, inherently incorporating age at death, can serve as an index of the social and economic consequences of mortality (3). Planning future health policy should rely more heavily on measures such as years of potential life lost. These findings suggest that health promotion strategies need to be sex-, age-, and geographic-specific to reach the right targets.

When county-level mortality data are presented as years of potential life lost and valued years of potential life lost, a different set of prevention or health service priorities can emerge. Causes of years of potential life lost common to the whole country (heart disease, preventable malignant neoplasms, and other) should be prevented by uniform national programs, whereas those causes with large variations across health regions (motor vehicle accidents, suicide, liver diseases, and so forth) may require locally designed interventions.

Every death is important for the society. From a social point of view, it is of great importance at what age death occurs. People of working age usually assume a greater responsibility for the daily activities of

a society than other age groups. Society may properly expect from each generation not only its own reproduction, but a bequest of material and intangible values to succeeding generations. Thus prevention of premature deaths before age 65 should be an important goal for public health and health care workers.

References

- 1 Uemura K. Excess mortality ratio with reference to the lowest age-sex-specific death rates among countries. *World Health Stat Q* 1989;42:26-41.
- 2 Plaut R, Roberts E. Preventable mortality: indicator or target? Applications in developing countries. *World Health Stat Q* 1989;42:4-15.
- 3 Lopez AD. Who dies of what? A comparative analysis of mortality conditions in developed countries around 1987. *World Health Stat Q* 1990;43:105-14.
- 4 Gardner JW, Sanborn JS. Years of potential life lost (YPLL) – what does it measure? *Epidemiology* 1990;1:322-9.
- 5 US Centers for Disease Control and Prevention. Florida state health profile, 1991. Atlanta (GA): CDC; 1992.
- 6 McDonell S, Vossberg K, Hopkins RS, Mittan B. Using YPLL (years of potential life lost) in health planning. *Public Health Rep* 1998;113:55-61.
- 7 Zdravstveni statistični letopis, Slovenija, 1998. Ljubljana: Inštitut za varovanje zdravja Republike Slovenije; 1998.
- 8 Statistical office of the Republic Slovenia. Life tables for the population of Slovenia [in Slovenian]. Ljubljana: Statistični urad republike Slovenije; 2000.
- 9 Mednarodna klasifikacija bolezni in sorodnih zdravstvenih problemov za statistične namene, Deseta revizija (MKB-10). Ljubljana: Inštitut za varovanje zdravja Republike Slovenije; 1995.
- 10 Zdravstveni statistični letopis Slovenija 1998. Ljubljana: Inštitut za varovanje zdravja Republike Slovenije; 2001.
- 11 Holland WW, editor. European Community atlas of "avoidable death" 1974-78 and 1980-84. 2nd ed. Oxford: Oxford University Press; 1991.
- 12 Yang ZC, Zhou XZ. An analysis of YPLL, WYPLL and VYPLL in Guangzhou, 1983-1994 [in Chinese]. *Zhonghua Liu Xing Bing Xue Za Zhi* 1996;17:208-12.
- 13 Humblet PC, Lagasse R, Leveque A. Trends in Belgian premature avoidable deaths over a 20 year period. *J Epidemiol Community Health* 2000;54:687-91.
- 14 Rennert G. Premature mortality, Israel 1986. *Isr J Med Sci* 1992;28:442-6.
- 15 Ramirez de Arellano AB. The death divide: differentials in premature mortality by gender in Puerto Rico. *Bol Asoc Med P R* 1992;84:11-4.
- 16 Mingot M, Rue M, Borrell C. Years of potential life lost: comparison of 3 calculation methods. *Gac Sanit* 1991;5:21-8.
- 17 Chi GB, Wang SY. A comparative study on mortality and YPLL of accidents. *Zhonghua Liu Xing Bing Xue Za Zhi* 1996;17:195-8.
- 18 Clayton D, Barcel A. The cost of suicide mortality in New Brunswick, 1996. *Chronic Dis Can* 1999;20:89-95.
- 19 Struttman TW, Scheerer A, Moon E. Potentially productive years of life lost (PPYLL) in Kentucky due to occupational fatalities, 1994-1996. *J Ky Med Assoc* 1998;96:369-73.
- 20 Bustamante-Montes LP, Rascon-Pacheco RA, Borja-Aburto VH. Effects of the application of the years of productive life lost index (investment-producer-consumer model) on the sequence of causes of death in Mexico [in Spanish]. *Rev Saude Publica* 1994;28:198-203.
- 21 Klatt ML, Kennedy RD, Conway GA. Years of potential life lost and lost future productivity due to occupational fatalities – Alaska, 1990-1994. *Alaska Med* 1995;37:123-5.

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