

A Comparison Of The Accident Situation For Different Road User- And Age Groups During The Last Two Decades Western Europe Vs. U.S.A.

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SYNOPSIS

This study, which is concerned with mortality from motor vehicle accidents was undertaken to show trends for the last two decades with respect to road user- and age groups. Specifically, the objectives of the study were to: 1) Identify various changes in fatalities, as experienced by the U.S.A. and Western Europe (WE) during the time period from 1977 to 1999, and 2) Determine whether there were statistically significant changes in the traffic accident characteristics studied.

As a result of this study, the following conclusions can be drawn:

1. During the last two decades the population numbers, differentiated by age groups, shifted strongly from the age group "< 25" to the age group "> 25"; on the average to about 8.5 percent in both continents.
2. With respect to road user groups a decreasing trend of fatalities was found in WE regarding the non-motorized traffic and an increasing trend regarding the motorized traffic, while in the U.S.A. an enormous increase in truck fatalities has to be considered. These qualitative trends could be proven by the application of t-Test statistics, at least partially.
3. When superimposing road user- and age groups marginal and significant deteriorations in safety were observed during the last decade for motorcyclists and passenger car occupants in the age group "> 64", and also for motorcyclists in the age group "25-64", at least for WE.
4. Positive t-Test results with respect to fatality risks were found for motorcyclists in the age group "15-24" and for passenger car occupants in all age groups up to 64 years of age in both continents from the end of the 1980's to the end of the 1990's.
5. The accident situation of the road user group "pedestrians" could be evaluated as positive for all age groups. The same is true for bicyclists in WE, while in the U.S.A. the fatality development of bicyclists "> 25" has to be regarded as more or less critical for the observed time period.

The marginal and significant results, supported by t-Test statistics are important, in that they could pinpoint the problem areas in traffic safety, and thus direct the responsible authorities to concentrate more on those troubled areas.

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INTRODUCTION

“Day in, day out, 365 times a year, a passenger plane crashing somewhere in the European Union? On average, 110 people killed, 4,650 injured, every day? Impossible, of course. There would be panic, uproar, governments falling in the face of such unremitting carnage. But the only lie in this horrendous scenario is the word plane. Substitute car, and that is the annual swath in the E.U. – 40,000 people dead, another 1.7 million injured, with a little help from trucks, bicycles, motorbikes and errant pedestrians (Usher, R. 2002).”

This lack of awareness and responsibility may be an important reason why more than 500,000 people are killed—or about one life every minute—and over 15 million suffer injuries as a result of road accidents every year worldwide. Of the millions who are injured, tens of thousands are maimed for life. The financial cost is many thousands of millions of dollars annually (Jacobs, G.D., and S. Kirk, 1997). The most recent estimate by the Environmental and Prognosis Institute in Heidelberg, Germany, indicates that 50 million people will die and 1.1 billion will be injured from road traffic accidents worldwide between 1995 and the year 2030, if the development of the motor vehicle traffic remains unchanged in the future (Bild-Zeitung, 1995, UPI, Environmental and Prognosis-Institute,). Put in the context of the 1995 population of nations, this represents the death of about 90 percent of the population of France and injury to every man, woman, and child in China (Lamm, R., B. Psarianos, T. Mailaender, 1999).

METHODOLOGY

Investigated in the study are fatalities in Western Europe (WE) and the U.S.A. during the time periods at the end of the 1970's to the end of the 1990's. WE in this study includes the seven countries:

Austria (A), Denmark (DK), France (F), Germany (G), Italy (I)The Netherlands (NL) and Switzerland (CH).

The specific objectives of the study are to

1. Identify the qualitative changes in the motorvehicle fatalities as experienced by each of the seven Western European countries, by Western Europe as a whole, and by the United States from 1977 to 1999.
2. Identify those road user groups, that were most frequently involved in fatal accidents.
3. Identify those age groups, that were most frequently involved in fatal accidents.
4. Determine whether there were statistically significant changes in the accident characteristics for different periods in the time span from 1977 to 1999.

The majority of the data used for this study were obtained from the United Nations, Statistics of Road Traffic Accidents (U.N. up to 1999). For comparative reasons, death within 30 days of an accident was taken as a basis for this study, since it was used by the majority of the countries under study.

It should be noted, before we go any further, that:

1. At the time the manuscript was completed the data were as up to date as possible.
2. Readers who are interested in a comparative analysis and evaluation of traffic safety between the two continents since the 1970's should consult, exemplarily (Lamm, R., F.B. Lin, E.M. Choueiri, and J.H. Kloeckner, 1986, Lamm, R., E.M. Choueiri, and J.H. Klöckner. 1988, Lamm, R., E.M. Choueiri, 1991, Lamm, R., E.M. Choueiri, T. Mailaender, 1992, Lamm, R., and E.M. Choueiri, 1992, Choueiri, E.M., R. Lamm, B.M. Choueiri, and G.M. Choueiri 1992, Lamm, R., T. Ruscher, and A. Beck. A Review of the Motorcycle Accident Situation in Western Europe and the United States 2002, Lamm, R., J. Treiterer. 1981)

To achieve the objectives stated previously, this study includes the following task:

- identification of accident trends (fatalities), and safety improvements needs.

The purpose of the task is to reveal the similarities and dissimilarities among the subject countries and to show quantitatively the changes in fatalities as experienced by each of the subject countries from 1977 through 1999. The primary concerns of this task include the trends in fatalities over the last two decades.

To accomplish this, t-Tests (Brownlee, K.A, 1960) are conducted to determine whether there are real changes in the accident trends. These changes are analyzed respectively for different road user- and age groups for the following three time periods:

- Time period I contains the years 1977, 1978, and 1979 to enable us to describe the fatality situation at the end of the 1970's,
- Time period II contains the years 1987, 1988, and 1989 to enable us to describe the fatality situation at the end of the 1980's, and
- Time period III contains the years 1997, 1998, and 1999 to enable us to describe the fatality development at the end of the 1990's.

The analysis is based on the average number of fatalities per year. The null hypothesis tested with the fatality data was as follows: "There is no significant difference between the mean number of fatalities between any two time periods in each of the subject countries or continents."

The hypothesis testing was conducted by computing the t-statistic where "t" is a measure of the difference between the mean number of fatalities compared. The calculated t-value was then compared with an appropriate critical t-value obtained from the standard statistical tables for the corresponding degrees of freedom and confidence interval, used (95 %). If the calculated t-value was smaller than the critical t-value, the hypothesis was accepted. A higher t-value resulted in the rejection of the null hypothesis. The implications of the acceptance or rejection of the hypothesis are as follows:

1. Acceptance of the null hypothesis signified, that there was no real difference between the mean number of fatalities between any two time periods. Whatever small difference might have been observed between two data sets was indeed attributable to random chance.
2. Rejection of the hypothesis implied, that there was a significant difference between the mean number of fatalities between any two time periods in each of the subject countries.

The reader who is interested in a further discussion of the t-Tests may consult (Lamm, R., T. Ruscher, A. Beck, 2002, Brownlee, K.A, 1960).

Countries like Greece, Portugal, Spain could not be included in the study due to lack of data for these countries, especially in the 1970s. For the Northern European countries Denmark was chosen as representative. Great Britain was not regarded because of possible comparative problems due to the left-handed traffic.

POPULATION FIGURES, 1977 – 1999

In a former publication of the authors (Lamm, R., T. Ruscher, and A. Beck, 2002) it was found that between 1977 and 1999, the end points of the time span under study, the population increases for 21.7 percent in WE and for 27.0 percent for the U.S.A. It was also found, that in 1999 the population density (inhabitants per km²) of WE was about 5.5 times that of the U.S.A., 159 vs. 29. Among European Countries The Netherlands had the highest population density 359.5, followed by Germany 330.6.

Table 1 shows the distribution (%) of populations by age groups for WE and the United States. The following points can be observed:

- a) there is more or less a certain degree of similarity in the distributions (%) of the age groups in the countries under study,
- b) the age group 25-64 represents in 1999 more than one half of the populations of the countries under study, together with the age group > 64, both account for about 71 percent of the population in WE and for about 65 percent in the U.S.A.

That means the percentage of younger people (0-25 years) is decreasing in comparison to former investigations (Lamm, R., E.M. Choueiri, and J.H. Klöckner, 1988, Choueiri, E.M., R. Lamm, G.M. Choueiri, and B.M. Choueiri, 1995), and represents in 1999 less than 30 percent for WE and about 35 percent for the U.S.A.; a dramatic development during the last two decades.

TABLE 1 Distribution (%) of Populations by Age Groups for Western Europe and the United States for the Years 1977 and 1999

Population Age Groups, 1977				
Country	0-14 [%]	15-24 [%]	25-64 [%]	> 64 [%]
A	22,2	15,2	47,3	15,3
DK	22,3	14,6	49,4	13,7
F	23,7	16,5	46,2	13,5
G	20,9	14,4	49,9	14,7
I	23,3	14,6	49,3	12,8
NL	24,5	17,0	47,6	11,0
CH	21,6	15,0	50,4	13,1
Σ WE	23,3	14,6	49,2	12,8
U.S.A.	24,5	18,9	45,9	10,7

Population Age Groups, 1999				
Country	0-14 [%]	15-24 [%]	25-64 [%]	> 64 [%]
A	16.9	11.9	55.7	15.5
DK	18.4	11.7	55.1	14.8
F	18.9	13.0	52.2	15.9
G	15.8	11.1	57.2	15.9
I	14,5	12,3	55,5	17,7
NL	18.5	12.0	56.0	13.5
CH	17.4	11.6	55.8	15.2
Σ WE	16,6	12,0	55,3	16,1
U.S.A.	21.4	13.8	52.1	12.7

Fatalities by Road User Groups

Absolute comparisons of fatality data in different countries must be treated with considerable care, as they can contain results arising from such diverse factors as differing traffic compositions, traffic laws, driving behavior, variations regarding the proportion of rural and urban travel, and/or special influences such as highway standards, legislation, different qualities of street lighting, etc.

Table 2 reveals the overall number of fatalities as well as the percentage shares of fatalities for the time periods I and III. It can be stated, that between the end of the 1970's and the end of the 1990's decisive reductions in the absolute numbers of fatalities could be regarded, for WE in the range of 42 percent and for the U.S.A. in the range of 18 percent.

Fatality Trends

For the time period I it could be determined for WE as a whole and the individual Western European countries, that pedestrians, bicyclists and moped riders show a significant higher percentage share of fatalities than the United States. These road user groups including motorcyclists represent in WE at the end of the 1970's about 48 percent of the fatalities, while they exhibit in the U.S.A. only about 27 percent; this means a difference of about 20 percent. While between the two continents the fatalities of the passenger car occupants reveal no big difference in time period I, the comparison of the percentage share of fatalities for truck-occupants shows tremendous differences. In the U.S.A. the percentage share of fatalities for truckers was 16.8 percent, in contrast to WE with only 3.0 percent at the end of the 1970's.

In comparison to time period III, Table 2 shows for WE an enormous reduction for the road user groups "pedestrians", and "moped riders", while the percentage shares of fatalities for motorcyclists and passenger

car occupants strongly and for truck-occupants slightly increase. For the U.S.A. reductions for the percentage shares of fatalities could be observed for pedestrians, motorcyclists and passenger car occupants, however a nearly unbelievable increase for fatalities of truck-occupants was found. In conclusion it can be stated that at the end of the 1990's in WE motorcyclists and passenger car occupants represent endangered risk-groups, while in the U.S.A. the highest risk-group are the so-called truckers.

The difference in truck-occupant fatalities between Western Europe and the United States may be explained by the fact that, contrary to Western Europe where speed limits of 60 to 80 km/h do exist for trucks, truckers in the United States drive at speeds similar to or even higher than those of passenger cars. Compared to European drivers, passenger car drivers in the United States normally drive in a more defensive and polite way, while truckers normally drive in a more aggressive way, probably because of longer travel distances and financial constraints. Thus, a European driver for the first time in the United States would feel like a rabbit being chased by truckers. What is needed, is that truckers in the United States should be required to follow certain speed limits that are lower than those for passenger cars, as is the case in Europe. Until such speed limits could be put in effect, an enforcement of existing general speed limits by the police is deemed necessary.

It can be possible, that the lower percentage shares of pedestrian-, bicyclist-, moped rider- and motorcyclist fatalities in the United States, is due to the fact that, contrary to Western Europe, in the United States the majority of pedestrians, bicyclists, and motorcyclists also are car drivers. It is assumable that pedestrians, bicyclists, and motorcyclists with driving experience have a better surviving chance in a traffic world reigned by cars (Lamm, R., and E.M. Choueiri, 1992). Furthermore, vehicles per capita in the United States are higher than those in Western Europe. Thus, it can be expected that Americans spend more time in passenger cars than Europeans, who are mostly pedestrians, bicyclists, moped riders, and motorcyclists, and are thus exposed to more traffic safety risks.

Of course, in spite of these statements, the road user group "passenger car occupants" represents with about 57 percent for WE and with about 51 percent for the U.S.A. the highest fatality category for both continents. That means, the questions of active and passive safety of motor vehicles, especially, by automatically functioning safety systems (like airbags for frontal- and side-protection) combined with proper seat-belt usage, as well as ABS etc., stand in the forefront and guarantee the highest safety gain, when analyzing the risk of road user groups (Lamm, R., B. Psarianos, T. Mailaender, 1999).

Note that according to Table 2, at the end of 1990's (time period III), Italy shows within the fatality-development of the Western European countries a contrary trend. It has the 2nd highest percentages for pedestrians and motorcyclists, and the highest percentages for mope-riders and truckers, however the lowest percentage in fatalities for passenger cars occupants.

TABLE 2 Comparison of Fatalities by Road User Groups in Percent – WE vs. the U.S.A. – for the Time Periods I and III

(The percentages for time period II were also determined, however they are not presented in this publication because of space constraints)

Fatalities for Road User Groups for the Time Period I							
Country	Overall	Pedestrians	Bicyclists	Moped-Riders	Motorcyclists	Passenger-Cars	Truck-Occupants
	[-]	[%]	[%]	[%]	[%]	[%]	[%]
A	2057	24,2	6,1	10,9	6,1	50,1	2,6
DK	793	20,0	13,0	12,2	8,6	42,0	4,3
F	13013	18,2	4,8	13,1	7,2	54,6	2,1
G	14119	25,3	9,2	6,0	8,7	49,1	1,9
I	8614	23,0	8,1	10,7	8,9	43,3	6,1
NL	2262	15,0	20,0	10,5	5,4	46,8	2,4
CH	1269	27,1	5,9	10,5	10,0	42,3	4,1
Σ WE	42127	22,0	8,0	9,9	8,0	49,7	3,0
U.S.A.	49939	15,9	1,8	0,2	9,3	56,0	16,8

Fatalities for Road User Groups for the Time Period III							
Country	Overall	Pedestrians	Bicyclists	Moped-Riders	Motorcyclists	Passenger-Cars	Truck-Occupants
	[-]	[%]	[%]	[%]	[%]	[%]	[%]
A	1150	16,4	6,2	4,5	9,7	59,9	3,3
DK	496	16,3	12,2	5,4	6,3	53,3	6,7
F	8700	11,6	3,9	5,6	10,9	65,1	3,0
G	7955	13,5	8,3	1,9	11,8	61,3	3,2
I	4468	19,5	9,0	15,1	12,2	35,6	8,6
NL	1108	10,3	19,7	8,0	7,6	49,6	4,9
CH	572	20,6	8,2	3,9	13,6	51,2	2,5
Σ WE	24449	14,1	7,4	6,2	11,2	56,9	4,2
U.S.A.	40876	12,4	1,9	0,1	5,7	51,4	28,6

The listings of table 2 are presented once more graphically for W.E. as a whole, the U.S.A., and Italy in Figure 1.

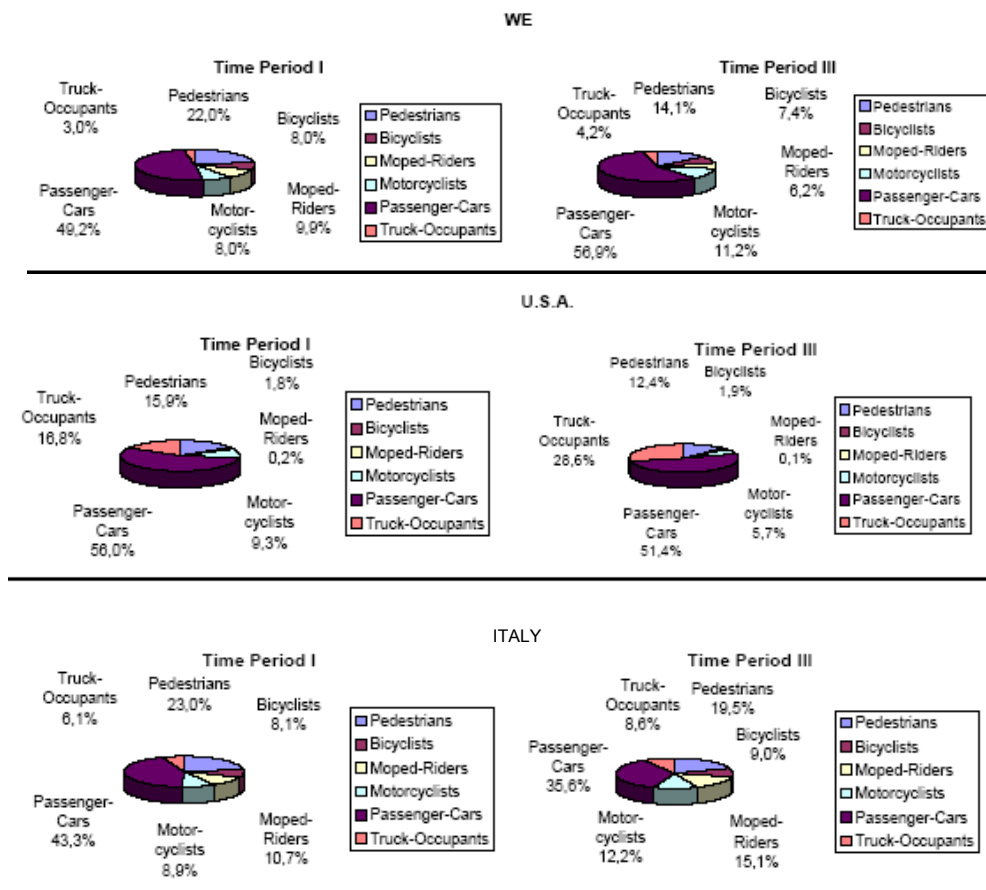


Figure 1: Percentages of Fatalities for Road User Groups in W.E., USA, and Italy for the time Period I and III

Statistical Significance

As already previously explained, in the following fatalities for different time periods will be compared by t-Tests to determine if there was a statistically significant difference between the periods. The formula used in calculating the t-statistic is provided in (Lamm, R., B. Psarianos, T. Mailaender, 1999, U.N. up to 1999 Lamm, R., F.B. Lin, E.M. Choueiri, and J.H. Kloeckner, 1986 13, Lamm, R., T. Ruscher, and A. Beck, 2002, Brownlee, K.A, 1960). Readers may wish to consult these references for additional information on the t-statistic.

In order to be able to statistically analyze the actual development of the accident situation with respect to a significant, respectively marginal improvement or a significant respectively marginal deterioration in traffic safety, Table 3 for comparing time periods I and III (1978-1998) and Table 4 for comparing time periods II and III (1988-1998) were developed. The tables are based on the absolute fatality numbers for the different road user groups.

TABLE 3 Summary of Findings (t-Tests) for the Western European Countries, for Western Europe as a whole, and for the United States in Terms of their Experience with Road User Groups for the Time Periods I-III

Time-Period I – III (1978 – 1998)	A	DK	F	G	I	NL	CH	WE	U.S.A.
Pedestrians	X	X	X	X	X	X	X	X	X
Bicyclists	X	X	X	X	X	0	X	X	X
Moped Riders	X	X	X	X	X	X	X	X	0
Motorcyclists	0	X	–	X	X	0	X	X	X
Passenger Cars	X	X	X	X	0	X	X	X	X
Truck-Occupants	X	0	0	0	X	0	X	0	+

Legend: x = Significant improvement in safety
 0 = Marginal improvement in safety
 – = Marginal deterioration in safety and
 + = Significant deterioration in safety

While Table 3 is added as overview for the general development of fatality numbers for the individual road user groups, Table 4 represents in detail the development of the last decade and will be discussed in the following. In connection with Tables 3 and 4 the symbol “X” means significant improvement in safety during the time periods considered for the country in question, respectively for WE as a whole and the U.S.A. The symbol “+” has been used to denote a significant deterioration in traffic safety. The symbols “0” and “–” reveal marginal improvements or marginal deteriorations, that means the trend is positive or negative, but not significant on the 95 percent level of confidence.

TABLE 4 Summary of Findings (t-Tests) for the Western European Countries, for Western Europe as a whole, and for the United States in Terms of their Experience with Road User Groups for the Time Periods II-III

Time Period II – III (1988 – 1998)	A	DK	F	G	I	NL	CH	WE	U.S.A.
Pedestrians	X	X	X	X	X	0	X	X	X
Bicyclists	X	X	X	X	X	0	X	X	0
Moped Riders	X	X	X	X	+	X	X	X	0
Motorcyclists	0	0	–	+	X	–	X	0	0
Passenger Cars	X	X	X	+	0	0	0	0	X
Truck-Occupants	–	X	X	+	-	+	X	-	+

Legend: x = Significant improvement in safety
 0 = Marginal improvement in safety
 – = Marginal deterioration in safety and
 + = Significant deterioration in safety

According to Table 4 the t-Test results of the different road user groups reveal for WE mostly significant or marginal improvements in traffic safety, related to the investigated fatality categories between 1988 and 1998 (expressed by the symbol "X" and "0"). Only the road user group "truck occupants" shows for WE, as a whole a marginal deterioration (expressed by the symbol "-").

In contrast indicate the t-Test results according to Table 4 in the U.S.A. only for the road user groups "pedestrians" and "passenger car occupants" significant improvements with respect to fatalities. The categories "bicyclists", "moped riders", and "motorcyclists" show marginal improvement-trends, however no significance (expressed by the symbol "0"). The t-Test result for the road user group "truck-occupants" exhibits for the U.S.A. a significant deterioration, expressed by the symbol "+", as could already be expected by the former trend-analyses.

In respect to an overall comparison of Tables 3 and 4 it can be stated that the development, considered over two decades, can be regarded as more favorable than the development in the last decade. This becomes understandable, if one takes into consideration the huge reductions in the fatality numbers since the end of the 1970's and knows, that it is much simpler to reduce high accident numbers in a statistically significant way, than to minimize already reduced fatality numbers furthermore.

Special attention should be given for WE and the U.S.A. regarding the road user group "truck-occupants". The extremely negative development of the road user groups "motorcyclists", "passenger cars", and "truck-occupants" in Table 4 for Germany can certainly be explained by the unification in 1989.

Additionally, with respect to the statements about significant negative developments for Germany and the U.S.A. the significant deteriorations of the road user group "moped-riders" in Italy and "truck-occupants" in the Netherlands is still to mention. That means the colleagues in these countries should urgently regard this road user accident categories in their traffic safety work. Less stringent these statements are also valid for groups with the symbol "-", although in these cases the increase of the fatality trend is only marginal, so far.

SUPERIMPOSITION OF AGE- AND ROAD USER GROUPS

So far, the development of fatalities was differentiated according to road user groups. Furthermore, different age groups shall be regarded in the analysis.

It is not possible to include the road user groups "moped riders" and "truck-occupants" with respect to age groups, since the data base of the UN-Statistics is not sufficient for such an investigation. Therefore, the road user groups "motorcyclists and passenger car occupants" (Table 5) as well as "pedestrians and bicyclists" (Table 6) will be additionally discussed regarding their age-structure for the individual countries in WE, for WE as a whole, and for the U.S.A.

TABLE 5 Overview of the t-Test Results for Motorcyclists and Passenger Car Occupants, Differentiated by Age Groups – WE in Comparison to the U.S.A. – for the Time Periods II-III

	0-14	15-24	25-64	> 64
Country	Motorcyclists			
A	n.s.	X	+	-
DK	0	X	-	-
F	X	X	+	0
G	-	X	+	+
I	X	X	+	0
NL	0	0	+	n.s.
CH	n.s.	X	X	-
Σ WE	X	X	+	-
U.S.A.	0	0	0	+

	0-14	15-24	25-64	> 64
Country	Passenger Car Occupants			
A	X	X	X	–
DK	0	X	0	0
F	X	X	X	–
G	+	0	–	+
I	X	X	-	+
NL	0	X	X	0
CH	0	X	X	0
Σ WE	X	X	X	+
U.S.A.	X	X	X	+

Legend: x = Significant improvement in safety
0 = Marginal improvement in safety
– = Marginal deterioration in safety and
+ = Significant deterioration in safety
n.s. = No statement possible

Table 5 reveals, that the age group “> 64” represents highly endangered results for “motorcyclists and passenger car occupants”. In this age group there does not exist a single significant safety improvement (expressed by the symbol “X”) for the investigated countries, as well as for WE and for the U.S.A. That means, the traffic safety work for the age group “> 64” should be concentrated on the motorized traffic, first of all. Already since the beginning of the 1980’s the main author has pointed out this fact in numerous publications for example (Lamm, R., B. Psarianos, T. Mailaender, 1999, Lamm, R., F.B. Lin, E.M. Choueiri, and J.H. Kloeckner, 1986, Lamm, R., and J. Treiterer 1981). Reasons may be: A decreasing sight potential, restriction of the sight-field, lessening of reaction-capabilities, and difficulties of the healing process in case of injuries for elder persons.

For the age group “25-64” Table 5 indicates for “motorcyclists”, especially for the Western European countries with the exception of Switzerland, a significant increase in the number of fatalities (expressed by the symbol “+”). This result should be regarded with respect to future traffic safety work in most western European countries. In contrast the U.S.A. reveal in this connection at least a marginal improvement (expressed by the symbol “0”).

It is a great success, that for the first time during the last two decades significant or marginal improvements of the fatality risk could be proven for motorcyclists and passenger car occupants in the age group “15-24”, in both continents; the same is true for the age group “25-64” for passenger car occupants (Table 5).

The statements for the age group “0-14” are indifferent for motorcyclists; this is understandable, since children and juveniles can only be killed in an accident as passengers, and the database for such an occurrence is very low. Furthermore, the t-Test results in this age group reveal for passenger car occupants significant improvements in both continents in the time period II-III. The exception of Germany probably is caused again by the reunification and the high motorization of the eastern part in the 1990’s.

The extremely favorable development for all age groups up to 64 years, related to fatally injured passenger car occupants can be explained, as already previously mentioned, by the increasing improvements of the motor vehicle fleet in connection with active and passive safety systems.

Finally Table 6 represents the differentiation by age groups according to Table 5 for the road user groups “pedestrians” and “bicyclists”. For “pedestrians” the t-Test results reveal a continuously positive development between the end of the 1980’s and the end of the 1990’s. For “bicyclists” the results are more or less positive, however often in marginal ranges. An exception represents the age group “25-64” for the U.S.A. with a significant deterioration for bicyclists.

TABLE 6 Overview of the t-Test Results for Pedestrians and Bicyclists, Differentiated by Age Groups – WE in Comparison to the U.S.A. – for the Time Periods II-III

	0-14	15-24	25-64	> 64
Country	Pedestrians			
A	X	X	X	X
DK	X	0	0	X
F	X	X	X	X
G	X	X	X	X
I	X	0	X	0
NL	0	0	X	X
CH	0	0	0	X
Σ WE	X	X	X	X
U.S.A.	X	0	X	X

	0-14	15-24	25-64	> 64
Country	Bicyclists			
A	X	X	–	X
DK	0	0	0	X
F	0	X	0	0
G	X	X	–	0
I	X	0	0	0
NL	X	X	0	0
CH	0	X	0	0
Σ WE	X	X	X	X
U.S.A.	X	0	+	–

Legend: x = Significant improvement in safety
 0 = Marginal improvement in safety
 – = Marginal deterioration in safety and
 + = Significant deterioration in safety

The importance of the results of Tables 3 to 6 is that they provide traffic safety authorities in the investigated countries with a tool to (1) study the development of different fatality categories; (2) compare their results to other countries; and (3) come up with recommendations for improving traffic safety, especially for those age and/or road user groups, which have experienced significant safety deteriorations. In other words, this research study could assist the authorities in the identification of endangered human and vehicular involvements, in terms of their fatality developments.

CONCLUSION

This paper reports the results of research investigating motor vehicle accident characteristics of Western Europe and the U.S.A., in order to determine some of the problem areas in traffic safety. Western Europe includes the countries Austria, Denmark, France, Germany, Italy, The Netherlands, and Switzerland, furtheron Western Europe as a whole, and the U.S.A. are investigated. The study represents the continuation of the main author's research work since the 1980's extending the accident data base for two decades.

The specific objectives of the study are to:

1. Identify the changes in fatalities as experienced by each of the investigated seven Western Europe countries, by Western Europe as a whole, and by the United States from 1977 to 1999.
2. Identify those road user groups differentiated by age groups, that were most frequently involved in fatal accidents.

3. Determine whether there were statistically significant changes in the accident characteristics for different periods in the time span from 1977 to 1999.

Some conclusions of the study are:

1. The distribution of population numbers, differentiated by age groups, represents for both continents a strong displacement in percentage shares from the age groups "0-14" and "15-24" to the age groups "25-64" and "> 64". This shift amounts on the average to about 9 percent for Western Europe and the United States between the end of the 1970's to the end of the 1990's according to Table 1.
2. The comparison of fatalities by road user groups reveals for the time periods I to III in Western Europe a more or less strong shift from the non-motorized traffic (pedestrians, bicyclists) to the motorized traffic (motorcyclists, passenger cars, and trucks). For the United States the development is to evaluate positively by all means with the exception of the tremendous increase in fatalities of truck-occupants, Table 2.
3. The previous statements are confirmed more or less distinctly by the t-Test results according to Table 4 for the last decade. While for pedestrians and bicyclists statistically significant improvements in safety could be proven for WE, the results for the motorized traffic (motorcyclist, passenger car) remain indifferently in marginal ranges. Note, that Table 4 reveals for the U.S.A. a significant deterioration in safety with respect to truck-occupants, as could be expected by the investigations, so far.
4. More distinct trends reveal the results, when superimposing road user- and age groups for the time periods II to III in Tables 5 and 6. For the age group "> 64" marginal and significant deteriorations could be observed for motorcyclists and passenger car occupants in both continents. The same is true for motorcyclists in the age group "25-64", at least for WE. That means, the traffic safety work should be concentrated on the age groups "25-64" and "> 64" for motorcyclists and for the age group "> 64" with respect to passenger car occupants in both continents.
5. It is a great success, that for the first time during the last two decades marginal or significant improvements of the fatality risks could be proven for motorcyclists in the age group "15-24" and for passenger cars in all age groups up to 64 years of age in WE and the U.S.A.
6. The t-Test results for pedestrians are to evaluate extremely positively for all age groups. The same is true for bicyclists in WE, while in the U.S.A. bicyclists have to be considered again as more or less endangered in the age groups "25-64" and "> 64".
7. Especially for Italy it is to mention that the road user group "moped-riders" is seriously endangered with respect to all age groups, while the road user group "motorcyclists" revealed during the last decade a significant deterioration in the age groupe "25-64".

Traffic safety officials can directly deduce from comparisons, like those shown previously, where safety deteriorations exist, and consequently propose appropriate measures to combat them. Thus, it becomes relatively easy for countries to pin point any significant or even marginal safety deterioration, and in doing so that is by conducting accident analyses and evaluations timely countermeasures can be developed to improve the safety of the most endangered target groups.

However, note, that the previous comparisons have not to be conducted only between different countries or continents, but it can also be dealt with in the country itself, for example, by comparing different provinces or urban/suburban areas, or rural/urban networks etc. with eachother for specific national demands.

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