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Trends of mortality from external causes in the Umbria region of Italy: 1994-2004

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Abstract

The aim of the present paper is to analyse the mortality from external causes in the Umbria region, from 1994 to 2004, in order to have an indication of the effectiveness of primary prevention interventions. Sex and cause-specific AADR (the age-adjusted death rates) and YPLL rates (the age-adjusted rates of years of potential life lost up to 74 yrs) time trends were analysed by means of joinpoint regression utilising SEER software. The expected annual percent change and its significance were also calculated. The cause groups examined were: all external causes, transport accidents, falls, accidental poisoning and exposure to noxious substances, intentional self-harm and assault. The age-adjusted death rates from the selected external causes showed, in both sexes, a decreasing trend. The joinpoint regression of AADR indicated that all statistically significant variations are declining. For the AADR cause group significant decreases were found in all external combined and poisoning causes for both sexes, transport accidents and falls for females.
Among males the age-adjusted YPLL rates showed significant decreases for all external causes combined (EACP = -2.8%). This analysis provides a useful tool to evaluate the effectiveness of interventions performed in the last decade and indicates that further assessment and monitoring are needed.

Key words: external causes mortality, trends, epidemiology

Introduction

Injuries represent a significant cause of death and disability in western countries. In Umbria, a Region in Central Italy with 845.000 inhabitants, 2645 (240.4 /year) deaths due to external injuries and poisonings occurred among males and 4019 (365.4 /year) among females during the period 1994-2004. External injuries and poisonings represented the fourth and fifth main cause of death for males and females respectively, following cardio-circulatory diseases, cancer, respiratory and digestive diseases for females [1]. Deaths from external injuries and poisonings are included among avoidable causes [2-4] and they are used as an exploratory indicator of effectiveness of a health system. In 1976, Rutstein *et al.* first proposed a list of sentinel health events to be used as outcome indices to evaluate the quality of medical care and preventive services. Avoidable mortality was used principally as an indicator of the quality of health policies, whether investigating geographical variation within a country or trends over time in various regions or countries. Conventionally deaths are deemed avoidable by primary prevention in the 5-64 age groups [5], though they may be avoidable in all age group [6]. Primary prevention interventions to reduce avoidable mortality due to external causes include both health promotion to induce lifestyle modification such as reduction of alcohol and illegal drugs consumption, and government measures (e.g. building of safe roads, issuing of laws, surveillance) to improve road, home, and workplace safety.

A regional mortality registry, named ReNCaM (Nominative Registry of Causes of Deaths) has been operational in Umbria since 1994; it collects mortality data from municipal offices and death certificates, and publishes yearly mortality statistics, from all causes, with respect to the previous year.

The analysis of mortality trends from external causes in Umbria provides a useful tool to evaluate the overall effectiveness of the interventions performed in the last decade. Every year almost four hundred people die from injuries in the Umbria region; this indicates that accurate monitoring and effective interventions are needed to reduce this heavy burden on the population's health.

The aim of the present paper is to analyse the mortality from external causes in the Umbria region, from 1994 to 2004, in order to have an indication about the effectiveness of primary prevention interventions.

Materials and methods.

Mortality data, from the period 1994-2004, were collected by the ReNCaM operators from the deaths list supplied by the registry population offices of the Umbrian municipalities; the database was completed with causes of death resulting from death certificates and classified by the IX and X International Classification of Diseases [7,8]. The cause groups examined were: all external causes (V01-Y98 ICDX), transport accidents (V01-V99 ICDX), falls (W00-W19 ICDX), accidental poisoning and exposure to noxious substances (X40-X49 ICDX), intentional self-harm (X60-X84 ICDX) and assault (X85-Y09 ICDX).

For each cause, we calculated the age-adjusted death rates (AADR), and the age-adjusted rates of years of potential life lost up to 74 yrs (YPLL). The choice of 75 as the upper age limit for YPLL calculation is of course arbitrary but seemed logical considering the average life expectancy at birth for the study period [9, 10].

The rates were calculated relating the number of deaths with the mean resident population for that year.

To reduce the bias of excessive difference in age structure, we used Umbrian residents (as of 1991 census) as the standard population in the joinpoint analyses.

Sex and cause-specific AADR and YPLL time trend were analysed by joinpoint regression (ln(y)=xb; where x represents the calendar year and y the rate), using SEER software [11] based on the Kim et al. method [12]. A joinpoint represents the time point when a significant trend change is detected, that is a joinpoint is maintained in the final model only if the model using two linear segments with different slopes significantly improve over the simpler model including only a linear segment. Time change is conveniently expressed in terms of expected annual percent change (EAPC), calculated by exponentiating coefficients for each linear approximation retained in the final model; significance of time trends is also reported.

Results

Table 1 reports the age-adjusted deaths rates from the selected external causes: from all external causes (V01-Y98 ICDX), from transport acci-

Table 1. Age-adjusted mortality rates, *e.s.*, from all external causes (V01-Y98 ICDX), from transport accidents (V01-V99 ICDX), from falls (W00-W19 ICDX), from accidental poisoning and exposure to noxious substances (X40-X49 ICDX), from intentional self-harm (X60-X84 ICDX) and assault (X85-Y09 ICDX)

MALES												
YEAR	all external causes		transport accidents		falls		accidental poisonings		intentional self-harm		assault	
1994	75.6	*4.5*	28.3	*2.7*	14.9	*2.1*	1.7	*0.6*	18.3	*2.2*	1.3	*0.6*
1995	69.4	*4.2*	23.8	*2.2*	6.4	*1.3*	1.0	*0.5*	18.4	*2.2*	0.3	*0.3*
1996	63.6	*4.0*	22.2	*2.4*	5.6	*1.1*	2.8	*0.8*	17.5	*2.1*	0.2	*0.2*
1997	59.2	*3.8*	15.9	*2.0*	7.1	*1.3*	2.9	*0.8*	14.5	*2.9*	0.7	*0.4*
1998	61.3	*3.9*	21.7	*2.3*	8.9	*1.5*	4.1	*1.0*	10.6	*1.6*	0.9	*0.4*
1999	57.1	*3.8*	24.5	*2.5*	6.7	*1.3*	1.2	*0.5*	10.7	*1.7*	0.2	*0.2*
2000	54.5	*3.6*	21.9	*2.3*	8.6	*1.4*	0.7	*0.4*	12.3	*1.7*	0.0	*0.0*
2001	53.0	*3.6*	23.6	*2.4*	5.0	*1.1*	0.3	*0.3*	16.9	*2.0*	0.0	*0.0*
2002	51.1	*3.5*	23.0	*2.4*	6.9	*1.2*	0.2	*0.2*	15.9	*2.0*	0.6	*0.4*
2003	46.7	*3.3*	19.2	*2.2*	4.8	*1.0*	0.2	*0.2*	14.5	*1.8*	1.5	*0.6*
2004	50.7	*3.4*	20.8	*3.2*	7.7	*1.3*	0.0	*0.0*	12.3	*1.7*	0.5	*0.4*
FEMALES												
YEAR	all external causes		transport accidents		falls		accidental poisonings		intentional self-harm		assault	
1994	24.5	*2.2*	8.7	*1.4*	6.8	*1.1*	1.6	*0.6*	2.0	*0.7*	0.7	*0.4*
1995	27.6	*2.3*	7.1	*1.3*	4.1	*0.8*	0.4	*0.2*	4.3	*1.0*	0.2	*0.2*
1996	27.4	*2.3*	7.7	*1.3*	3.5	*0.8*	0.7	*0.4*	3.2	*0.8*	0.2	*0.2*
1997	26.5	*2.2*	6.9	*1.3*	4.0	*0.8*	1.3	*0.5*	2.5	*0.7*	0.9	*0.4*
1998	23.8	*2.2*	9.5	*1.5*	4.6	*0.8*	1.0	*0.5*	1.6	*0.6*	0.0	*0.0*
1999	17.4	*1.9*	5.7	*1.1*	3.7	*0.8*	0.9	*0.4*	3.5	*0.9*	0.4	*0.3*
2000	19.7	*2.0*	7.2	*1.3*	4.1	*0.9*	0.5	*0.3*	3.5	*0.9*	0.0	*0.0*
2001	17.3	*2.0*	7.5	*1.4*	2.2	*0.6*	0.0	*0.0*	4.2	*1.0*	0.4	*0.3*
2002	14.1	*1.7*	4.7	*1.0*	2.1	*0.5*	0.0	*0.0*	4.8	*1.1*	0.4	*0.3*
2003	15.3	*1.6*	4.2	*1.0*	3.4	*0.7*	0.2	*0.2*	2.8	*0.7*	1.3	*0.5*
2004	20.5	*1.9*	6.4	*1.2*	3.7	*0.6*	0.0	*0.0*	2.6	*0.8*	0.6	*0.4*

dents (V01-V99 ICDX), from falls (W00-W19 ICDX), from accidental poisoning and exposure to noxious substances (X40-X49 ICDX), as well as from intentional self-harm (X60-X84 ICDX) and assault (X85-Y09 ICDX). For both sexes the trend is generally decreasing and, in the current joinpoint analysis of AADR, the joinpoint regression showed that all statistically significant variations were declining (Table 2).

The decrease was evident when all external causes combined were considered and the EAPC were equal to -4.12% and -5.24%, respectively in males and females (Figure 1). Significant decrements in AADR were recorded in transport accidents (EACP = -4.2) and falls (EACP = -5.5), only in females (Figure 1). In males poisonings did not show a significant decrease until 2002 and then dramatically fell afterwards approaching 100%. In females the continuous diminution was close to 46% (Figure 1). In both sexes the more recent AADR were equal to zero (Table 1). Falls, suicides and homicides did not show significant different trends (Table 2). Rates of intentional self-harm were quite high and only in males did it display a tendancy to diminish.

Among males the age-adjusted YPLL rates showed significant decreases for all combined external causes (EACP = -2.8%) (Tables 3, 4 and Figure 1). The trend of male poisonings was quite similar to the correspondent AADR (Figure 1).

Discussion

Mortality rates from external causes are slightly lower in Umbria than the average Italian rates (58.2 and 24.3 per 100.000 inhabitants respectively among males and females, for the year 2000) [13]. In our region both the AADR and YPLL rates for external causes were decreasing throughout the studied period, though the -1.8% per year YPLL rates observed among females was not statistically significant. AADR showed a higher slope than YPLL: this may reflect a shift toward older age of some deaths or a mortality reduction occurring for causes typically associated with older age (e.g. falls) thereby influencing more AADR rates than YPLL. Indeed the general decrease inf mortality detected is likely to be the consequence of the introduction of effective preventive interventions.

In Italy, about 270 000 road traffic accidents occur annually, causing almost 7000 deaths [14]. According to the available literature, considerable differences exist amongst countries and also within countries, large regional differences in traffic accident mortality may be present; these differences seem to be correlated to socio-demographic factors and to specific factors such as driver behaviour, infrastructural road safety measures and to some extent, to the accessibility and quality of medical care [15,16]. For instance, 5-40% of motor vehicle accident deaths in Europe were attributed to alcohol consumption [17]. In the last decade, there has been a great deal of attention on behavioral interventions aimed at decreasing alcohol related crashes, increasing safety belt use, as well as others. Indeed, excluding deaths due to vehicle speed, driver's injuries are strongly associated to the lack of car seat belts and crash helmets useage [18,19], as well as to the quality of emergency health care [20,21]. Vehicle safety features may also play a role [22]. Moreover, interventions based on more restrictive laws and strict police controls were introduced to ensure that speed limits were respected and that driving after the consumption of alcoholic beverages or drugs was

Table 2. Joinpoint analysis of AADR, by sex and causes, in the Umbria region. 1994-2004

Site (ICD X)	Sex	Range	EAPC	p
All external causes V01-Y99	M	1994-2004	**-4.1***	0.000
	F	1994-2004	**-5.2***	0.004
Transport accidents V01-V99	M	1994-2004	**-1.7**	0.24
	F	1994-2004	**-4.2***	0.047
Falls W00-W19	M	1994-2204	**-5.1**	0.10
	F	1994-2004	**-5.5***	0.03
Poisonings X40-X49	M	1994-2002	**-5.1**	
	M	2002-2004	**-99.2***	0.04
	F	1994-2004	**-45.7***	0.037
Intentional self harm X60-X84	M	1994-1999	**-11.3**	
	M	1999-2002	**16.6**	0.21
	M	2002-2004	**-15.8**	0.26
	F	1994-2004	**1.5**	0.63
Assaults X65-Y09	M	1994-2004	**-4.9**	0.76
	F	1994-2004	**29.8**	0.68

* The expected annual percent change (EAPC) is statistically significant.

Table 3. Age-adjusted YPLL rates, *e.s.*, from all external causes (V00-Y99 ICDX), from transport accidents (V01-V99 ICDX), from falls (W00-W19 ICDX), from accidental poisoning and exposure to noxious substances (X40-X49 ICDX), from intentional self-harm (X60-X84 ICDX) and assault (X85-Y09 ICDX)

MALES												
YEAR	all external causes		transport accidents		falls		accidental poisonings		intentional self-harm		assault	
1994	1627.9	*143.2*	894.2	*111.3*	74.3	*29.7*	41.0	*20.6*	381.2	*64.2*	43.4	*22.1*
1995	1376.3	*130.2*	691.4	*98.5*	88.0	*33.1*	38.2	*20.9*	340.5	*57.4*	0.0	*0.0*
1996	1428.7	*140.2*	758.9	*110.2*	29.1	*11.0*	82.9	*31.0*	332.3	*58.7*	6.1	*6.2*
1997	1205.6	*120.9*	512.1	*86.4*	45.6	*17.0*	88.3	*88.3*	272.0	*52.8*	22.6	*16.4*
1998	1398.8	*133.6*	715.1	*102.6*	54.1	*19.4*	90.0	*30.2*	165.5	*42.3*	22.9	*16.4*
1999	1432.7	*142.0*	897.9	*119.5*	65.2	*24.5*	21.7	*12.3*	222.0	*48.2*	0.4	*0.4*
2000	1407.3	*137.3*	804.4	*109.3*	66.0	*24.8*	6.3	*4.2*	325.0	*65.7*	0.0	*0.0*
2001	1205.7	*126.4*	774.5	*108.1*	28.9	*13.2*	19.2	*19.3*	273.5	*52.9*	0.0	*0.0*
2002	1234.4	*134.6*	749.5	*109.8*	54.3	*27.1*	8.0	*8.1*	309.0	*60.2*	34.5	*24.7*
2003	1149.9	*130.4*	674.9	*105.4*	28.6	*14.9*	0.0	*0.0*	299.3	*63.6*	42.1	*17.7*
2004	1091.3	*118.5*	712.7	*101.1*	66.4	*20.5*	0.0	*0.0*	184.0	*46.2*	20.4	*15.8*
FEMALES												
YEAR	all external causes		transport accidents		falls		accidental poisonings		intentional self-harm		assault	
1994	411.7	*74.1*	270.3	*62.4*	8.5	*4.6*	51.4	*28.8*	22.0	*11.8*	30.6	*18.3*
1995	471.6	*79.0*	263.3	*59.5*	25.7	*14.5*	0.0	*0.0*	105.7	*34.0*	6.1	*6.1*
1996	353.8	*68.0*	217.5	*56.0*	11.7	*7.3*	16.9	*14.4*	58.1	*22.7*	0.0	*0.0*
1997	395.8	*72.5*	224.1	*58.0*	10.9	*7.5*	32.1	*19.5*	63.3	*29.1*	15.0	*10.9*
1998	513.7	*86.0*	383.4	*77.0*	11.9	*7.7*	24.3	*13.3*	30.4	*18.0*	0.0	*0.0*
1999	374.3	*71.3*	206.1	*53.6*	7.3	*4.7*	32.7	*24.6*	106.5	*37.8*	11.3	*9.1*
2000	408.1	*76.3*	217.3	*55.2*	13.0	*10.6*	10.4	*7.4*	83.0	*32.9*	0.0	*0.0*
2001	491.0	*74.8*	322.6	*74.8*	39.2	*26.1*	0.0	*0.0*	93.2	*32.4*	2.7	*2.8*
2002	323.5	*67.5*	125.2	*44.0*	3.4	*2.9*	0.0	*0.0*	148.0	*46.1*	14.9	*15.0*
2003	249.2	*59.2*	149.4	*52.2*	6.5	*4.3*	0.3	*0.3*	44.9	*17.6*	43.2	*20.8*
2004	399.7	*79.5*	226.7	*61.8*	0.3	*0.3*	0.0	*0.0*	71.8	*28.8*	16.0	*0.0*

Table 4. Joinpoint analysis of YPLL, by sex and causes, in the Umbria region. 1994-2004.

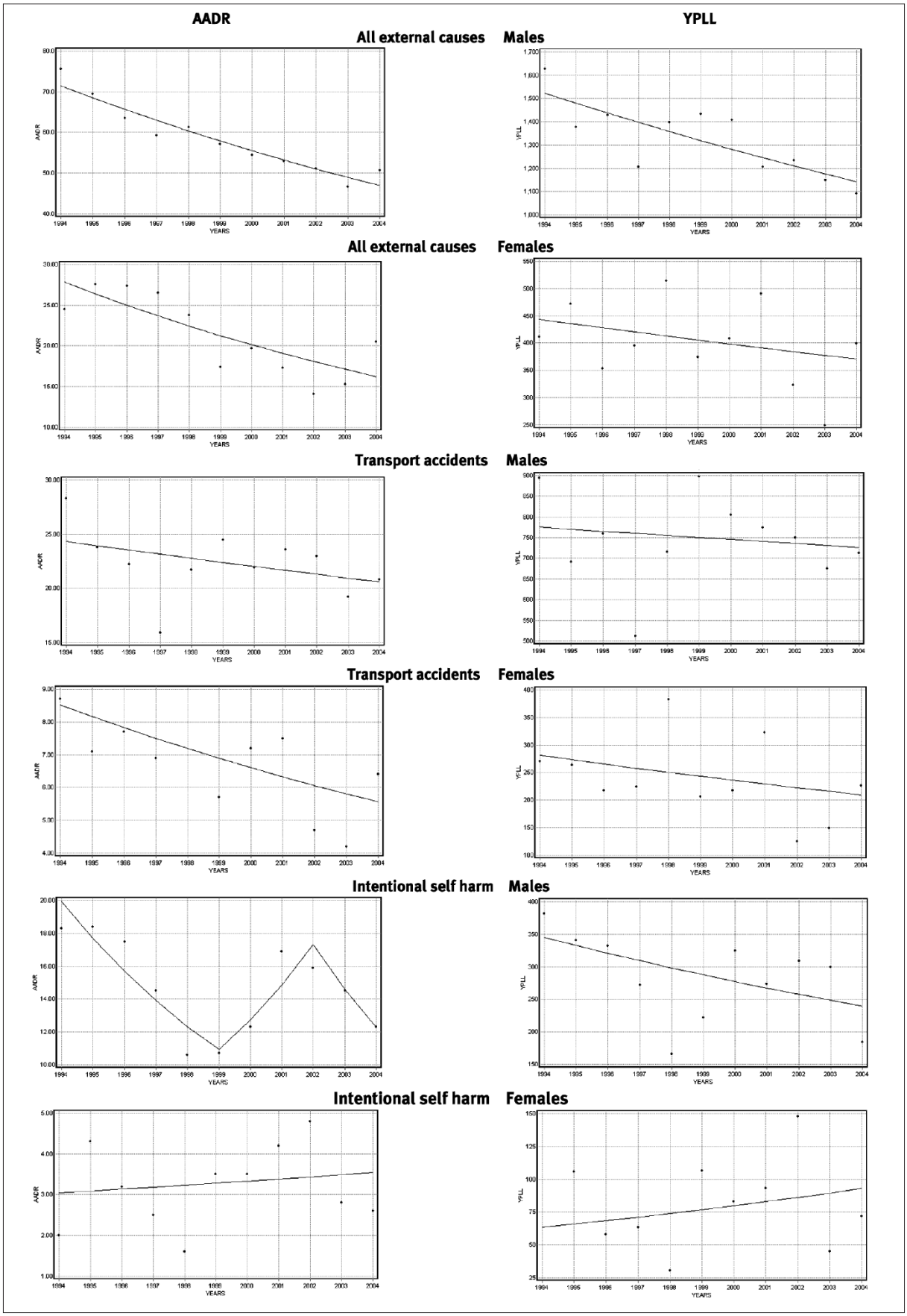
Site (ICD X)	Sex	Range	EAPC	p
All external causes V01-Y99	M	1994-2004	**-2.8***	0.004
	F	1994-2004	**-1.8**	0.36
Transport accidents V01-V99	*M*	*1994-2004*	**-0.6**	*0.66*
	F	1994-2004	**-2.9**	0.34
Falls W00-W19	M	1994-2204	**-1.5**	0.69
	F	1994-2004	**-11.9**	0.20
Poisonings X40-X49	M	1994-1997	**59.7**	
	M	1997-2004	**-51.7***	0.27
	F	1994-2004	**-9.5**	0.60
Intentional self harm X60-X84	M	1994-2004	**-3.6**	0.11
	F	1994-2004	**3.9**	0.47
Assaults X65-Y09	M	1994-2004	**6.7**	0.83
	F	1994-2004	**25.5**	0.56

* The expected annual percent change (EAPC) is statistically significant.

discouraged; driving licence points, similar to other countries, were introduced in Italy during 2002. In recent years, in Umbria, some important structural road network improvements have been achieved. The increasing number of circulating vehicles may be a determinant of mortality counteracting preventive efforts [14].

Fall rates increase sharply with advancing age. Falls mortality is also a phenomenon typical of advanced age (in Umbria 71% of deaths occurred among people>75 years, i.e. the older and oldest old). Because of population ageing [23], falls crude rates and hospital admissions due to falls are increasing [24]. Standardized mortality rates,

Figure 1. AADR and YPLL standardized rates (dots) and joinpoint regression estimates (lines) for major external causes of death



however, decreased in our study. YPLL rates decreased to a much lesser extent among males and this observation likely reflects the influence of falls in younger ages on the YPLLs calculation: exposure to both professional and behavioural falls risk factors is higher among young males than females and seems not to be decreasing. [25,26]. Instead, mortality in elderly trauma patients is declining, probably, as the result of improved trauma management, more effective treatment of coexisting medical conditions, and better intervention strategies [27].

In Europe suicide is an important public health problem representing the second leading causes of death among people aged 15-34 years [28].

A study carried out in an area of Southern Italy in the period 1998-2002 showed a decreasing trend in the standardized suicide mortality rate: among males the rate decreased from 7.7 in 1998 to 6.1 in 2004 and among females from 2.4 to 1.8 [29].

Suicide also seems to constitute an important public health problem in Umbria, where the suicide rates are high and the trend is fairly constant for both males and females. As to the population aged >64, the crude rate was 24.9 per 100.000 inhabitants during the period 1994-1996 and 26.2 in the 2002-2004. The decreasing YPLL <74 male rate was balanced by the rate relative to older people, which is similar to that found in areas with the highest incidence of intentional self-harm [30,31]. Certainly this phenomenon is worthy of further attention by public health authorities.

In Umbria, the number of deaths due to accidental poisoning and exposure to noxious substances, in the last calendar period, is close to zero, and the number of assaults remained constantly low throughout the period 1994-2004. However, because of the small number causing high variability in AADR and YPLL rates, these trends are difficult to interpret. As an example of a much different health burden and trend, mortality rates due to accidental poisoning has been increasing in the United States over a similar period: in fact during the 21year period spanning 1981 to 2001, mortality rates due to accidental poisoning more than doubled from 2.0 per 100 000 in 1981 to 4.9 per 100 000 in 2001. Moreover during this period, the deaths attributable to accidental poisoning contributed more than 250 000 YPLL before the age of 65 to the total YPLL count.

There are some limitations of this study that may influence the conclusions. Variations in the quality of coding of causes of death may have limited the overall accuracy of the death rates and, diverging trends between deaths and disability rates from injuries may not have been detected. Current analysis takes into consideration only mortality from external causes. Thus it does not measure another important components of the health burden from injuries, that is disability and other health consequences from non-fatal accidents. Mortality trends, however, may be used as an informative indicator for the evolving distribution of the overall impact of accidents on the population's health [32].

Almost four hundred people die from injuries each year in Umbria; thus effective interventions and accurate monitoring are needed to effectively reduce the health burden from such causes. The analysis of mortality trends from external causes in Umbria provides a good tool to evaluate the effectiveness of the interventions performed in the last decade.

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