A Survey of Road Traffic Injuries

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Abstract: The appearance of cars has raised material civilization and living standard to an unprecedented level. Today, it is hardly imagine how we human beings live without cars. Yet, motor vehicles can also cause a great number of peoples' death and injury and considerable economic loss, which has constituted the globe burden. Understanding the occurrence and development of the road traffic injuries will contribute to the prevention and control of the crash and to the implementation of "everybody has the right to enjoy health" proposed by WHO.

1. Development of road traffic injuries as "health" problem

The first fatality from a road crash occurred in 1896 in the U.K. The coroner said: "this is a terrible tragedy which must never happen again." But there have been an estimated 25 million deaths world wide since then [1].

O'Neill [2] presented following background about "health" problem of road traffic crash: By the late 1920s about 30,000 MV deaths were occurring each year in the United States and they were increasing rapidly. The death rate per 100 million miles was about 16, and the death rate per 100,000 populations was about 27. Obviously, MV crash deaths and injuries had been a significant and growing public health problem then. Strange to say, it was not considered a medical problem, but a "safety" problem at that time.

From 1920s to 1960s, the National Safety Council paid much attention to "the Three Es", i.e.: enforcement of traffic laws, education of motorists and engineering of highways. However, "the Three Es" were not complete and sufficiently effective for improving traffic safety. Today there is awareness that motor vehicle caused crash death and injury are more than a safety problem. They are recognized as a public health problem, requiring countermeasures based on science and engineering rather than wishful thinking. In 1953 the American Medical Association adopted a resolution that "recommends to the motorcar manufacturers of America that they consider equipping all automobiles with safety belts."

In the mid-1960s, the belts became standard equipment in response to state laws even though getting belts in new cars took about 30 years.

2. Occurrence of road traffic injury

Trinca et al estimate that the average citizen of the world has about a one in seven chance of being injured in a traffic crash sometime during his or her life [3].

Evans L, the chairman of International Traffic Medicine Association, reported that averagely a driver has traffic crash once every ten years, most crashes cause only slight damage to vehicles, and fatal traffic crash happens once every 4,000 years [4]. But based on the National Safety Council (1989) data, the average vehicle has about a 20% probability of being involved in some type of crash per year, or is likely to be involved in some type of crash about every five years [5].

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Haegi M [6], the chairman of European Road Traffic Fatality Federation, cited the statistical data of traffic crash from UN to show that for lifetime exposure, the average person in a developed country has a 1% risk of death and a 30% risk of injury. that is, the chances of non-fatal traffic crash are 30 times of those of fatal traffic crashes.

There is great difference in severity of non-fatal traffic crash injuries, from minor abrasion to nearly lethal injury. Generally, police departments only register slight injuries, severe injuries and deaths at the scene [5].

Hansen and Ask [7] from Norway compared the injury conditions of hospitalized traffic injury patients with those registered by the police office and indicated that the statistical figure from the police office is not exact, with correct rates of 84.2% for minor injury, 30.8% for moderate injury and only 19.2% for severe injury.

Evans [5] analyzed US data of 13,000 vehicle crashes of 1986 from National Accident Sampling System (NASS) and indicated that among non-fatal injuries AIS was mostly 1 and 2, accounting for 84.7% and 10.8%, respectively.

The rates of deaths vs injuries was 1:74, considering that there were about 27% of non-fatal traffic crashes were not registered and most of them are of minor injuries, the ratio of deaths vs. injuries should be 1:94, instead of 1:74.

3. Trends in global motorization

At present, total motor vehicles in the world amounts to 1,000 million, among which more than 80% are in the developed countries and less than 20% in the developing countries. However, less than 15% of population died of traffic crash belongs to the developed countries and more than 85% to the developing countries. The average global increase rate of automobile production is 3.5% and in the corresponding period the increase rate is 13.7% in China. The average global increase rate of total motor vehicle production is also 3.5% and in the corresponding period 26.4% in China. In 2001, all the motor vehicles in China totaled at 68,518,788. Total number of motor vehicles and total number of motor vehicles/person in some countries in 1997 are presented in Figure 1 and 2, respectively, and total number of motor vehicles in China these years in Figure 3 and Table 1 [8].

Table 1. Increase of motor vehicles in China

Year	Total amount of MV (ten thousands)	Total amount of automobiles (ten thousands)	Total amount of motorcycles (ten thousands)
1951	6.19	6.19	/
1978	158.89	135.49	10.43
2001	6 851.88	1 844.55	4 342.05
2001:1951	1 106.9	298.0	/
2001:1978	43.1	13.6	416.3

From Table 1, we can see that the total number of motor vehicles of China in 2001 is 1 106.9 times of that in 1951, 43.1 times of that in 1978. The total number of automobiles in 2001 is 298.0 times of that in 1951 and 13.6 times of that in 1978. Total number of motorcycles in 2001 is 416.3

times of that in 1978[8]. The increase is so rapid and it's rarely seen even in developing countries. However, compared with developed countries, China's MV remains in a lower level both in quantity and quality. In 2001, the average ownership of cars is 3.85/1,000 people [9] in China, lagged far behind the developed countries.

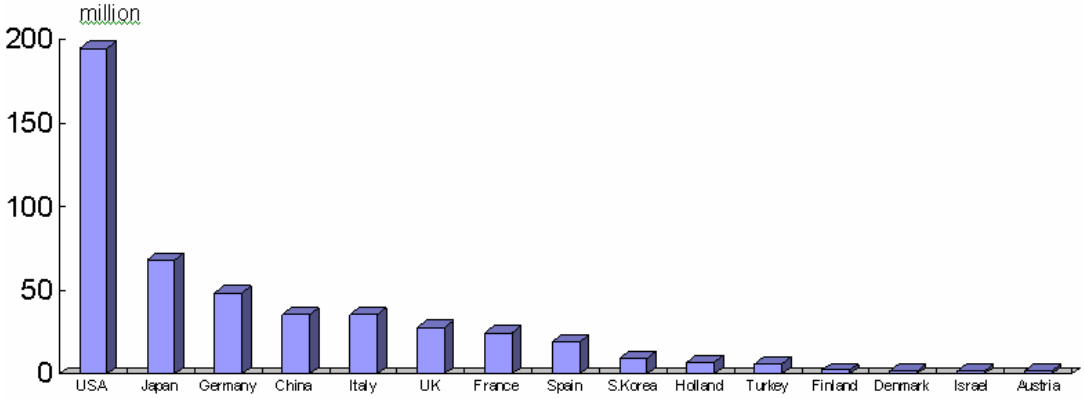

Figure 1. Total number of motor vehicles in some countries (1997)

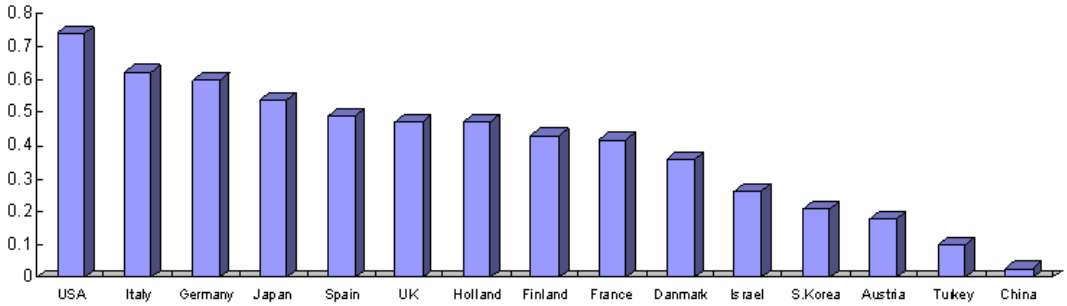

Figure 2. Total number of motor vehicles/person in some countries (1997)

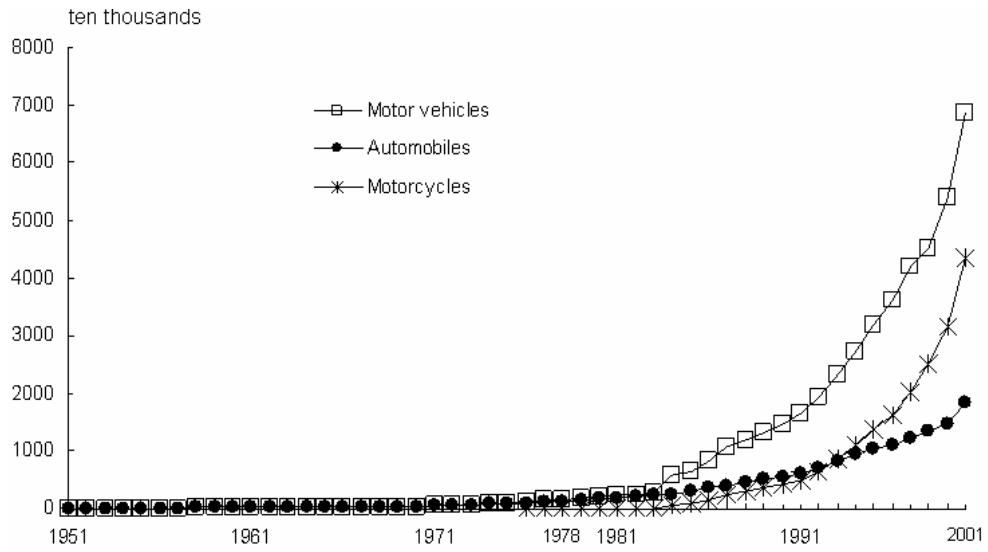

Figure 3. Changes in the total numbers of motor vehicles, automobiles and motorcycles in China

4. Trends of road traffic deaths in developing and developed countries

Figure 4 shows the percentage change in fatalities resulting from traffic crash in developed and developing countries. If it takes 1980 as a cardinal number, the mortality is rising in many low-income countries, but it is dropping in developed countries. WHO predicted that the road traffic injuries will account for about 2.3 million deaths globally by 2020. Among them, developing countries accounts for 90% of the death [10].

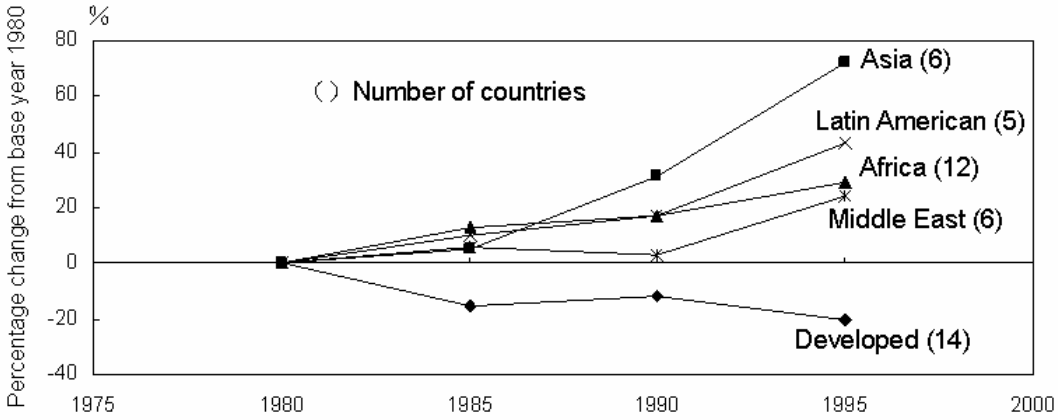

Figure 4. Percentage change in fatalities
(Source: Baguley CJ et al, 1999, cited from Downing, 2002)

As for in China, the death and the injuries from motor vehicle crashes increased years by years. The number of crashes, deaths and the injured in 2001 were 754 919, 105 930 and 546 485, respectively, about 127.48, 124.33 and 105.93 times, respectively, as compared with those in 1951, and 7.04, 5.55 and 7.05 times, respectively, compared to those in 1978 (Figure 5).

In China, fatality rate per 10 000 MV and fatality rate per 100 000 persons in 2001 were 15.46 and 8.51, respectively. Figure 6, 7 show the dynamic changes of fatality rate per 10 000 MV and fatality rate per 100 000 persons from 1951 to 2001 in China.

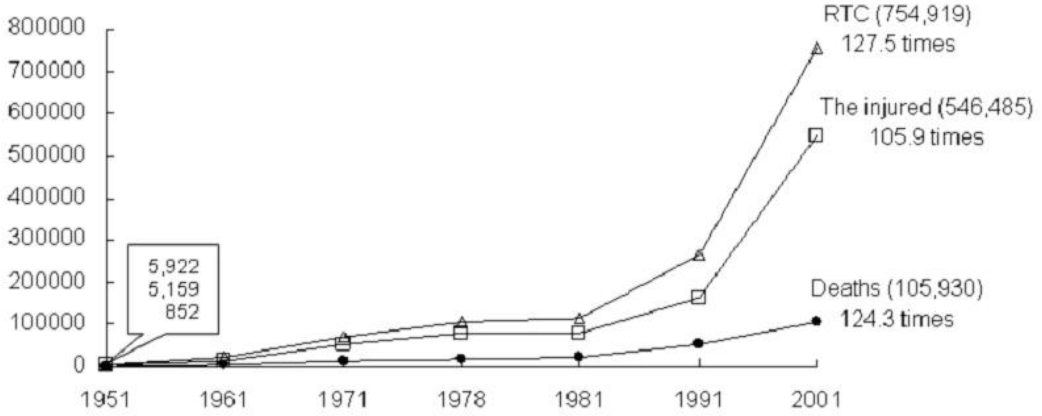

Figure 5. the Number of RTC, deaths and injured in China (2001)

Figure 6. Fatality rate per 10 000 MV in China (1951~2001)

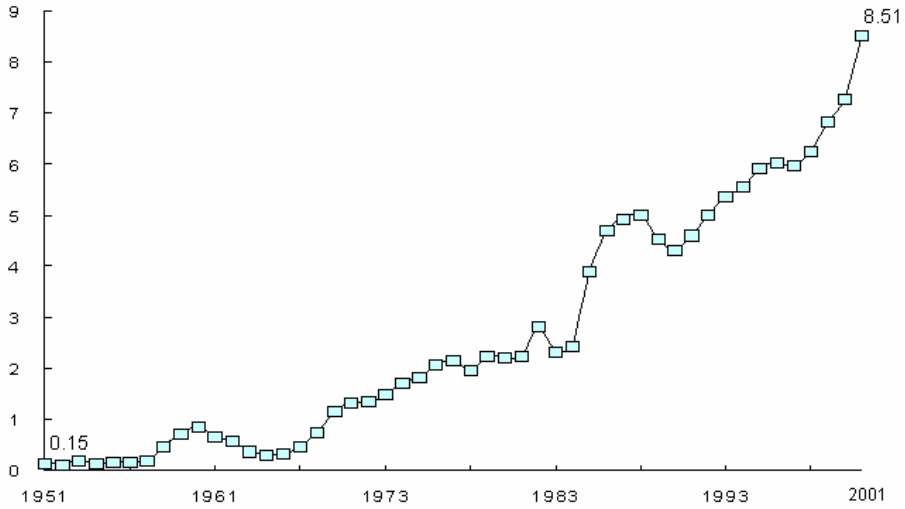

Figure 7. Fatality rate per 100 000 persons in China (1951~2001)

Just as Dr. Wolfensohn, President of World Bank Group, said: "Road safety is an issue of immense human proportions, it's an issue of economic and social proportions, and also an issue of equity. Road safety very much effects poor people."[1]

5. Relationship between RTC and GNP

Statistics in Table 2 of some countries indicate that in countries whose GNP per capita are more than $18,000， cars comprise more than 50% (58%-89%) of the total motor vehicles; Motorcycles are much fewer, usually comprising less than 20%. The average ownership of motor vehicles per population was 0.52-0.74.

In the countries with annual product of $3,000-10,000 per capita the proportion of car occupants holds about 30%-35% (33%-34% in Table 2-8) , motorcycle occupants are over 20% (24%-56% in Table 2), and the occupancy of motor vehicles per person is 0.21-0.34. In the countries with annual

product of less than $1,000 per capita the proportion of car occupants is less than 30%, motorcycle occupants often more than 50%, and even as high as 90% in some countries like Vietnam, the occupancy of motor-vehicles per person is < 0.06.

Table 2. Vehicle ownership in different countries [11]

Country	GNP per capita (US $)	Total number of vehicles/1,000 persons	Motorcycles as % of total vehicles	Cars as % of total vehicles
Japan	34 630	640	20	58
USA	24 780	740	2	88
Germany	23 980	570	9	89
France	23 420	520	10	87
UK	18 340	410	3	86
Australia	18 000	610	3	76
Republic of Korea	8 260	206	24	33
Malaysia	3 140	340	56	34
Thailand	2 140	190	66	16
Philippines	950	32	26	28
Indonesia	810	58	69	15
Sri Lanka	600	50	60	13
China	530	21	40	24
India	320	30	67	14
Vietnam	210	27	91	9

Statistics are taken from country reports, international agency publications and conference papers, year range 1992-1995.GMP- gross national production; MTW- motorized two-wheelers (motorcycles)

The above data show that the annual product per capita is related to the occupancy of motor vehicles and to the proportions of cars and motorcycles among motor vehicles in a country, that is, the higher the per capita income, the higher the motorization, and the higher the occupancy of cars. Studies show the increase of per capita income is the main factor to promote the development of motorization. The income elasticity coefficient is between 1.02 and 1.95, i.e. the income increases by 1%, the occupancy of motor vehicles increases by 1.02%-1.95%. The income elasticity coefficient of cars is mostly higher than that of trucks and other motor vehicles, in other words, for the same increase of per capita income cars increase more rapidly than that of other motor vehicles [12].

6. Relationship between RTC and the speed of economic development

The history of industrialized countries indicates that each country always experienced a period of rapid development of economy, followed by a slow development period. For example, in the United States between 1952 and 1972 the economy developed most rapidly, meanwhile, the traffic fatalities deaths went up dramatically from 37,794 deaths of 1952 to 56,278 deaths of 1972, with increased of 49% and annual increase of 2.1%. In 1973 as the development of economy decreased, so did traffic deaths. Until 1994 the annual increase rate of traffic deaths was -2.0%. In Japan the 18 years from 1952 to 1970 was the period of rapid development of motorization and also a peak of mortality of

traffic crash, from 4,696 deaths of 1952 to 16,765 deaths of 1970, with increase of 25.7% and annual increase of 7.7%. After 1971 the motorization development slowed down and the number of traffic deaths presented a negative increase accordingly. Until 1995 the annual increase rate of traffic deaths was -1.6% [13]. In general, the number of injuries and deaths caused by traffic crashes rises when the speed of national economy development is over 4%-6%, and drops when below 4% [12].

Since open-up and reform policy was carried out in China in 1978 the national economy has been developed rapidly, meanwhile the occupancy of motor vehicles especially motorcycles has increased dramatically. Similarly, traffic crashes, traffic deaths, traffic injuries and the number of traffic deaths per 100,000 people have increased accordingly, while the number of traffic deaths per 10,000 vehicles has dropped to some extent.

7. Relationship between RTC and education

It has proved that education along won't reduce traffic crashes though it has long been considered to be a vital factors involving traffic safety during past 50 years.

Status Report from Insurance Institute for Highway Safety says: "Research indicates that education has no effect, or only a very limited effect on driver's behavior like staying within speed limits, heeding stop signs, and using safety belts. The education might increase driver's knowledge (for example, about the benefits of using belts), but usually doesn't result in behavior changes."

It's interesting that the greater the compliance the more effective the traffic laws. If motorists don't know about a law or don't believe it will be enforced, compliance will be limited. Even the laws that frequently are violated can have positive effects, because drivers typically won't go more than 10 mph faster than a posted limit. Motorists are much more like to change their behavior in response to traffic laws than because of education about what increase crash risk. They believe their driving skill will enable them to avoid collisions, but won't enable them to avoid a ticket. Therefore, the effective program is the combination of education with traffic law enforcement. This is the key to changing driver behavior.

8. Prediction of the future

Evans [4] says that the world fatalities are expected to increase beyond the current level of more than a million per year but eventually to reach a peak and then decline. We cannot know how high fatalities will climb before peaking when the peak will occur and the rate of decline from the park, but these phenomena will profoundly affect many millions of human lives.

Recently Sweden has put forward a long term strategic task on traffic safety – Vision Zero, i.e., the idealistic goal of zero killed or severely injured road users. From now on we should do our best to work for this lofty objective.

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