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Report

Adverse Health Outcomes of Road Traffic Injuries in Iran after Rapid Motorization

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Recent studies have made it clear that Iran has too many road traffic injuries (RTI). This paper explains the reasons for high traffic injury rates and points to solutions. It also provides detailed data on the burden of traffic injury in Iran in 2005. Traffic injury rates have rapidly risen out of control because for a variety of possible reasons such as increasing number of non-standard cars and motorcycles, low gas price, decreasing ratio of travels via public transportation than with private vehicles, and problems with safety design. Besides a high need for a system safety approach, Iran needs to deal with the problem of producing a high number of cars and motorcycles. Providing safe mobility for the people of Iran needs to be a top priority of the government.

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Introduction

Socioeconomic development, change in life style, and improved life expectancy have been leading to dramatic changes in the disease profile in developed and most developing countries.[1] At the end of the 1960's, under-5-year death had a 40% share of total mortality in Iran. After four decades this figure decreased to only 9%.[2] Infectious and diarrheal diseases used to be the main cause of death in Iran, the analysis of the vital registration data in 2005 showed a complete transition to non-communicable diseases.[3] According to this analysis, the share of the five leading cause of death in the total mortality were: Cardiovascular disease (23%), cerebrovascular accidents (11.3%), road traffic injuries (10.3%), other cardiovascular disease (3.8%), and gastric cancer (2.6%). Road traffic injuries (RTI) have only been recently recognized as a leading public health concern in Iran. Road traffic injuries were calculated as the leading causes of disability adjusted years of life lost (DALYs) according to the national burden of disease study done by the Ministry of Health and Medical Education (MOHME) in 2002.[4]

This was part of a major undertaking by the MOHME to provide the infrastructure necessary to begin estimating the burden of all diseases and injuries. The Global Burden of Disease (GBD) study, is a comprehensive and comparable assessment of the burden of all diseases and injuries in all countries.[5] Iran, with estimated 44 RTI death per 100,000 population in 2002 had the highest RTI death than any other country for which reliable estimates can be made. For the sake of comparison we will provide some examples on RTI mortality rate per 100,000 population: in the United States 19 persons in 100,000 population die of road traffic injuries. In Eastern Mediterranean and North African countries, the WHO epidemiological region in which Iran is also placed, this number is 26 and in Sub-Saharan Africa the average number is 29. In Canada and

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Germany the RTI rate is nine and six per 100,000 population, respectively. Finally the world average is about 19 deaths per 100,000 population.

The purpose of this article is to explain how Iran came to recognize the true public health burden of road traffic injuries in the country. This story has important lessons for other developing countries, where the problem may still not be fully appreciated. We first give details on health outcomes of RTI and then explain the socio-political environment that lead to the rise of road traffic injuries in Iran over the last few decades. Finally, we describe the path that Iran needs to follow to control the menace of road traffic injuries.

RTI, a major public health problem in Iran

Over 30,000 people die annually in Iran from road traffic crashes, amounting to a death rate of 44 per 100,000. Similarly, the annual mortality of road traffic crashes is substantially higher than the number of deaths from the 2003 Bam earthquake, one of the worst natural disasters of recent decades.[4] Reliable road traffic injury surveillance is an important component of evidence based road safety policy making. In many developing countries, such estimates are derived from police and crime reports. In many developing countries, including Iran, police only record road traffic deaths that happen at the crash scene. Thus, deaths that happen subsequently in the hospital are not captured by such recording.

Building the death registration system (DRS)

Over recent years, the MOHME and the National Organization of Civil Registration (NOCR) have invested substantial efforts towards improving national death registration.[6] Although, the system dates back to the late 1960s, the coverage of the data systems and the quality of the cause of death attribution was initially poor. Prior to 1995, mortality records were based on a sample set of cities. Although the system was later upgraded to cover the entire country, cause of death remained unreliable because it was based on cemetery records with considerable misclassification. The system aimed for comprehensiveness by obtaining records from five different sources: 1) All public and private hospitals in each district report mortality information monthly to local District Health Center (DHC); 2) A DHC representative visits the death registration office of the district cemetery by reviewing death certificates, or, when a death certificate is missing, via information from local informants; 3) The District Office of the Forensic Medicine Organization provides the District Health Center with a copy of all burial certifications issued in this office on a monthly basis; 4) Community health workers gather the mortality information in rural areas during weekly house visits. When a physician visits the Health House s/he completes a verbal autopsy form for each death in case the death is not already certified by a physician. 5) Obituary printing houses, clergymen who eulogize the deceased, and Urban Health Community Volunteer Workers are other sources used to inform the District Health Center of causes of death. This death registry data collected by the DHC is channeled to their Province Health Center, which in-turn feeds it upwards to the national MOHME Deputy of Health program. In a multi-source death registry system double registration of death is highly likely. To avoid such a problem, redundant death records are removed by inspecting the records at three levels: within district, cross-district, and cross province. The DRS is being implemented progressively—starting with only one province in 1998 and 18 provinces in 2001, the system covered 29 provinces (all except Tehran) by 2004, and is expected to cover all provinces in near future. Because the death registration system incorporates all other death registration sources, such as forensic medicine, it is more complete than all other death registers in the country.

The DRS also incorporated innovative coding tools to improve coding accuracy and reduce the use of ill-defined codes for cause of death attribution. This was implemented using a computer algorithm for assigning International Classification of Disease-10 (ICD-10) based on the underlying causes input by the coder. The system eliminated the use of garbage codes that should not be considered as underlying causes of death. The example of garbage codes would be septicemia, and heart failure, which are intermediate cause of death and provide little insight toward the underlying cause. Sex, and age adjusted redistribution of such codes was the procedure DRS adopted to solve the problem of so-called garbage codes. The development of the DRS has had a profound influence on how the problem of road traffic injuries is viewed in the country. As the DRS improved in coverage and quality, a national debate arose about the number of road traffic deaths in the country.

Improving the quality of morbidity data

Deaths in road traffic crashes only describe a part of the burden posed by road traffic crashes. Although it is well recognized that non-fatal injuries are a leading source of detriments to population health, collecting and analyzing population representative information on non-fatal injuries has been difficult. In the Demographic and Health Survey (DHS) in Iran people were asked to answer several questions about involvement and care for road traffic injuries. This survey provided nationally representative estimates of RTI incidence in 2000. However, population surveys cannot capture medical descriptions, external causes and the severity of injuries. Recent data collection by MOHME has attempted to tackle many of these problems by conducting a hospital sample registry. Time limited data on deaths and injuries was collected from all medical facilities in 12 provinces (East Azarbyjan, West Azarbayjan, Kermanshah, Ilam, Khoozestan, Hormozgan, Isfahan, Yazd, Semnan, Golestan, Khorasan, and Fars) in 2005. According to 2005 estimates of the Statistical Center of Iran and adjusted results of the national census in 2006 the total population of the 12 provinces under the study was 33,046,751. This number covers 47.8% of total population of the country, 7.7%, and 1% of a year for inpatient care and outpatient care, respectively. Hospital inpatient admission records were limited to four weeks (the first week of the last month of each season) and hospital outpatient admission records were similarly limited to four random days spread across the four selected weeks (the same days across all provinces). This strategy allowed estimating rates of injury involvement which could be extrapolated to annual population incidence. For the cases identified, information was collected and collated from the death registration system (for fatalities), from the hospital records, and from a household follow-back face-to-face interview with the victim or their relatives. This process of comprehensively polling all information sources allowed capturing both medical information from the hospital and detailed cause and epidemiological information from the victim. Thus the resulting dataset provided the demographic characteristics of the victims, information about the crash (time of the event, place of occurrence, and external cause), pre-hospital and care (time elapsed before medical care was received, who provided care, and mechanism of victim transport), and detailed medical descriptions of victim injuries.

The outcome of these data collection efforts was that for the first time the burden of non-fatal injuries could be estimated. The results showed that ignoring non-fatal injuries leads to an incorrect description of the burden of injuries. Analysis of hospital data illustrated that motorcyclists dominate inpatient admissions, outpatient visits, even though motorcyclists rank behind pedestrians and car occupants in the total death count (Figure 1). In fact, almost half of hospital admissions and outpatient visits are motorcycle riders. Thus

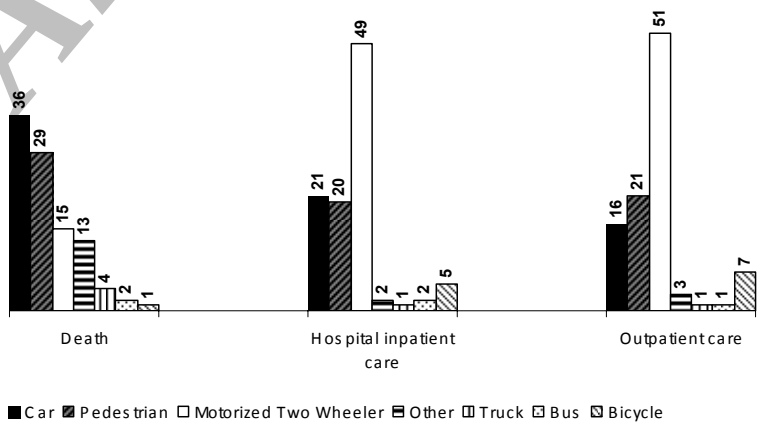

Figure 1. Distribution of external causes of road traffic injuries and deaths; ***Source:*** Death: DRS 2005[6]; Injuries: Hospital registration of injuries in 12 provinces.[13]

motorcycle injuries impose a substantial new burden on medical facilities, which is only apparent when non-fatal injuries are analyzed. Table 1 shows that total public health burden measured in DALYs is highest for motorcycle riders. A closer look at this table also demonstrate that, 1) Although the absolute count of death in the young and middle age people is higher than older persons but death rate in older people is greater than that of younger age groups; however, both absolute value and rate of Years of Life Lost (YLL) is higher in young and middle-age people than those of older age groups. Of note, Years of Life Lived with Disability (YLD) in the age group 75 – 84 years is the second highest hospital YLD after that of the age group 15 – 24 years. This may

Table 1. Health outcomes of road traffic injuries in Iran in 2005. Table Rate=per 100,000 population; YLD=Years of Life Lived with Disability; YLL=Year of Life Lost; DALYs=Disability Adjusted Life Years; 'All others' refers to bicycle, motorized three wheeler, tractor, bulldozer, and other road reconstruction moving vehicles. ***Source:*** analysis of vital registration database (2005) for fatal injuries and analysis of 4-week hospital survey database for non-fatal events.

		Death		YLL		Hospital inpatient		Hospital outpatient		Total
		Cases	Rate	YLL (yr)	Rate	YLD (year)	Rate	YLD(year)	Rate	DALYs (yr)
All transportation by age, sex, and place of residence	< 1 year	265	23	8701	757	648	56	4659	405	14008
	1–4	800	18	27006	598	2754	61	4756	105	34517
	5–14	2275	15	83820	562	15698	105	30061	202	129579
	15–24	8741	50	310876	1794	59263	342	112265	648	482404
	25–34	6825	59	212177	1848	30130	262	63202	550	305510
	35–44	4734	61	117733	1506	19937	255	14948	191	152618
	45–54	3790	74	71171	1381	13045	253	12255	238	96471
	55–64	2412	78	31261	1014	8143	264	1949	63	41352
	65–74	2507	104	19744	817	4753	197	4508	186	29005
	75–84	1847	176	7766	740	3201	305	2970	283	13937
	85+	329	208	570	361	207	131	4	2	781
	All ages	34525	50	890825	1290	157779	228	251578	364	1300181
	Male	28135	80	735399	2086	124607	354	215828	612	1075834
	Female	6390	19	155425	460	33172	98	35750	106	224347
	Urban	22501	49	580342	1254	110928	240	186005	402	877275
	Rural	12024	53	310483	1362	46851	206	65573	288	422907
Pedestrian	Urban	5898	13	143308	310	27469	59	37535	81	208313
	Rural	3906	17	96707	424	7778	34	18974	83	123458
	Total	9804	14	240015	348	35247	51	56509	82	331771
Motorcycle	Urban	3242	7	94634	204	47032	102	101244	219	242911
	Rural	2156	9	62475	274	24127	106	37913	166	124515
	Total	5398	8	157109	227	71159	103	139157	201	367425
Car occupant	Urban	9390	20	243849	527	24082	52	30657	66	298588
	Rural	3363	15	85274	374	9656	42	4895	21	99825
	Total	12753	18	329123	477	33738	49	35552	51	398413
Truck	Urban	961	2	24083	52	1723	4	4477	10	30284
	Rural	536	2	14112	62	1123	5	49	0	15284
	Total	1496	2	38195	55	2846	4	4527	7	45567
Bus/minibus	Urban	355	1	7100	15	1873	4	96	0	9069
	Rural	182	1	5093	22	2785	12	1851	8	9729
	Total	538	1	12193	18	4658	7	1947	3	18798
All others	Urban	2655	6	67367	146	8748	19	11996	26	88111
	Rural	1881	8	46823	205	1383	6	1890	8	50096
	Total	4536	14	114190	351	10131	25	13886	34	138207

reflect the high vulnerability of elderly. 2) The highest DALYs resulting from RTI is seen in the age group of 25 – 34 years. Unfortunately, these victims are the working and highly active fraction of Iran's young population. 3) Male to female ratio of all the metrics (YLL, YLD, and DALYs) is almost four. 4) Total DALYs due to road injuries was 1,300,181 years in 2005 that ranks second after cardiovascular diseases. With 1,305,714 DALYs, road traffic had received the same rank among all causes of morbidity and mortality in 2003. Death rate and YLL in rural residents are higher than those of urban dwellers. On the other hand, the YLD rate of outpatient and inpatient cases was more in residents of urban areas comparatively. This might imply the higher fatality of accidents in rural areas as a result of riding unsafe motorcycles and possibly seeking less hospital care compared to residents of urban areas. 5) Bus and minibus have the lowest RTI death rate that makes them still the safest means of transportation.

Implications of these data efforts

These data gathering efforts uncovered the evidence that road traffic injuries were a leading problem in Iran. This has important implications for other countries. Improving the death registration system successfully demonstrated that police underestimates road traffic deaths. Researchers in other countries, where official government estimates of road traffic deaths are based on crime statistics, should investigate incidence based on health sector data, even if these are incomplete and/or of low quality. When population representative surveillance information cannot be derived from existing sources, time- and geographically-limited data collection can provide information to estimate incidence rates for policy planning. It is important to note that neither the Iranian Death Registration System nor the hospital data gathering covered the entire country. However their results successfully initiated a public debate about an important health problem. The question the country faces now is how to solve the problem. The remainder of this article focuses on explaining how Iran ended up with possibly the highest death rate in the world and describing the path to safe mobility.

Why did RTIs in Iran increase to such a large number

Geopolitical characteristics of the country

Iran has a unique geo-political and social history that has contributed to the uncontrolled growth of road traffic injuries. These have resulted in broad structural problems in the transportation sector that impact the economy and the well-being of the population in multiple ways. Although these are the primary drivers of high road traffic injury rates, road safety is never explicitly discussed vis-à-vis these issues.

Iran has a young population which can be a risk factor for more exposure to road traffic injuries. Iranian "2006 population and housing Census" shows that 68% of the country's population age between 15 and 64 years old.[7] The median of the age distribution of the country has been moving slowly from 16.6 years in 1966 up to 23.1 years 40 years later while the ratio of urban to rural areas has been doubled in the recent 5 decades and reached to urban occupancy of 68.5% of total population.[7–8] Also, unemployment was reported by 12.7% of the population.[7] According to the 2006 census, the population density noticeably varies across different provinces. The highest densities are in Tehran Province with 713 people/km^2 and Guilan Province with 171 people/km^2 are those with the highest densities and south Khorasan Province and Semnan Province with 7 people/km^2 , and 6 people/km^2, respectively have the lowest densities in the country.

The paradox of gas subsidy

Consider first, the role of cheap and abundant gasoline supply in Iran. Gasoline consumption far exceeds gasoline production in the country[9] and has been rapidly increasing in the last decade (Figure 2). Nevertheless, the government continued to hold the price artificially low (approximately, 0.1USD/liter or 0.4 USD/gallon) via a gasoline subsidy amounting to 40 billion USD annually until very recent rise in gas price in 2007. After Venezuela and Turkmenistan, Iran has had the lowest gas price in the world. In 2004, gas was sold at a price 10 times less than what government pays to produce or import it.[10] As it is evident from Figure 2 the production of gasoline is going way above its consumption after 2000 with a trend which is parallel to the trend of increasing car and motorcycle production in Iran (Figure 3).

In 2006, 38% of government subsidy budget was spent on gas.[11] Along with low car insurance fees and relatively low repair costs, cheap gas makes the maintenance car and motorcycle expenses be affordable for most people. There is a

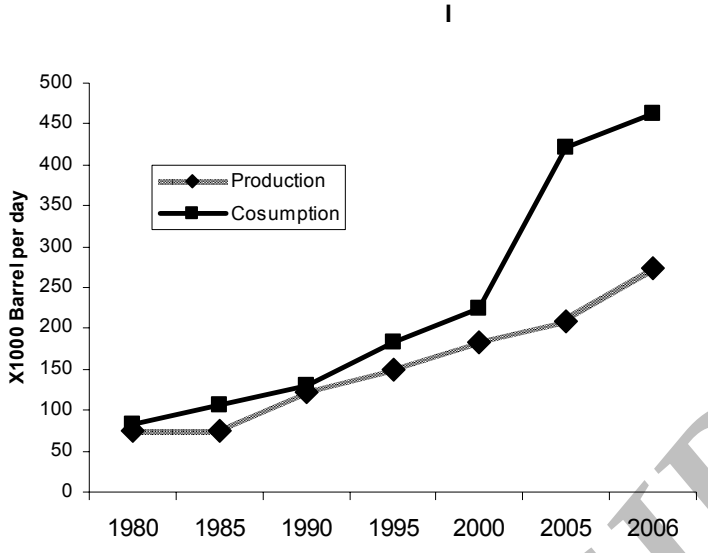

Figure 2. Gas production and consumption in Iran from 1980 to 2006 [9]

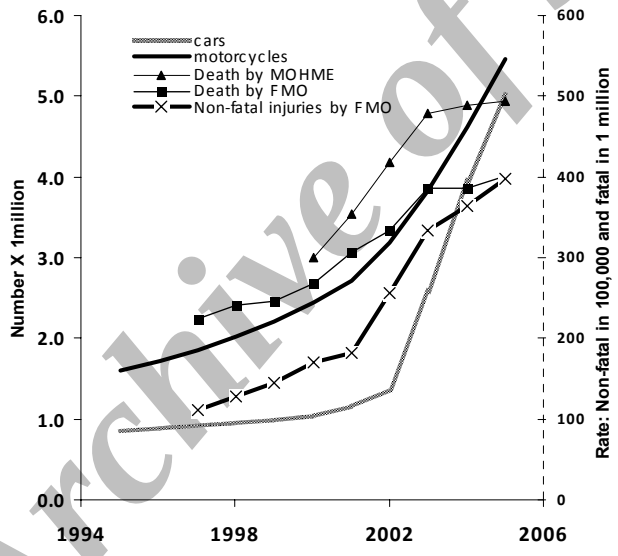

Figure 3. Time trend of 1) number of registered vehicles, 2) road injuries, and 3) road traffic deaths from 1995 through 2005; ***Source:*** Death: Death Registry System by the Ministry of Health and Medical Education[6] and Forensic Medicine Organization (FMO),[30] and number of vehicles: Statistical Center of Iran.[24]

vast transportation economics literature on the response of motorists to fuel prices showing that maintaining depressed fuel prices in the long run leads to substantially increased travel.[12] This artificially increased travel and gasoline consumption has had a wide range of negative impacts. Some of these are local effects—such as poor air quality and excessive traffic congestion in the metropolitan centers,[13] others have international ramifications, such as global climate change and wars resulting from countries trying to secure future oil resources. Although these issues dominate policy discussions about gas prices, high road traffic injury rates are another direct result of the increased exposure to a risk environment caused by the resulting increased travel. This effect is well documented. For instance, in the US recent short-run price increases have lead to a decline in road traffic deaths[14] while the long-run cheap gasoline in the US (compared with other OECD countries) has resulted in the US having higher road traffic injury rates than other high income

countries. Besides the direct impact of cheap gasoline on travel exposure, the gasoline subsidy has had various indirect effects on road safety. The large subsidy is not pro-poor because it favors private motor vehicle use. Thus, in 2000, the highest income decile of the population received 78 times more gasoline subsidies than the lowest income decile.[15]

Public transportation in Iran: a failure

In Iran, relative to other sectors, transportation sector is much more developed. It contributes in 10% of the Gross Domestic Products (GDP) of the country that comparatively higher than that of most other countries.[16,17] In 2006, the country had 103 km road per 100,000 population from which two km was expressway, 39 km was highway asphalt road, 54 km asphalt local road , and 7 km was non-asphalt road.[7,18] Provinces with higher densities had lower share of roads. Over a decade from 1997 through 2006 average life span of the public transportation vehicle fleet was 20.4 years for heavy trucks, 16 years for buses, and 20 years for minibuses on inter-city or inter-village roads. Overall, transportation of goods via railroad was lower than that of road.[19] Non-formal and unregulated passenger transportation by private vehicles is a completely well known route of transportation in many big cities in Iran. Passenger transfer is the second job of many employed people and also the first job of many unemployed people. Unfortunately, there is not any useful information on the magnitude and quality of the non-formal type of passenger transport in Iran.

Inter-city public transportation shows no growth in a 10-year period from 1997 through 2006. It was shown in 2008 that the fraction of public transportation in the country was only 7.1% of total[19] (Figure 4). The down-warding trend of inter-city transportation can be due to both increasing number of non-formal passenger carriers and escalating private car use by people. Of note, buses and most of the minibuses are being regulated by public transportation regulations. There is no doubt that enforcing safety rules to control non-formal passenger carriers is much harder than keeping the formal carriers (mainly buses and mini-buses) under control. Low benefit of the public transportation has made the public vehicle fleet completely outworn. In the last decade the average age of half of the intercity public passenger transport vehicle fleet has been around 16 years. Even worse, this average for minibuses that transfer passengers mainly between small cities and villages is 20 years.[20] Public passenger transport within the metropolitan cities like Tehran has not been a predominant mode of transport. In 2003 in Tehran, public passenger transport shares lower 57% of total passenger transport.[20] Figure 5 clearly shows the trend of production of buses and minibuses, as a fraction of total car production over three decades. Looking at Figure 4 and Figure 5 together reveals that over the period of prosperous auto market, i.e., 1995

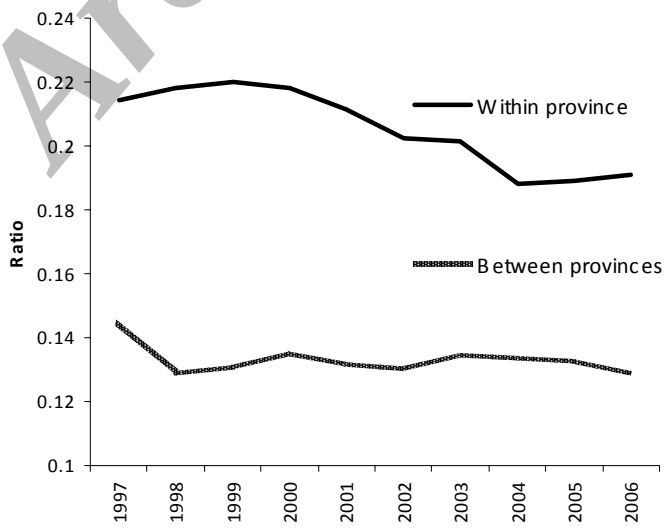

Figure 4. Fraction of population traveled within and between provinces; ***Source:*** SCI.[24]

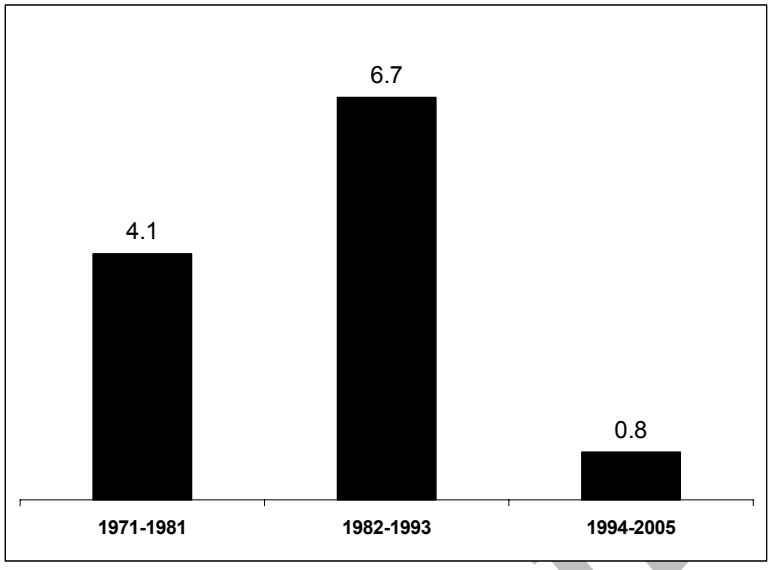

Figure 5. Percentage of buses/minibuses of total vehicles in the last three decades. ***Source:*** Reconciled from information on IDRO's website[22] note that motorcycles have not been included in the denominator.

onward, production of publicly used vehicles has been getting little attention.

Diesel gas gets a heavy subsidy in the country and currently the travel cost by a public bus for example in Tehran equals $ 0.05 per trip in 2006 (8000 Rials equaled one US dollar).[16] Despite the fact that public transportation is very cheap, it has already lost its attraction to people who tend to get to their destinations faster, and by people who care about low level of convenience of buses and minibuses.

As in other countries, the poor in Iran travel primarily by public transport, which remains under-resourced and thus, unreliable. Crowded buses and subways with unreliable and infrequent schedule are not attractive even to the poor encouraging a mode-shift to motorized two wheelers. The neglect of public transport has profound road safety implications. Mass transit systems can be much safer than private modes in general. Buses, because of their increased mass and size, offer much greater protection to occupants than cars and motorcycles. In fact, the shifting urban travel pattern from buses to motorcycles represent a transition from one of the safest road transport vehicle to one of the riskiest. Similarly, inter-city rail travel and urban metro travel are much safer than road travel.[21]

Rapid increase of vehicle manufacturing

Closely linked with the oil and gas economy, is the growth of the Iranian automobile industry, which is already the largest automobile industry in the region and the fastest growing industry in Iran. The time trend of car and motorcycle production is shown in Figure 5. As it is evident from this graph, after the year 1994 the car and motorcycle production started to go up and got accelerated after 2002. This giant industry accounts for 4% of Iran's GDP. The total product of this industry is over one million cars and 1.5 million motorcycles. Over 0.5 million people are working in 25 car producing companies and 1200 factories producing auto parts. These companies import main parts mainly from European and Asian countries paying a very low custom tariff. The accessory parts are mainly produced domestically. These companies assemble the parts and sell their products at a higher price than that of the original foreign car producer. People have to pay a very high custom tariff to import foreign made vehicles themselves. This set up has been paving the road for producing more and more vehicles in the country.[22] People's demand for car or motorcycle is the main drive of the auto market production.

Figure 5 shows that the upward trend of car and motorcycle production is accompanied with a concomitant growth in road traffic injuries and deaths. A similar process was witnessed in many OECD countries in the first half of the 20th century. However, governments in these countries acted to enforce regulations that made the automobile industry build safer vehicles.[23] Rampant growth in the Iranian auto industry has happened without similar controls. The most significant increment in car and motorcycle production can be seen after

1994 which coincides with the end of the Iraq-Iran war and the start of construction period. Car production companies set new assembly lines. They also imported different makes and models of car mainly from Europe, Japan, and South Korea. Before 1994 Iran had only two companies producing motor cycles. In 2000, more than 30 registered companies were manufacturing or importing motorcycles.[24] The demand for passenger transporting by motorcycle in big cities such as Tehran has been increasing lately as unemployment rate has been on the rise. Figure 6 indicates an uneven distribution of cars and motorcycles between rural and urban dwellers. It seems reasonable to assume that the higher DALYs of RTI in rural areas (2,115 years per 100,000 population) comparing to that of urban areas (1,744) is because of more usage of unsafe motorcycles.

Safety equipments of vehicles and unsafe motorcycles

Where safety technology exists, enforcement and usage is lax. In 2001, the government passed a rule requiring seat belt use on city roads, which was subsequently extended to all roads. Similar laws requiring helmet use were also passed. In 2005, a national survey on risk factors of non-communicable diseases was done in Iran. According to this survey, when sitting on front seats, 61.4% of population 15 years old and above reported they fastened the seatbelt. Helmet use was reported from only 7.3% of motorcyclists.[25] It seems that the proportion of motorcyclist wearing helmet differs from across different cities. Compared with helmet use, the law of compulsory use of seat belt is more followed by car drivers and passengers across the country. Most cars and motorcycles on roads are not equipped with adequate safety measures. Although the law requires cars sold after 1999 to be equipped with a standard seat belts, 40% of cars in motion were produced before 1999 and are equipped with either non-standard seat belts or do not have a seat belt at all. According to the official statistics, only seven of 39 existing car types (<6% of the cars produced) are equipped with driver-side airbags and Anti-lock Braking System (ABS).[13,26]

As we emphasized earlier motorcycles pose a special threat. Figure 1 illustrates the enormous contribution of motorcycles in fatal and more significantly non-fatal road traffic injuries. From Figure 7 it is evident that motorcycle crashes happen most often on roads inside the cities followed by rural roads. Almost none of million motorcycles in motion have standard safety measures like leg guards. Villagers own 2 million motorcycles[7] and drive them on unsafe roads that are mainly uncovered by police patrolling. Also only less than half of drivers of about 5 million motorcycles have driver's license.[22,26] More than 80% of roads are not wide enough to be two-way but they are. More than 40% of mortality of car occupants or motorcyclists happen on the crash site. Another 20% of the victims die in the first few hours following the crash. This is highly likely due

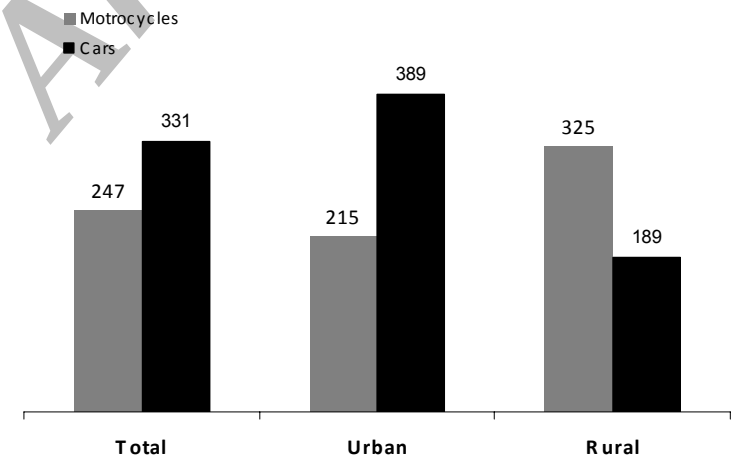

Figure 6. Number of motorcycles and cars per 1000 households in urban and rural areas of Iran in 2006, ***Source:*** SCI.[24]

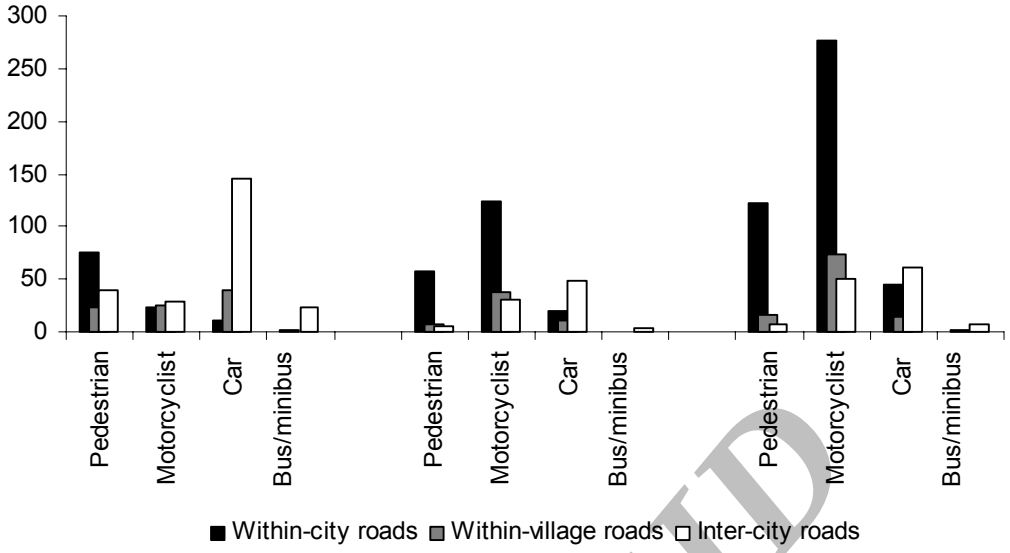

Figure 7. External causes of road injuries by type of road-Left: Death, Middle: Hospital inpatient cases, Right: Hospital outpatient cases; (events in one million population); ***Source:*** Hospital registration of injuries in 12 provinces.[13]

to high speed of vehicles in typical narrow roads.[27] Unfortunately, demand for buying motorcycles by low-income people has been very high in the recent decade. Low-income people use cheap motorcycle as a means of making money by carrying passengers in big cities like Tehran. They also use motorcycle to carry their goods out of their workplace. In response to this high demand motorcycle producers/dealers help customers finance their purchase which probably induces more demand for motorcycles.

Our key message in this section has been that road traffic injury is an outcome of rampant uncontrolled motorization driven by private industry forces. In fact these strong economic interests have been a primary driver of transport policy in Iran and have ignored the public interest of safe mobility. Providing safety by regulating industry and providing safe infrastructure has to be the responsibility of the government.

The path to road safety

Iran is not the first country to have experienced a rapidly rising road traffic injury problem. Most currently high-income-countries experienced a similar increase prior to 1970s. However, starting in the 1970s these countries took a series of actions that reversed this rising trend. Iran needs to follow this example by taking a systems approach to road safety that comprehensively addresses all aspects of the transportation system that result in injuries.

In this paper we did not aim to discuss a conceptual model of road safety and provide advice how the country can tackle the problem of huge number of years lost due to road traffic accidents. There are a wide variety of interventions that focus on ensuring that the people who are exposed to traffic are able to use the man-machine transport system safely.[28] We agree with road traffic safety experts that in order to get a handle on the road traffic injuries countries need to keep reinforcing traffic safety regulations, build more public health infrastructure, and increase people's access to health services and control the growth of motorized vehicles.[29] But, for Iran our particular emphasis is on directing the car industry toward making fewer but safer cars and motorcycles. This cannot be an easy undertaking though. Replacing low-cost car/motorcycle insurance with a high quality but pricy obligatory insurance, tackling the paradox of artificially priced gas, restricting inter/within-city and inter-village passenger/good transfer via motorcycles, and increasing the vehicle fleet of public transportation and making them look more attractive are policies that if implemented correctly, can encourage people to use public transportation more than using private vehicles.

The systems approach to road safety requires collaboration of a wide range of stakeholders and a multi-dimensional approach that encompasses education, enforcement, highway design, vehicle design, and medical care. We believe the most effective way of reducing the burden of road traffic

injuries is to balance the car/motorcycle production with the capacity of escalating all the other classic interventions.

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