

Karolinska Institutet
Department of Public Health Sciences
Division of Social Medicine
Norrbacka, 2nd Floor
SE-171 76 Stockholm
Sweden



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Sheikh Muazzam Nasrullah
B.Sc., M.B;B.S.



Curriculum Vitae

I, Sheikh Muazzam Nasrullah born in November 1, 1976, am a medical doctor from Pakistan. Got a Gold medal and school colour for getting 1st position and excellent performance through out school life. I passed my Medical School in 2001 and did internship in Jinnah hospital, Lahore, Pakistan in Otolaryngology Head & Neck Surgery, Internal Medicine, Cardiology and Oncology. I was very interested in Research from the beginning and try to make every effort to get into the true research. Its my honour to be in Karolinska Institutet, Dept. of Public Health Sciences, Div. of Social Medicine for my Masters in Safety Promotion where my thesis is "The impact of unemployment on cause specific fatal injuries – a statistical analysis". My plan is to go ahead for the Ph.D. studies in the field of accidental injuries especially traffic injuries. I am looking every opportunity to excel in this field under the kind supervision of our Professors especially Professor Leif Svanström.

muazzam76@hotmail.com
Mobile No: +46-73-7436366

Impact of Unemployment on Cause Specific Injury Mortality – A Statistical Analysis

Thesis defence: Muazzam Nasrullah

Supervisor: Jahangir Khan

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Abstract

Introduction: According to previous studies change in unemployment status in a country has influence on injury mortality. Mostly data for all injuries (not cause specific) from developed countries were analyzed in past studies.

Objectives: To analyze the impact of unemployment and economic level on four cause specific injury mortality (Motor vehicle traffic accidents, accidental falls, suicide & self inflicted injuries, homicide & injury purposely inflicted by other persons) in OECD and non-OECD countries. **DATA:** Cause specific injury mortality per 100 000 population in age 25-64 years for both male and female from 66 countries for a period of 1996-1997 are employed in analysis. For explaining injury mortality unemployment rate, GDP per capita and demographic structure are used. **METHODS:** In a multiple regression analysis injury mortality is explained by explanatory variables (independent variables). A year dummy is used for taken into account unobserved events between 1996 and 1997. Analysis has been done for all countries together as well as separately for OECD and non-OECD countries. In all analysis, male and female has been treated separately.

Results: Traffic injury mortality show significant positive relationship with unemployment rate (i.e. increase unemployment increases injury mortality) in both males ($t=2.2$) and females ($t=2.69$) in non-OECD countries. Mortality due to homicide and injury purposely inflicted by other persons in OECD countries has a positive borderline significant relationship for males ($t=1.23$) only. There is no significant relationship found for accidental falls and suicide & self-inflicted injuries in both OECD and non-OECD countries and for male and female. In general, GDP per capita has significant negative relationship with injury mortality (i.e. increase in GDP per capita decreases injury mortality) in all countries.

Conclusions: Unemployment has different impact on injury mortality in OECD and non-OECD countries. In general countries with better economic level are less prone to injury mortality. Gender specific difference is evident in both OECD and non-OECD countries.

Key words: Cause specific injury mortality, economic level, gender, OECD and non-OECD countries, unemployment.

1 Background

Unemployment has strong impact on injury mortality due to suicide, homicide and accidents (Leenaars & Lester, 1998). Ostamo showed that in severe economic recession (turns to high unemployment), incidences of suicide attempts increased and males were more affected than females (Ostamo, et al, 2001). Individuals, who had serious suicide attempts, were mostly found unemployed. Relationship remained unchanged, but became less strong, even after adjusting for the antecedent childhood, family and educational factors (Beautrais et al. 1998). A study conducted in Canada showed that unemployment, part-time work and being out of the labor force were all associated with attempted suicide (Kraut & Walld, 2003). There is a significant relationship between unemployment and self-poisoning (Kelleher et al. 1996). Cross-sectional individual studies, individual longitudinal studies and aggregate longitudinal analyses by Platt revealed that suicide and parasuicide rates are always higher among the unemployed, compared to employed. But aggregate cross sectional studies on the other hand showed no relationship (Platt, 1984).

The long-term ecological study of 10 years comparing the rate of unemployment with penetrating trauma (homicide) in a metropolitan area confirms that rates of penetrating trauma increase with increasing unemployment rates (Reed et al., 2003). Exploring the relationship between women's criminal behavior it was evident that the unemployed subjects were more likely to be involved in violent crimes (Campbell, Robinson, 1997). Yang B. and Lester found that suicide and homicide rates for USA from 1957-1986 in monthly time series regression analysis were associated with unemployment but in contrast suicide and homicides is not strongly associated with unemployment when deal with the annual time series data. (Yang, Lester, 1992). A study based on total USA population or within various subpopulations (within states of USA) showed no evidence by analyzing the yearly data of rates of employment, unemployment and nonlabor force that leads to improved forecasts of the level of motor vehicle fatalities, suicides, or homicides even by using any of the modeling techniques (Reinfurt et al, 1991).

Correlation was also being found between unemployment, birth, marriage and rates of birth with the natural causes of deaths (stomach cancer, cirrhosis of liver), accidents (motor vehicle accident), suicide and homicide in Canada (Leenaars, Lester, 1998). Leigh and Waldon proved that if the number of miles driven is held constant, worsening unemployment leads to higher fatality rates in highway accidents, which is most likely due to stress effects (Leigh, Waldon, 1991). Traffic accidents to pedestrians under age 15 years were studied in small island of Montreal for eighteen months and when the socioeconomic status of the victim's family was measured by education, income and unemployment, it was found to be low (Joly et al., 1991).

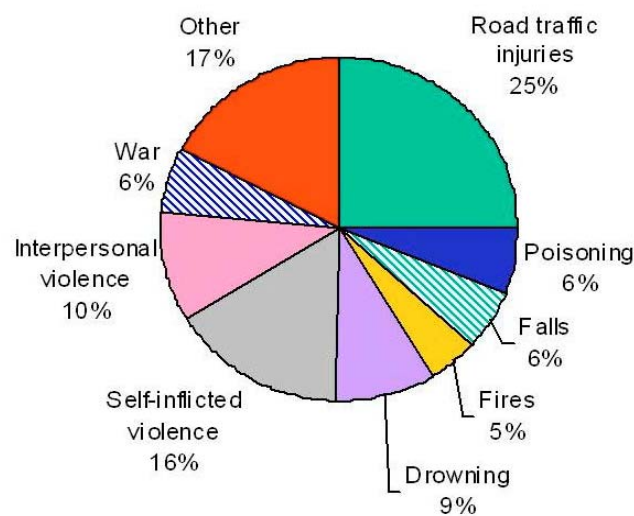
Review by Jin, et al. to see the scientific evidence supporting an association between unemployment and adverse health outcomes concluded that there is a strong positive association between unemployment and many adverse health outcomes on the epidemiological basis but there are many mediating and confounding factors like social, economic or clinical which is responsible for this relation (Jin et al., 1995). Data for the entire United States showed that indices of acute pathological disturbances, including suicide and homicide, rose within a year of increased unemployment rates (Brenner, 1979).

Gertham, on the contrary, found in his studies, decrease in unemployment rate is associated with rise in total mortality and the same is true for increase in deaths from cardiovascular disease, influenza/pneumonia, liver disease, motor vehicle fatalities and other accidents. (Gertham, et a, 2002). In his other study he analyzed cause-specific mortality in Sweden, aged 20-64 years of individuals followed up for 10 to 17 years, and found out that unemployment significantly increases the risk of suicides and the risk of dying from "other diseases" (all diseases except cancer and cardiovascular), but has no significant effect on cancer mortality, cardiovascular mortality or deaths due to "other external causes"

(motor vehicle accidents, accidents and homicides) (Gerdtham, Johannesson, 2003).

In choosing the causes of injury mortality for studying in this current paper, I gave emphasis on the burden of cause specific injuries. Motor vehicle traffic accidents, accidental falls, suicide & self inflicted injuries (included in self-inflicted violence), homicide & injury purposely inflicted by other persons (included in interpersonal violence and wars) constitute 63 percent of total global burden of injuries (WHO, 2003). These four causes are responsible for 25 percent, 6percent, 16 percent and 16 percent of total global injuries respectively.

Distribution of global injury mortality by cause, 2000



One quarter of all injury deaths are due to road traffic injuries; suicides and interpersonal violence combined account for another quarter of the global total.

Source: WHO, *Injury Chart Book*, 2004.

In most of the previous studies, data from OECD (Organization for Economic Cooperation and Development) countries has been analyzed for investigating the relationship between unemployment and injury mortality. OECD countries include the developed countries of the world. The knowledge from other non-OECD countries is consequently missing. I, therefore, intend to study the relationship between unemployment and injury mortality both in OECD and non-OECD countries. I expect that it will provide us with better knowledge for understanding the relationship in a more general manner than the developed world only.

In section 2, the objectives of the paper are clarified. Section 3 contains the material and method. In section 4, the results of the study are presented. In the discussion in section 5, the interpretation of the results and its underlying causes, the limitations, the strong points, contribution of the paper and the research scope are discussed along with previous studies in the same field. Conclusions of the study are presented in section 6.

2 Objectives

In the current study, I intend to analyze the impact of unemployment on four-cause specific injury mortality (Motor vehicle traffic accidents, Accidental falls, Suicide & self inflicted injuries, Homicide & injury purposely inflicted by other persons) in OECD and non-OECD countries. The impact of GDP per capita at the level of countries, differs between male and female are of interest.

3 Materials and Methods

Injury mortality data due to four causes (Traffic injuries, accidental falls, suicide and homicide) from 28 OECD countries (Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, United States), and 38 non-OECD countries (Albania, Argentina, Armenia, Azerbaijan, Belarus, Belize, Brazil, Bulgaria, Costa Rica, Croatia, Chile, Columbia, Dominican Republic, Estonia, Georgia, Israel, Kazakhstan, Kuwait, Kyrgyz Republic, Latvia, Lithuania, Malta, Macedonia, Mauritius, Moldova, Paraguay, Romania, Russia, Singapore, South Africa, San Marino, Slovenia, Tajikistan, Turkmenistan, Uzbekistan, Ukraine, Uruguay, Venezuela) for male and female, covering the period 1996-1997 for age group 25 to 64 years are employed for multiple regression analysis. Injuries per 100,000 population reported in World Health Organization (WHO, 2003) is used in the analysis. Data on unemployment rate per 100 people and GDP per capita, adjusted for purchasing power parity (see appendix) for the years 1996-1997 is taken from World Development Indicators, 2002. To convert national income into International dollars I used purchasing power parities instead of conventional market exchange rates, since exchange-rate conversions will overstate (understate) real income in high (low) income countries (Kravis & Heston, 1978).

Cause specific injuries in 66 countries divided into OECD & non-OECD countries for male and female, compiled by age and gender. Unemployment rate per 100 people were taken at country level. Mean and standard deviation of unemployment rate per 100 people and GDP per capita are being taken for both OECD and non-OECD countries separately for both years 1996 and 1997. Rate of all injuries per 100,000 population and cause specific injuries per 100,000 population are taken into consideration and their mean and standard deviation are calculated. Population is weighted (to equalize the number of people in a population of different countries) for calculating means and standard deviations.

A regression analysis is performed by taking unemployment and GDP per capita as independent variable and rate of injuries per 100,000 population as dependent variables by taking into consideration the demographic structure of the countries. A year dummy is used for taken into account unobserved events between 1996 and 1997. Unemployment rate per 100 people are taken into account at country level to have a look on the economic condition of a country as a whole and not at the individual level. Unemployment rate per 100 people is not taken separately for men and women in the analysis. The t-values, p-values, coefficient and standard error for all injuries and cause specific injuries for OECD and non-OECD countries separately and combined are calculated by using the statistic software (STATA, version 7). GDP per capita is rescaled to log GDP in order to normalize the distribution curve. Also see appendix in formula of regression analysis.

4 Results

Descriptive Statistics

Mean and Standard Deviation (SD) of Unemployment per 100 people, GDP per capita, all injuries per 100 000 population together and cause specific injuries per 100 000 population for 1996-97 are shown in the table 1 for OECD and non-OECD countries.

Table 1.

Economic indicators, total and cause specific fatal injuries (mean, standard deviation) in OECD and Non OECD countries, 1996-1997.

Economic indicators and fatal Injuries	OECD*			Non OECD			OECD			Non OECD		
	1996			1996			1997			1997		
	Mean	St. Dev.		Mean	St. Dev.		Mean	St. Dev.		Mean	St. Dev.	
Unemployment rate **	8.660	4.330		11.400	7.510		7.910	4.200		10.310	6.770	
GDP per capita ***	21438	5397		7700	4284		21589	5793		8490	5432	
All injuries	14.423	12.362		35.974	29.898		13.818	11.639		31.131	27.317	
	Male			3.928			5.349			3.878		
	Female	4.527		7.350			4.443			6.557		
Motor vehicle traffic accidents	20.909	12.613		30.990	8.329		20.023	10.496		28.248	8.735	
	Male	7.004		7.224			6.844			7.046		
	Female	5.022		3.152			5.099			3.077		
Accidental Falls	1.118	0.589		1.718	0.962		1.090	0.579		1.457	0.911	
	Male	2.6199		8.421			37.259			8.477		
	Female	8.069		3.071			8.047			9.664		
Suicide & self-inflicted injuries	5.560	5.312		37.903	23.084		5.297	5.119		31.158	21.363	
	Male	1.918		1.475			1.790	1.446		8.070	5.581	
	Female											

* OECD countries = Organization for Economic Cooperation and Development.

** Unemployment Rate = Country specific unemployment rate, mean and standard deviation

*** GDP per capita = GDP per capita in International dollars and adjusted for purchasing power parity (PPP)

It is evident from figure 1 and figure 2 as well as from table 1 that OECD has the mean Unemployment rate per 100 people of 8.66 and 7.91 in 1996 and 1997 respectively while it is 11.4 and 10.31 for non-OECD countries respectively. Mean of GDP per capita for OECD countries are International dollars (ID) 21438 in 1996 which increases to ID 21589 in 1997 while in non-OECD countries it is ID 7700 in 1996 and raises to ID 8490 in 1997.

Fig 1. Unemployment rate per 100 in OECD and non-OECD countries

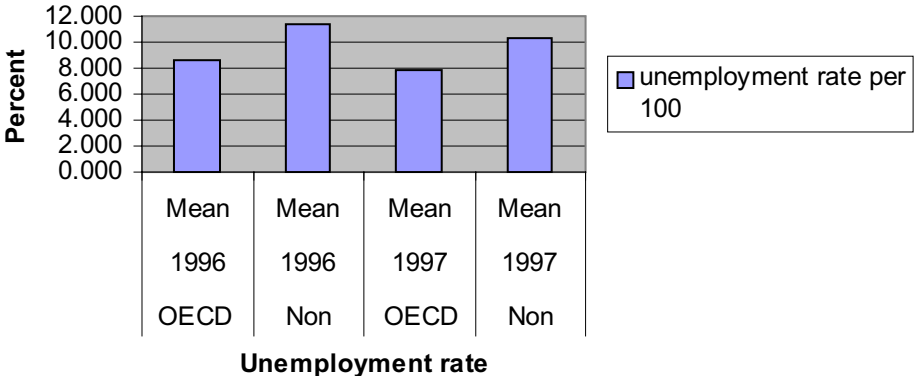
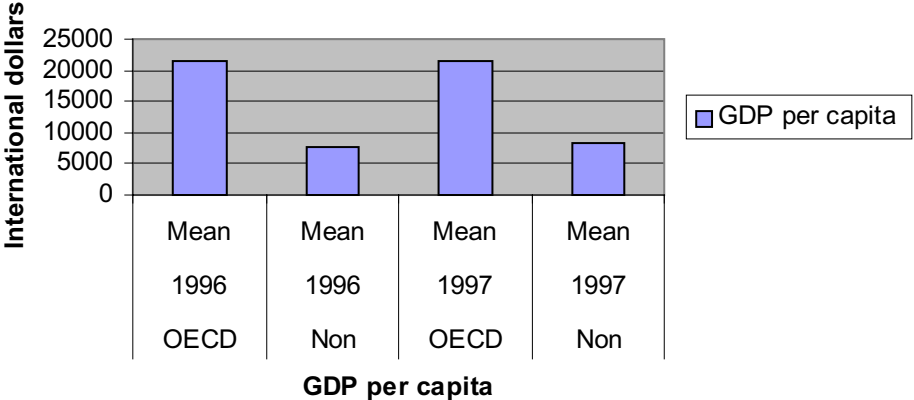


Fig 2. GDP per capita of OECD and non-OECD countries



The table 1 and figures 3,4,5,6,7 shows that injuries in OECD countries are less than non-OECD countries as whole and in cause specific injuries in both years 1996 and 1997. Males are more prone to injuries than females in both years. There was a trend of decrease in injuries per 100,000 population in both sexes in OECD countries from 1996 to 1997. In non-OECD countries similar trend of decrease in injuries per 100,000 population is found from 1996 to 1997. Unemployment rate is less in OECD countries than non-OECD countries but there was a decrease in trend from 1996 to 1997. GDP per capita is more in OECD countries than in non-OECD countries and there is an upward trend to it from 1996 to 1997.

Fig 3. Mean of all injuries per 100,000 population

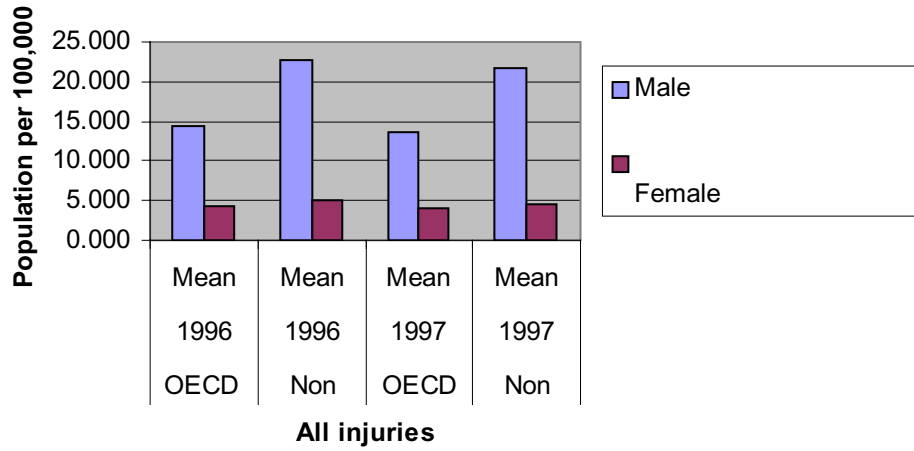


Fig 4. Motor vehicle traffic injuries per 100,000 in OECD and Non-OECD countries

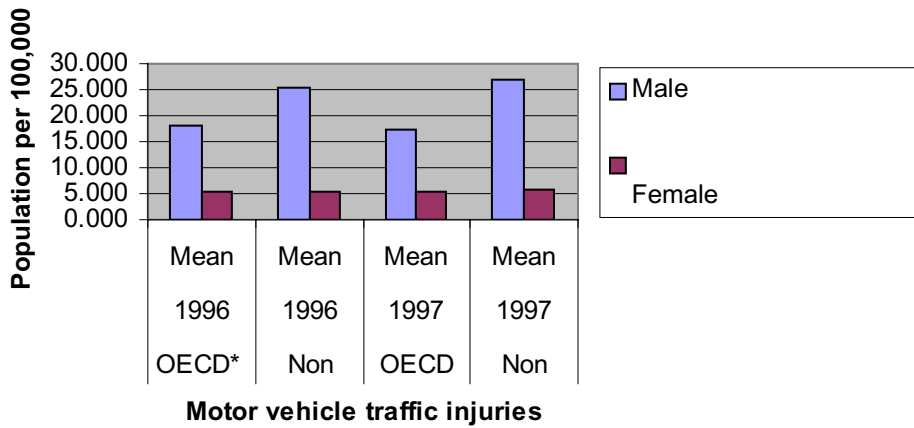


Fig.5 Accidental fall injuries per 100,000 population in OECD and non-OECD countries

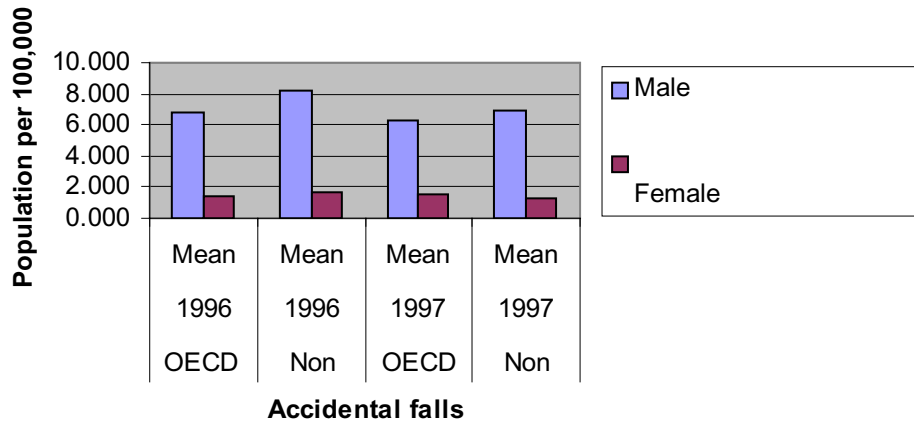


Fig 6. Suicide & self inflicted injuries in OECD and non-OECD countries

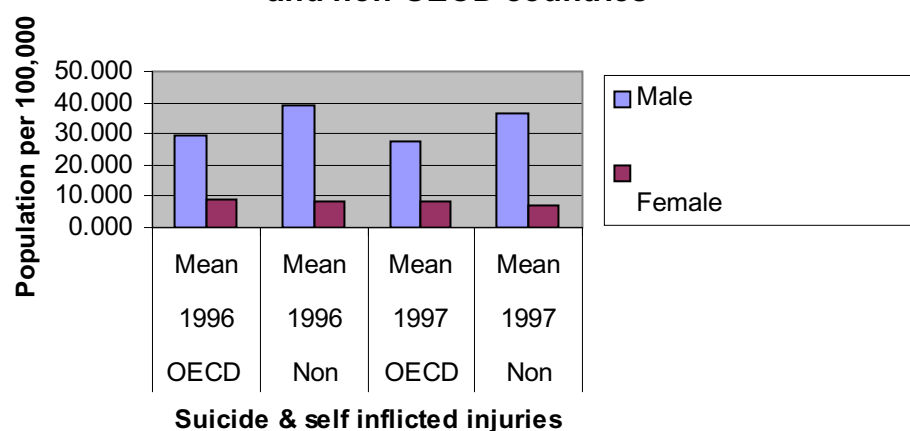
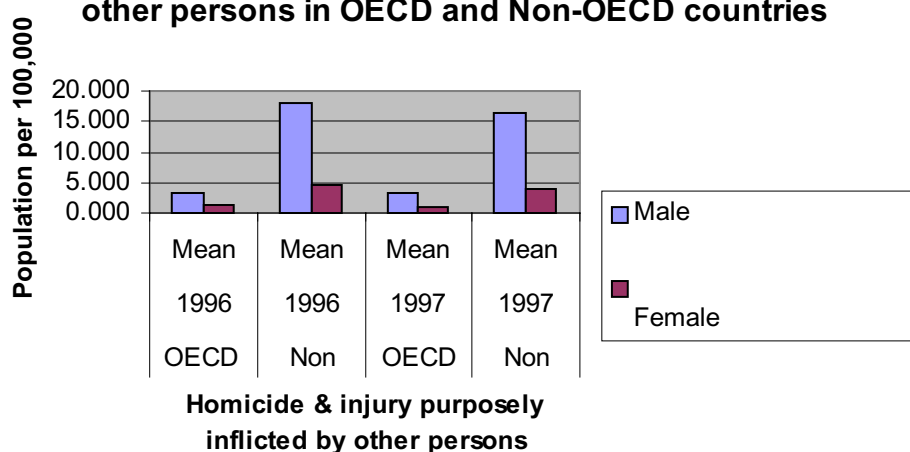


Fig 7. Homicide & injury purposely inflicted by other persons in OECD and Non-OECD countries



Statistical Analysis

Using regression analysis, coefficient, standard error, t-values and p-values of all countries together as well as OECD and non-OECD countries separately are shown for cause specific injuries and all injuries in relation to unemployment change and log GDP in table 2 and table 3 respectively.

In table 2, OECD countries show a different trend in injury pattern with change in unemployment rate than non-OECD countries.

All Injuries

Considering all injuries together as in table 2, with change in unemployment rate per 100 people, positive relation is found with injuries per 100 000 population in non-OECD countries in both males and females, meaning there by that with increase in unemployment injury rate per 100 000 population increases. No relation is being found in OECD countries between unemployment rate per 100 people and injury rate per 100 000 population in either of the sex.

Motor vehicle traffic injuries

In motor vehicle traffic accidents when regression analysis is being performed, a significant positive relation is found with traffic injury rate per 100 000 population and unemployment rate per 100 people in non-OECD countries in both males and females. In OECD countries significant level is not reached in both sexes.

Accidental falls and Suicide & self-inflicted injuries

There is positive with no significant relation between accidental fall injuries per 100,000 population and unemployment in both OECD and non-OECD countries in both sexes except females in OECD countries that is negative but not come upto significant level.

Trend found in Suicide & self-inflicted injuries are same as accidental falls.

Homicide & injury purposely inflicted by other persons

Homicide & injury purposely inflicted by other persons there is a slight positive relation with unemployment rate only in males in non-OECD countries. Otherwise there is no significant relation in both males and females and in OECD and non-OECD countries.

According to table 3, it is very interesting to note that when all the countries are put into the regression analysis together they nullify the effect and in general there is almost no relation with all as well as cause specific injuries with unemployment except in males in all injuries and in motor vehicle traffic injuries.

Relation with GDP per capita

In general, on seeing the table the injury pattern can also be explained on the basis of GDP log per capita and more or less there is negative relation of it with injuries and the relation is more strong in non-OECD countries than OECD countries except accidental falls (in both sexes) and suicide (positive and much stronger in females than males) which is more pronounced in OECD countries.

Table 2.

		OECD				Non OECD				
		Coefficient	St. Err.	t value	P value	Coefficient	St. Err.	t value	P value	
All injuries	Male	Unemployment rate	-0.542	0.262	-0.210	0.836	0.825	0.537	1.540	0.127
		Logged GDP per capita	-1.090	3.869	-0.280	0.779	-10.518	4.988	-2.110	0.037
	Female	Unemployment rate	-0.046	0.076	-0.600	0.547	0.159	0.096	1.650	0.100
		Logged GDP per capita	1.003	1.130	0.890	0.376	-1.086	0.891	-1.220	0.225
Motor vehicle traffic accidents	Male	Unemployment rate	-0.531	0.499	-1.070	0.293	1.357	0.618	2.200	0.036
		Logged GDP per capita	-9.670	7.340	-1.320	0.196	-13.999	5.742	-2.440	0.021
	Female	Unemployment rate	-0.132	0.132	-1.000	0.322	0.373	0.139	2.690	0.011
		Logged GDP per capita	-1.049	1.965	-0.530	0.596	-2.181	1.285	-1.700	0.100
Accidental Falls	Male	Unemployment rate	0.019	0.203	0.090	0.926	0.162	0.279	0.580	0.569
		Logged GDP per capita	-5.725	2.997	-1.910	0.063	-1.163	2.590	-0.450	0.666
	Female	Unemployment rate	-0.013	0.037	-0.350	0.725	0.008	0.054	0.140	0.887
		Logged GDP per capita	-0.930	0.547	-1.700	0.097	0.100	0.506	0.200	0.844
Suicide & self-inflicted injuries	Male	Unemployment rate	0.218	0.494	0.440	0.661	0.910	1.353	0.670	0.506
		Logged GDP per capita	10.552	7.296	1.450	0.156	-15.188	12.555	-1.210	0.236
	Female	Unemployment rate	-0.047	0.133	-0.360	0.724	0.163	0.191	0.860	0.399
		Logged GDP per capita	6.000	1.981	3.030	0.004	0.233	1.773	0.130	0.896
Homicide & injury purposely Inflicted by other persons	Male	Unemployment rate	0.077	0.098	0.790	0.437	0.859	0.698	1.230	0.228
		Logged GDP per capita	0.506	1.450	0.350	0.729	-11.591	6.477	-1.790	0.083
	Female	Unemployment rate	0.009	0.033	0.280	0.779	0.097	0.165	0.590	0.559
		Logged GDP per capita	-0.011	0.486	-0.020	0.983	-2.558	1.529	-1.670	0.104

Table 3.

Economic indicators and fatal injuries			All countries			
			Coefficient	St. Err.	t value	P value
All injuries	Male	Unemployment rate	0.384	0.270	1.420	0.155
		Logged GDP per capita	-9.530	1.790	-5.340	0.000
	Female	Unemployment rate	0.050	0.580	0.730	0.470
		Logged GDP per capita	-0.706	0.383	-1.840	0.066
Motor vehicle traffic accidents	Male	Unemployment rate	0.504	0.378	1.330	0.186
		Logged GDP per capita	-9.074	2.520	-3.600	0.001
	Female	Unemployment rate	0.111	0.094	1.180	0.242
		Logged GDP per capita	-0.789	0.630	-1.250	0.214
Accidental Falls	Male	Unemployment rate	0.141	0.166	0.850	0.400
		Logged GDP per capita	-2.689	1.099	-2.450	0.017
	Female	Unemployment rate	0.005	0.030	0.160	0.874
		Logged GDP per capita	-0.202	0.199	-1.010	0.315
Suicide & self-inflicted	Male	Unemployment rate	0.527	0.688	0.770	0.446
		Logged GDP per capita	-14.285	4.542	-3.150	0.002
	Female	Unemployment rate	0.019	0.115	0.160	0.873
		Logged GDP per capita	0.768	0.765	1.000	0.319
Homicide & injury purposely inflicted inflicted by other persons	Male	Unemployment rate	0.361	0.311	1.160	0.248
		Logged GDP per capita	-12.019	2.051	-5.860	0.000
	Female	Unemployment rate	0.039	0.077	0.440	0.660
		Logged GDP per capita	-2.608	0.508	-5.130	0.000

5 Discussion

My study found that OECD countries have different relations between injury mortality and unemployment as compare to non-OECD countries.

I find positive, significant relationship between unemployment and traffic injuries in non-OECD countries for both male and female, meaning that with increase in unemployment the traffic injuries also increases, while there is no significant relation between them in OECD countries. These analyses were able to replicate various findings previously published, regarding the relationship between unemployment and traffic injuries (Leenaars, Lester, 1998; Leigh, Waldon, 1991) but is contrary to Gertham's findings (Gertham, et a, 2002). OECD countries have good and safe transport system. Law is implemented and being followed by most of the people in developed countries. The situation is almost opposite in the non-OECD countries. These may be the reasons of having no relationship of unemployment with injuries in OECD countries but is there with non-OECD countries.

In case of Homicide and injury purposely inflicted by other persons there is borderline positive relation with unemployment in males in non-OECD countries but no relation was found in OECD countries, meaning that there is slight increase in homicide frequency when there is increase in unemployment. This relation shows more or less same findings as in USA and Sweden (Yang, Lester, 1992; Brenner, 1979; Gertham, Johannesson, 2003). OECD has good social and unemployment insurance system which may result in less effect on socioeconomic status of these countries as compare to non-OECD countries which are more at risk for the changes in socioeconomic status because of joblessness.

In case of fall related injuries and suicide & self inflicted injuries no relationship is found in both OECD and non-OECD countries in either of the sex, though females injury pattern is different between these groups of countries. In OECD countries there is negative but no significant relation, meaning that with increased unemployment these types of injuries decrease, but it increases in non-OECD countries. In my study the results in case of suicide & self inflicted injuries does not match with the findings of previous studies (Leenaars & Lester, 1998; Ostamo, et al, 2001; Beautrais et al. 1998; Kraut & Walld, 2003; Kelleher et al. 1996; Platt, 1984)

Data from non-OECD countries are usually neglected in previous studies because of non-availability of data, especially for long time period. I took data from 66 countries, which is relatively high number of observations for the individuals years, compared with other studies. Cause specific injuries (Motor vehicle traffic accidents, Accidental falls, Suicide & self-inflicted injury, Homicide and injury purposely inflicted by other persons) have not been studied enough earlier.

The limitation of my study is that only two years, 1996-1997 is being taken into the analysis. Moreover, cause specific injuries are taken according to ICD-9 and ICD-10 coding. Some of the countries even having different ICD coding for 1996 and 1997 are also considered in the analysis on the basis of falling into same category.

My studies will be interesting to find the impact of unemployment on four injuries (Motor vehicle traffic accidents, Accidental falls, Suicide & self-inflicted injury, Homicide and injury purposely inflicted by other persons) within OECD and non-OECD countries. It will be the one of the interesting study in which I have taken into so many countries at the same time. This kind of relationship is never being conducted to the best of my knowledge. This study will make the policy makers aware of the fact that how strategies should be put for two different groups of countries i.e. OECD and non-OECD countries. It will also help them to make an intervention and prevention program for alleviating the incidences of the injuries due to unemployment.

Future research studies can be conducted by considering the time series data. It would be possible to see the relationship of these injuries with unemployment that will lead to improved forecasts of the level of these four cause-specific injuries in the total population of OECD and non-OECD countries or within various subpopulations of interest.

Moreover, it will be interesting if further research will be carried out by taking into account other cause specific injuries and to see their relationship with unemployment.

6 Conclusions

Impact of unemployment on injury mortality varies between OECD and non-OECD countries. Gender specific difference is evident.

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Appendix 1

Unintentional injuries, Motor vehicle traffic accidents and Accidental falls in the *International Classification of Diseases, ninth revision* (ICD-9) are coded as E 471 & E50 respectively and in *International Classification of Diseases, tenth revision* (ICD-10) are coded as 'V02-V04; V09; V12-V14; V19-V79; V86-V89' & 'W00-W19' respectively. Intentional injuries, Suicide & self-inflicted injury, Homicide & injury purposely inflicted by other persons are coded as E54 & E 55 respectively in the *International Classification of Diseases, ninth revision* (ICD-9) and in *International Classification of Diseases, tenth revision* (ICD-10) are coded as 'X60-X84' & 'X85-Y09' respectively.

Definition of unemployment considered.

Unemployment per 100 labour force and not per 100 people.

What is t-value?

Coefficient divided by standard error.

What is standard deviation?

Squared distance between each observation and the mean.

$$\text{Standard deviation} = \frac{\sum (x_1 - x)^2 + (x_2 - x)^2 + \dots + (x_n - x)^2}{n}$$

where x is average of x.

What is standard error?

Spread or range of data of every variable. For example, the spread from 1 to 11 (mean will be 6) if the value is near the mean of 6 then the standard error is less and if the range is more i.e far from mean, then the standard error is more.

$$\text{Standard error} = \frac{\text{standard deviation}}{\sqrt{n}}$$

What is coefficient?

Shows the measurement of how one unit of explanatory variable or independent variable effects how much units of the dependent variable. It explains the relationship of unemployment with injuries e.g if the coefficient is 0.1 then it means that if unemployment increases by 1 percent then injuries will increase by 0.1 percent

What are explanatory variables?

Independent variables are called explanatory variables i.e they explain the dependent variables.

What is year dummy?

Year dummy is taken into consideration to have the control for the unobserved changes during the two years.

International dollars?

Takes into account all transactions in whole world as compare to US dollars.

Purchasing power parity?

The basis for PPP is the "law of one price". In the absence of transportation and other transaction costs, competitive markets will equalize the price of an identical good in two countries when the prices are expressed in the same currency. For example, a particular TV set that sells for 750 Canadian Dollars [CAD] in Vancouver should cost 500 US Dollars [USD] in Seattle when the exchange rate between Canada and the US is 1.50 CAD/USD.

Proportion of old age in whole population?

Proportion of people older than 55 years of age in the whole population under consideration. As old people are more vulnerable to injuries and also certain countries may have more old aged people so this variable has been controlled for this reason.

Log GDP?

To have a normal distribution, GDP is rescaled.

Formula for regression analysis?

$$Y = \beta_1 + \beta_2 \text{unemployment rate} + \beta_3 \text{GDP log} + \beta_4 \text{Age} + \beta_5 \text{Year Dummy} + \epsilon$$

Where Y is injury rate per 100,000 and β_1 is a constant, β_2 is the coefficient of Unemployment rate, β_3 is coefficient of GDP log, β_4 is the coefficient Age and β_5 is the coefficient of Year Dummy and ϵ is the error term, explaining the unobserved explanations for the relationship

There is constant β_1 , see the fig. This means that if there is no unemployment even then there are certain amount of injuries in the society or country.

This formula explains the relationship by a slope of the straight line. If the slope is downwards then the relation is less strong and if the slope of the line is upwards then there is more strong relation.

