Trends in Productive Years of Life Lost to Premature Mortality Due to Coronary Heart Disease

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Objective - *To estimate the number of productive years of life lost to premature death due to coronary heart disease in Brazil and to report their trends over a 20-year period.*

Methods - *The Brazilian Ministry of Health raw database on death due to coronary heart disease from 1979-1998 was used. The productive years of life lost to premature death were estimated using 20 and 59 years of age as the cut points for the productive years, replacing the potential years of 1 and 70 of the original formula. A descriptive analysis was provided with adjustments, means, proportions, ratios, percentages of increase or reduction, and mobile means.*

Results - *A 35.8% increase in death for males and 51.3% for females was observed, +43.3% being the relative difference for females. The annual means of the productive years of life prematurely lost were analyzed in 140,865 males and 58,559 females, with the differential ratio between the age groups ranging from 2.3 to 2.5. The annual means were less favorable for males. Within each group (intragroup), the ratios decreased with the increase in age, and the age means at the time of death remained constant. The raw tendencies decreased in the 20- to 29-year age group and increased in the 40- to 59-year age group for females and the 40- to 49-year age group for males. When adjusted, the raw tendencies decreased.*

Conclusion - *The 43.3% increase in the number of female deaths as compared with that of males and the ascending tendency in the productive years of life lost in the 40- to 59-year age group point to the influence of unfavorable changes in female lifestyles and suggest a deficiency in programs for prevention and control of risk factors and in their treatment in both sexes.*

Keywords: coronary heart disease, premature mortality, productive years of life, age

Excluding the magnitude of coronary heart disease and the direct costs of its in-hospital treatment, the social impact on the productive years of life is not well known even in developed western countries. Well-known studies about this issue are related to years of potential life lost, with low and high age cut points of 1 and 70 years [1,2], respectively, which are different from the ages considered economically productive.

In countries that have not consolidated the epidemiological transition, as in Brazil [3], with little investment in the prevention of nontransmissible chronic diseases, cardiovascular diseases occur early and account for elevated costs to society [4,5]. The treatment of risk factors, such as diseases (hypertension, diabetes, obesity, and hyperlipemia), is unequal among social classes, the compliance to treatment is low, and, consequently, control is inadequate [6-8]. In the case of coronary heart disease, the most advanced investigative and therapeutic technologies used in cardiovascular emergencies have not homogeneously reached the different social classes. When the population assisted by the public health system (Sistema Único de Saúde) has access to cardiovascular procedures, implementation of procedures rarely occurs with the speed necessary for the best prognosis (Emergências Cardiovasculares em Salvador, Lessa, personal communication), resulting in deaths that could be avoided, particularly during the productive years.

The lack of official and comprehensive information about this issue, particularly regarding morbidity and retirement due to disability/invalidism consequent to premature coronary heart disease, impairs the global measurement of the social impact of the disease. That is why studies based on death are the most feasible and nondiscriminatory, because of the inclusion of all deaths, of all social classes, and of all assisting resources.

Knowing about the productive years of life lost to premature death provides important information to the health sector and social security. It partially reflects the social impact of the diseases, whose prevention or control, or both, are unquestionably beneficial. The results of some

national studies on all cardiovascular diseases, particularly cerebrovascular diseases [5,9], and on noncardiovascular diseases [10,11] were published in the 1990s. When these results are used rationally, they may guide more consistent decisions about preventive and control strategies or uninterrupted actions, or both, for cardiovascular diseases in general.

The present study aimed at estimating the number of productive years of life lost to premature death due to coronary heart disease in Brazil and at reporting their tendency in a 20-year period.

Methods

This is a tendency study over time (1979/1998) of the productive years of life lost to death due to coronary heart disease during economically active years. The Brazilian raw database was directly obtained from the information system on mortality (Sistema de Informação de Mortalidade - SIM) of the Centro Nacional de Epidemiologia of the Fundação Nacional de Saúde of the Brazilian Ministry of Health (www.datasus.gov.br) for the 20- to 59- year age group and for both sexes. The deaths were recorded in the official statistics as "ischemic heart disease" and were grouped under the numbers 410 to 414 of the International Classification of Diseases and Causes of Death, 9th review for the 1979-1995 period, and as the same causes in an alphanumeric code in the 10th review for the years 1996 to 1998. The population figures for the years 1980 and 1998 were obtained in the IBGE (Brazilian Institute of Geography and Statistics) only for calculating the mortality rates due to coronary heart disease in 2 temporal points (1980 and 1998).

The productive years of life lost were calculated according to the formula of Roemeder and McWhinnie [1], previously modified by Lessa and already used in other publications [5,10,11]. The modification consisted of replacing the original cut points for calculating the potential years of life lost by 20 (lower cut) and 60 years (higher cut), considering this the predominant age group of the economically active life and a parameter for calculating the productive years of life lost, as follows: productive years of life lost = $\Sigma f(60 - (X + 0.5))$, where f = frequency of death for each age group; 60 = higher cut point of age, X = mean point of the class interval of the age brackets; and 0.5 = factor of correction (appendixes I and II).

The analysis was descriptive with raw frequencies of the productive years of life lost adjusted for age and sex, with an adjusting parameter of the deaths that occurred during 1980 in Brazil at the same ages and from the same causes. To construct the pictures, we used the mobile means, order 3, of the frequencies of the productive years of life lost in all years of the series. Means, standard deviations, and intergroup (male x female) and intragroup (age brackets) mean ratios were calculated for the productive years of life lost, as were the percentages of increase or re-

duction in the number of deaths in the period and the increase/reduction ratios. The test of difference between 2 proportions was used in some analyses.

Results

During the 20 years studied, the annual deaths due to coronary heart disease in males ranged from 10,747 to 14,591, and the number of productive years of life lost ranged from 119,165 to 157,805. During the same period of time, the annual deaths due to coronary heart disease in females ranged from 4,272 to 6,465, and the number of productive years of life lost ranged from 47,470 (1982) to 68,625 (appendixes I and II).

Table I shows the percentages of increase or reduction in the number of deaths due to coronary heart disease. A 51.3% increase was observed for females and a 35.8% increase for males (fig. 1) with unfavorable absolute and relative differences in the female sex of +15.5% and +43.3%, respectively. The dynamics of the increases and reductions in deaths is shown with 3 different approaches in columns A, B, and C of table I: A) of each age group in regard to the one that is immediately below it, in which the 30-39 group stands out in regard to the 20-29 group for males, and the 40-49 group in regard to the 30-39 group for females; B) of the highest age group in regard to lowest ones. Lower ratios are observed for males; C) of each age group in regard to the youngest of all (20-29 years), with very high values for females, and a special emphasis for the 40- to 49-year age group with a 16.8-times greater ratio.

Table II shows the annual means and the mean ratios of the productive years of life lost to premature deaths. For males, the annual mean loss was 140,865 productive years, 2.4 times greater than that for females, for whom the annual mean loss was 58,559 productive years. In all age brackets, the losses in the male sex were 2.3 to 2.5 times greater than those in the female sex. Considering the intragroup perspective, the mean ratios were practically the same for males and females, when each age group was compared to the immediately lower one (column A), and they did not differ between the sexes when the 50- to 59-year age group was compared with all others (column B).
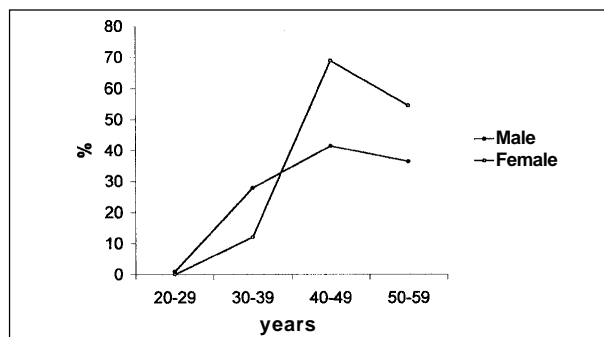

Fig. 1 - Frequencies of increase or reduction in the number of deaths due to coronary heart disease in Brazil from 1979 to 1998.

During the 20 years studied, no significant alteration was detected in the mean ages of males and females at the time of death in the 20- to 59-year age group. The means ranged from 48.3 (1989) to 48.8 (1982) years for the males (maximum difference of 0.5 years, and mode = 48.6 years) and from 48.2 (1979) to 49.1 (1992) years for the females (maximum difference of 0.9 years, and nonsignificant mode) (tab. III).

The population and the number of deaths observed in isolation increased more for females from 1980 to 1998 (p<0.0001), but the population increase in the male sex as compared with the increase in the number of deaths (+41.6%) was 84% greater than the increase observed for females (+ 22.6%) (tab. IV). The ratios between the mortality rates for males and females, 2.6 (1980) and 2.5 (1998), did not change over time, but a more significant reduction was observed in the male rates, whose drop was 52.3% as compared with that of the female sex.

The mobile means of the raw (fig. 2) and adjusted (fig. 3) frequencies of the productive years of life lost showed slightly decreasing tendencies for the 20- to 39-year age group; for the 40- 49-year age group, the frequencies were similar between the sexes and the curves were ascending. A slightly ascending tendency was observed in the 50- to 59-year age group, more evident in females. When adjusted (fig. 3), all curves were descending.

Discussion

In the 20 years studied, the increase in the number of deaths due to coronary heart disease during economically
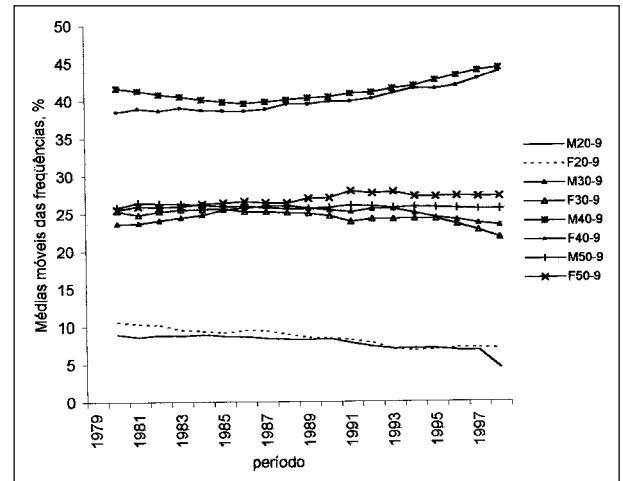

Fig. 2 - Tendency of the raw frequencies of the productive years of life lost to coronary heart disease in both sexes in Brazil from 1979 to 1998.

productive years for both sexes was significant, although more expressive in females. This increase does not necessarily mean that the probability of dying due to the above-specified cause has increased homogeneously, because the basis for calculation was the number of deaths due to coronary heart disease in the country and not the population. In addition, some authors have reported that mortality due to coronary heart disease has been slowly decreasing with no explanation in the municipality of São Paulo and in some age brackets in some selected capitals [12,13]. In the age groups and period of time studied, a small reduction

Table I – Percentage of increase or reduction in the number of deaths due to coronary heart disease from 20 to 59 years of age in Brazil, 1979-1998									
Age	Male % of increase or reduction	Intragroup ratio of increase			Female % of increase or reduction	Intragroup ratio of increase			Absolute difference of the F/M %	Relative difference Fem/Male % of increase or reduction
		A*	B**	C***		A*	B**	C***		
20-29	-6.6	-	5.5	-	-4.1	-	13.3	-	-2.5	-61.0
30-39	+27.9	4.2	1.3	4.2	+12.1	3.0	4.5	3.0	-15.8	-130.6
40-49	+41.4	1.5	0.9	6.2	+68.9	5.7	0.8	16.8	+27.5	+66.4
50-59	+36.4	0.9	-	5.5	+54.4	0.8	-	13.3	+18.0	+49.5
Total	+35.8				+51.3				+15.5	+43.3

* Refers to each age bracket in regard to the one that is immediately below it; ** refers to the 50- to 59-year age group in regard to the others; *** refers to each age group in regard to the 20- to 29-year age group.

Table II - Means, standard deviations (SD), and mean ratios (MR) of the productive years of life lost to premature death due to coronary heart disease in Brazil, 1979-1998									
	Male				Female				Male/fem intergroup MR
Ages	Mean	± SD	Intragroup MR		Mean	± SD	Intragroup MR		
			A*	B**			A*	B**	
20-29	11.196	1.054	-	3.2	4.950	563	-	3.1	2.3
30-39	35.525	3.486	3.2	1.0	14.388	1.378	2.9	1.1	2.5
40-49	58.248	5.431	1.6	0.6	23.540	3.340	2.4	0.7	2.5
50-59	36.444	2.672	0.6	-	15.581	1.939	0.7	-	2.3
Total	140.865	2.672			58.559	6.291			2.4

* Refers to each age group in regard to the one that is immediately below it; ** refers to the 50-to 59-year age group in regard to the others.
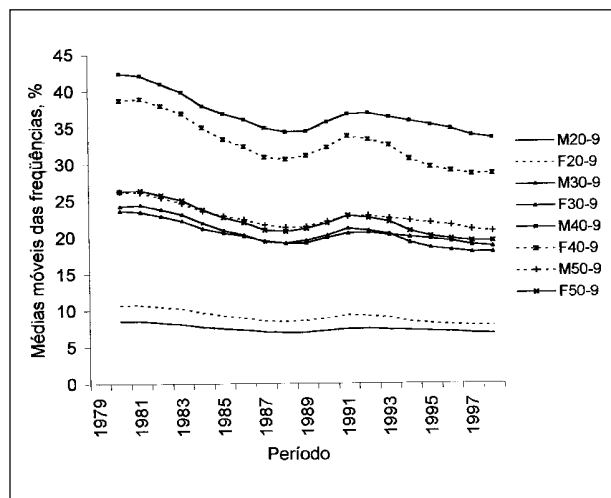
Fig. 3 - Tendency of the adjusted frequencies of the productive years of life lost to coronary heart disease in both sexes in Brazil from 1979 to 1998.

Table III – Mean and standard deviation (SD) of age at the time of death due to coronary heart disease in the 20- to 59-year age group for both sexes in Brazil, 1979-1998

Year	Male		Female	
	Mean	SD	Mean	SD
1979	48.4	7.9	48.2	8.3
1980	48.6	7.8	48.5	8.1
1981	48.6	7.8	48.4	8.1
1982	48.8	7.8	48.5	8.0
1983	48.5	7.9	48.4	8.2
1984	48.6	7.9	48.5	7.9
1985	48.6	7.9	48.7	8.0
1986	48.4	7.9	48.5	8.1
1987	48.6	7.9	48.6	7.9
1988	48.5	7.9	48.6	8.0
1989	48.3	7.9	48.6	7.9
1990	48.6	7.8	48.9	7.7
1991	48.6	7.8	48.7	7.9
1992	48.6	7.7	49.1	7.6
1993	48.6	7.7	48.8	7.6
1994	48.6	7.7	48.9	7.5
1995	48.7	7.6	48.9	7.6
1996	48.6	7.6	48.8	7.7
1997	48.6	7.6	49.0	7.5
1998	48.7	7.5	48.9	7.5

in the mortality rates for each sex was observed, with a significant gain of 52.3% for males as compared with that for females. In other countries, an increase in mortality due to coronary heart disease has been recently seen in young black males from the lower social class [2,14-16].

When comparing the dynamics of the population with that of the deaths, the greater population increase observed in females did not benefit them as occurred with that observed in males, whose percentage increase in population in regard to deaths was 84 % greater than that in the females.

In the sparse international literature about the productive years of life lost, information has been usually related to heterogeneous sets of causes of death [2,17,18] and has originated in countries with greater life expectancy than that in Brazil, with no possibility of comparison with the national data. Premature deaths due to certain causes occurring between 20 and 64 years of age in different social classes and in the male sex have been analyzed only in England; unfavorable and growing differences were found for the cardiovascular diseases in the lower social class [2].

Although in the national data, the greatest number of deaths and of productive years of life prematurely lost to coronary heart disease was observed in the male sex, the percentage increase was more significant in females, especially

in the 40- to 49-year age group. This suggests that the load of risk factors (smoking, obesity, arterial hypertension, hyperlipemia, diabetes, sedentary lifestyle, and stress), infrequent among Brazilian females prior to the last 3 or 4 decades, has been prematurely acquired and is expressed in this age group as significant morbidities, such as coronary heart disease.

Although it is very likely that this hypothesis is true, as is evident by the dynamics of the data shown in table IV, the lack of complementary Brazilian temporal series, of not only social variables but also the prevalence of risk or prognostic factors, restricts explanations about the tendencies at the present moment. The curves based on raw data show that the growing tendency was maintained in the 40- to 49-year age group in both sexes. This is reflected in the magnitude of the productive years of life lost and in the stability of the mean age at the time of death, represented by a plateau slightly above 48 years, independent of sex, and during the entire period studied. This may also be observed by the magnitudes of the increasing ratios of the proportions of intragroup deaths in the 40- to 49-year age group as compared

Table IV - Dynamics of the population, deaths, and mortality rates due to coronary heart disease in 2 points of the historical series: 1980* and 1998

Sex	Population			Deaths			% of increase of the population in regard to deaths	Mortality rate**		
	1980	1998	% of increase	1980	1998	% of increase		1980	1998	% of reduction
Male	26,088,125	39,309,214	50.7	11,371	15,445	35.8	+ 41.6	43.6	39.3	- 9.9
Female	26,088,125	41,113,449	53.8	4,492	6,465	43.9	+ 22.6	16.8	15.1	- 6.5
% of differences or ratios, R,between the sexes		- 6.1%#			- 37.7%#		+ 84.0%#	R = 2.6	R=2.5	+52.3%#

* We used data from 1980 because data on the population of 1979 were not available; ** per 100,000 males and females from 20 to 59 years of age; # p<0.0001.

with the youngest one used as a baseline (columns of tab. I). Considering the accelerated aging of the Brazilian population, a greater concentration of the frequency of death and of the productive years of life lost should be expected in the 50- to 59-year age group. A mean age at the time of death shifting to the lower ages of this age group should also be expected, that is, the migration of deaths to more advanced ages. However, the ratio of the 50- to 59-year age group in regard to the 40- to 49-year group was lower than the unit, because the increase in deaths in the latter group was greater. Premature deaths in both sexes occurred approximately 11.5 years before age 60, around which time retirement occurred, until the last year of the series, 1998.

In some countries, such as in the United States of America, the financial impact of coronary heart disease in premature ages is also significant; 10 years ago, only in California, the costs reached 5,200 billion dollars [19]. This information shows the socioeconomic burden of coronary heart disease in only 1 state of a wealthy country. In the 1980s, the costs of cerebrovascular diseases in Brazil were partially estimated [5]. They have been difficult to determine from that point on because of the economic instability and changes in the Brazilian currency in the last 2 decades, requiring correction of the values and exchange into a stable currency, usually the North American dollar.

The 50% and 57% drops in mortality due to coronary heart and cerebrovascular diseases, respectively, reported in the United States in 1997, with no reference to age, have been mostly attributed to the treatment of arterial hypertension [20]. In Auckland, New Zealand, half of the 23.6% drop in mortality due to coronary heart disease (1982/1993), with no reference to age, has been attributed to treatment, and the other half to preventive measures [21]. Both studies show how and how much mortality due to coronary heart disease can be reduced. Naturally, these reductions should reflect favorably in the costs and in other social impacts of the disease.

The analysis of the productive years of life lost to premature mortality due to coronary heart disease may, on the one hand, represent 1 of the feasible parameters to monitor that disease in Brazil, and, on the other, a landmark to further analyses of the impact of preventive strategies on risk factors, mainly smoking, obesity, and hypertension, which also contribute to several other causes of death. It is worth noting, however, that distortions in the analyses of historical series in Brazil may be due to the diagnoses reported on the death certificates as the basic cause of death by the assisting physician or the one responsible for filling out the certificate, or to the errors of selecting the basic cause of death, or to its typing, this latter in a centralized level.

Appendix I – Deaths and productive years of life lost to coronary heart disease in the male sex in Brazil, 1979-1998										
Year	20-29		30-39		40-49		50-59		20-59	
	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL
1979	319	11,165	1,133	28,325	3,320	49,800	5,975	29,875	10,747	119,165
1980	302	10,570	1,159	28,975	3,465	51,975	6,445	32,225	11,371	123,745
1981	316	11,060	1,194	29,850	3,440	51,600	6,576	32,880	11,526	125,390
1982	287	10,045	1,162	29,050	3,304	49,560	6,544	32,720	11,297	121,375
1983	356	12,460	1,314	32,850	3,619	54,285	6,943	34,715	12,232	134,310
1984	339	11,865	1,369	34,225	3,677	55,155	7,145	35,725	12,530	136,970
1985	350	12,250	1,390	34,750	3,687	55,305	7,380	36,900	12,807	139,205
1986	360	12,600	1,558	38,950	3,860	57,900	7,410	37,050	13,188	146,500
1987	349	12,215	1,505	37,625	3,854	57,810	7,642	38,210	13,350	145,860
1988	360	12,600	1,574	39,350	4,160	62,400	7,983	39,915	14,077	154,265
1989	360	12,600	1,645	41,125	4,111	61,665	7,609	38,045	13,725	153,435
1990	342	11,970	1,439	35,975	3,900	58,500	7,634	38,170	13,315	144,615
1991	333	11,655	1,371	34,275	3,774	56,610	7,273	36,365	12,751	138,905
1992	264	9,240	1,461	36,525	3,882	58,230	7,205	36,025	12,812	140,020
1993	282	9,870	1,499	37,475	3,914	58,710	7,447	37,235	13,142	143,290
1994	310	10,850	1,434	35,850	4,085	61,275	7,433	37,165	13,262	145,140
1995	285	9,975	1,421	35,525	4,136	62,040	7,590	37,950	13,432	145,490
1996	293	10,255	1,452	36,300	4,322	64,830	7,697	38,485	13,764	149,870
1997	293	10,255	1,452	36,300	4,461	66,915	7,694	38,470	13,900	151,940
1998	298	10,430	1449	36,225	4,693	70,395	8,151	40,755	14,591	157,805
Mean	319.9	11,196.5	1,399	35,525	3,883	58,248	7,289	36,444	12,891	140,865
SD*	30.1	1,053.7	139.4	3,486.3	360.9	5,413.2	534.3	2,671.7	991.3	10,939.3
% of I or R**	-6.6		+27.9		+41.4		+36.4		+35.8	

PYLL – productive years of life lost; * standard deviation; ** I - increase; R- reduction.

Appendix II - Deaths and productive years of life lost to coronary heart disease in the female sex in Brazil, 1979-1998										
	20-29		30-39		40-49		50-59		20-59	
YEAR	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL	Deaths	PYLL
1979	146	5,110	521	13,025	1,209	18,135	2,396	11,980	4,272	48,250
1980	151	5,285	478	11,950	1,273	19,095	2,590	12,950	4,492	49,280
1981	151	5,285	500	12,500	1,320	19,800	2,574	12,870	4,545	50,455
1982	131	4,585	482	12,050	1,228	18,420	2,483	12,415	4,324	47,470
1983	159	5,565	548	13,700	1,349	20,235	2,749	13,745	4,805	53,245
1984	132	4,620	557	13,925	1,479	22,185	2,844	14,220	5,012	54,950
1985	148	5,180	571	14,275	1,399	20,985	3,003	15,015	5,121	55,455
1986	172	6,020	636	15,900	1,545	23,175	3,225	16,125	5,578	61,220
1987	160	5,600	584	14,600	1,615	24,225	3,176	15,880	5,535	60,305
1988	167	5,845	651	16,275	1,637	24,555	3,384	16,920	5,839	63,595
1989	149	5,215	646	16,150	1,677	25,155	3,304	16,520	5,776	63,040
1990	130	4,550	546	13,650	1,532	22,980	3,222	16,110	5,430	57,290
1991	147	5,145	562	14,050	1,514	22,710	3,066	15,330	5,289	57,235
1992	119	4,165	513	12,825	1,462	21,930	3,191	15,955	5,285	54,875
1993	117	4,095	594	14,850	1,639	24,585	3,250	16,250	5,600	59,780
1994	111	3,885	599	14,975	1,708	25,620	3,342	16,710	5,760	61,190
1995	134	4,690	620	15,500	1,832	27,480	3,572	17,860	6,158	65,530
1996	139	4,865	658	16,450	1,819	27,285	3,614	18,070	6,230	66,670
1997	128	4,480	578	14,450	1,858	27,870	3,563	17,815	6,127	64,615
1998	140	4,900	584	14,600	2,042	30,630	3,699	18,495	6,465	68,625
Means	141	4,950	576	14,388	1,569	23,540	3,136	15,581	5,423	58,559
SD*	15.7	563.0	55.2	1,379.8	222.7	3,340.3	387.7	1,938.7	645.59	6,290.6
% of I or R**	-4.1		+12.1		+68.9		+54.4		+51.3	

PYLL – productive years of life lost; * standard deviation; ** I - increase; R- reduction.

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