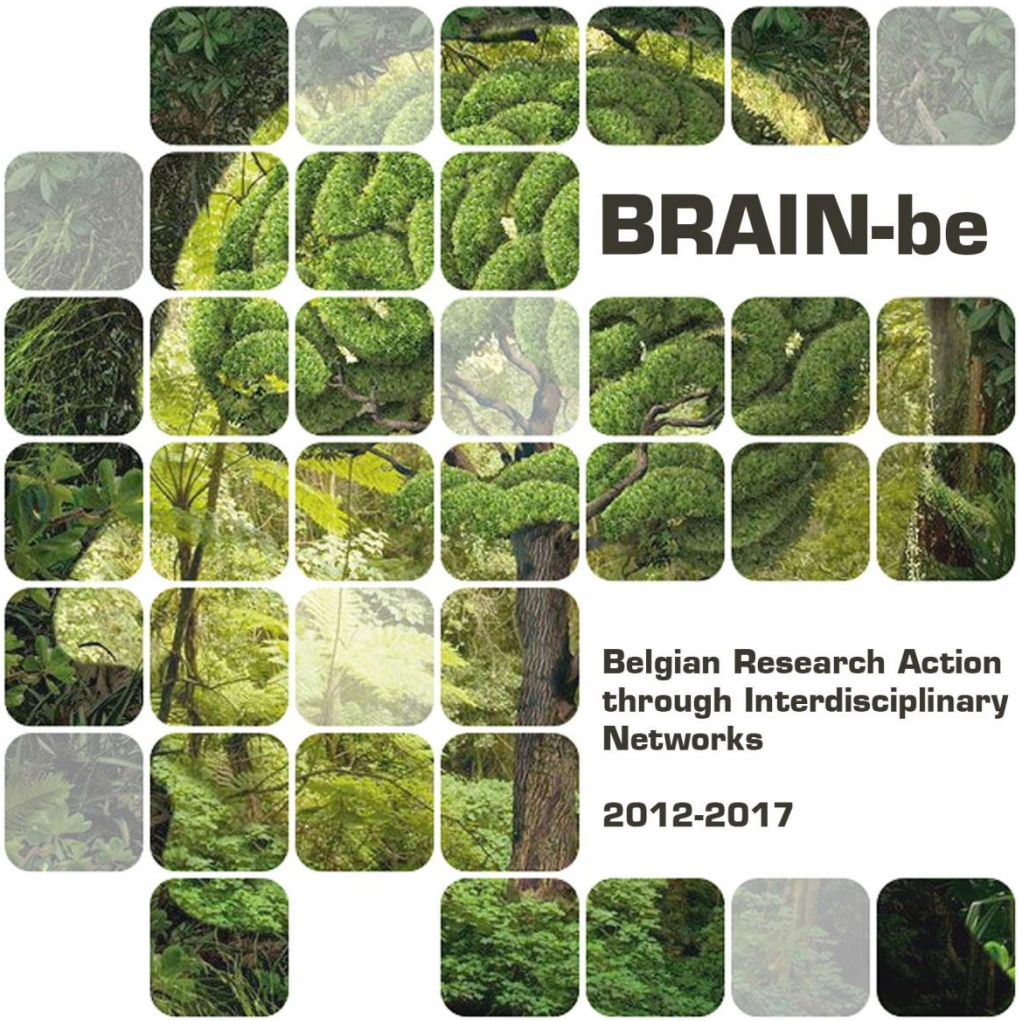

INTRAS

Inequalities in Traffic Safety

DELIVERABLE 1: Literature review & conceptual framework

Karin VAN VLIERDEN (IMOB) – Kris BRIJS (IMOB) – Stijn DANIELS (IMOB)

belspo .be

NETWORK PROJECT

INTRAS

Inequalities in Traffic Safety

Contract - BR/121/A5/INTRAS

DELIVERABLE 1: Literature review & conceptual framework

PROMOTORS: Kris BRIJS (IMOB)
Mario COOLS (ULg)
Peter SILVERANS (BIVV)

AUTHORS: Karin VAN VLIERDEN (IMOB)
Kris BRIJS (IMOB)
Stijn DANIELS (IMOB)

Karin VAN VLIERDEN, Kris BRIJS, Stijn DANIELS. ***INTRAS DELIVERABLE 1: Literature review & conceptual framework***. Brussels : Belgian Science Policy 2017 – 93 p. (BRAIN-be - (Belgian Research Action through Interdisciplinary Networks)

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INTRODUCTION

This report aims to provide a conceptual framework for research about inequality in traffic safety, in particular inequality in traffic safety for different socioeconomic and cultural groups.

The framework is first of all built on definitions of concepts concerning culture and socioeconomic characteristics and on the elaboration or measurement of these concepts in research. As a next step, determinants and mechanisms in the broader field of health and health inequalities are described. Finally, these determinants and mechanisms are used as a basis for similar determinants and mechanisms in traffic safety. The report ends with examples of models that are useful to investigate and explain inequality in traffic safety.

The literature search and selection followed an informal, rather inductive method, with some basic references (e.g. Laflamme, Burrows & Hasselberg, 2009; Factor, Mahalel & Yair, 2007; Steinbach et al., 2010) as a starting point. It ended the moment that the framework seemed solid and meaningful. We did not intend to give a complete overview of the literature available in the field of cultural and socioeconomic differences in health or traffic safety.

CULTURAL AND SOCIOECONOMIC DIFFERENCES IN TRAFFIC SAFETY

Across nations worldwide, we can see differences in the number of road traffic accidents occurring and in traffic safety outcomes. Some examples: Atchley, Shi and Yamamoto (2014) compared the number of registered vehicles and reported crashes, injuries and fatalities for China, Japan and the United States from 1990 to 2010. They found large differences between the three countries in for instance fatality rates per 100.000 vehicles. Hyder and Peden (2003) point to the fact that 90% of deaths related to road-traffic injury occur in low-income and middle-income developing countries, with the highest absolute numbers of deaths in Asia and the highest death rates in Africa. The high number of road accident fatalities and injuries in developing countries are also mentioned elsewhere (e.g. Nordfjærn, Jørgensen & Rundmo, 2012; Lund & Rundmo, 2009; Vasconcellos, 1999). Özkan et al. (2006) set up their study departing from the higher occurrence of fatal accidents in Southern (Greece and Turkey) than in Western/Northern Europe (Finland, the Netherlands, Great Britain). And to conclude, compared to European countries and USA, Arab Gulf countries have a very high road accident fatality rate (Bener, Özkan & Lajunen, 2008).

International statistics show that cultural and socioeconomic differences partly explain the number of road traffic accidents occurring in different countries (Leviäkangas, 1998). To explain the higher accident involvement in developing countries for instance: these countries face rapid urbanization and motorization with higher speeds and a diverse vehicle mix on the roads (Hyder & Peden, 2003), but physical road infrastructure, vehicle standards and enforcement of road traffic regulations are not always adapted at the same pace (Racioppi et al., 2004). On the other hand, explanations are found in cultural differences between the countries. Cultural traditions within countries have an effect on safety behaviors (Bener & Crundall, 2005) and may accordingly have relevance for the variability in accident frequencies (Nordfjærn, Jørgensen & Rundmo, 2012).

Cultural and socioeconomic factors do not only produce differences in accident involvement between countries, they also seem to play a role in differences in accident involvement within countries. A large amount of literature points to the different road accident involvement for different cultural groups within countries. This research often concentrates on ethnic minorities in a country.

- Christie (1995) found a clear over-representation of children from a 'non-white' ethnic origin in the group of accident involved children that she studied in the United Kingdom.
- Over the period July 1 1985 until December 1 1989, Junger and Steehouwer (1990) found large differences in the number of traffic accidents between ethnic groups of pedestrians or cyclists from 2-12 years old in the Hague (the Netherlands). Moroccan and Turkish children were more often than Dutch children hit by a car; Surinamese children were less often or at the same rate as Dutch children victim of a collision. These differences persisted looking at separate districts. Turkish and Moroccan children were also younger when involved in an accident. Moroccan, Turkish and Surinamese children were more often involved in an accident as pedestrian, the accident occurred more frequently while playing and these children were more often injured compared to Dutch children.

- In almost all countries where data are available, children of ethnic minority background do suffer substantially increased risk of pedestrian injury relative to the norms for the country as a whole. The trend is truly international and applies to countries as diverse as the United States, Sweden, Israel, Singapore and New Zealand (Thomson, Tolmie & Mamoon, 2001).
- Only Hjern and Bremberg (2002) found parental ethnicity (maternal country of birth) to be of relatively little importance for road traffic injuries in children and youth in Sweden.
- Factor, Mahalel and Yair (2008) found the accident involvement probability in Israel to be higher for non-Jews than Jews, and for Jewish drivers of African and Asian origin than of American and European origin.
- Same results in the study of Moran, Baron-Epel and Assi (2010). They found Arab drivers in Israel involved in road accidents three times more than Jewish drivers, even after controlling for distance travelled as an indicator of exposure.
- On the contrary, Gofin et al. (2002), who studied injury inequalities for 0-17 year olds in Israel, found that the incidence of emergency room admissions was 1.5 times higher among the Jews than among the Arabs. For the specific cause of traffic accidents, this rate was 1.2. However, the rate of hospitalization and the mortality rate were higher among Arabs than among Jews.
- In Finland, the accident rates of foreign drivers (mainly Russians) are radically higher than the corresponding rates of Finnish drivers (Leviäkangas, 1998).
- In Canada, Redelmeier et al. (2011) got somewhat opposite results. They found the crash frequency per 100,000 individuals significantly lower among recent immigrants than long-term residents (except for pedestrian accidents). This pattern persisted after adjustment for baseline characteristics (age, socioeconomic status, home location, gender, medical diagnosis, total physician visits) and was apparent across a range of crash types. It was most evident during initial years following immigration and attenuated slowly thereafter.
- Stirbu et al. (2006) found ethnic minorities in the Netherlands at higher mortality risk compared to the native Dutch population for pedestrian accidents and for car driver and passenger accidents. Mortality risk among cyclists and motorcycle drivers, in comparison, was significantly lower for ethnic minorities.
- Campos-Outcalt et al. (2003) compared rates of motor vehicle crash fatalities among different ethnic groups in urban and rural Arizona (USA). They found that the only ethnic group to have consistently higher rates of motor vehicle crash fatality was American Indians. In comparison with non-Hispanic whites, Hispanics had significantly lower rates except for urban males. African American males had slightly higher rates in urban areas but lower rates in rural areas; African American females had rates similar to non-Hispanic whites. In a preceding study, the same authors (Campos-Outcalt et al., 2002) looked at pedestrian fatalities in the state of Arizona and how rates and circumstances differ by ethnicity, rural or urban residence and gender. Here also, American Indians had markedly higher rates of pedestrian fatalities than other ethnic groups. Higher American Indian rates were found in all age groups, both genders and in both urban and rural areas. In urban areas, a high proportion of American Indian pedestrian deaths occurred on weekends. Other ethnic subgroups (urban Hispanic males, rural Hispanic females and African American urban females) had elevated pedestrian death rates compared to non-Hispanic whites, but their risk ratios were much lower than American Indians' and the elevated rates occurred in only a few age groups.

- In Singapore, significant differences were found in injury severity levels for motorcyclists of different nationalities (Quddus, Noland & Chin, 2002). A large number of commuters from Malaysia enter Singapore on motorcycles. Non-Singaporeans have more severe injuries. Singaporeans have about a 36.3% smaller probability of dying in accidents, relative to other nationalities.
- An Australian report (Henley & Harrison, 2013) looked at death and serious injury of Aboriginal and Torres Strait Islander people due to transport accidents in the five-year period 2005-06 to 2009-10. The age-standardized rate for land-transport injury for Aboriginal and Torres Strait Islander people was 2.8 times the rate for other Australians for fatal cases and 1.3 times the rate for other Australians for serious injuries. Aboriginal and Torres Strait Islander people who were fatally or seriously injured in land transport accidents were less likely to have been drivers and more likely to have been passengers and pedestrians than other Australians. Serious injury rates for Aboriginal and Torres Strait Islander people rose over the five-year period (2.3% per year), while serious injury rates for other Australians declined in the same period (1.1% per year).
- Dobson et al. (1999), who investigated women drivers' behavior, socio-demographic characteristics and accidents in Australia, found that women born in a non-English speaking country (born overseas) had a significantly higher risk of accidents, compared with women born in Australia. They did not, however, report higher levels of lapses, errors, violations or speeding.
- Schopflocher et al. (1998 – cited in Rothe & Elgert, 2003) demonstrated that in Canada, when weather, travel exposure and highway geometry are controlled for, citizens from Alberta's six northern regional health authorities have a significant higher death rate due to motor vehicle crashes than do people from other regional health administration sectors in the province.

Socioeconomic differences in accident involvement are present in the literature to the same degree as cultural differences.

- Laflamme and Diderichsen (2000) reviewed the scientific literature concerning social differences in traffic injuries in childhood. They mentioned two different designs that were employed. Some studies grouped geographic areas by socioeconomic status and compared injury rates across socioeconomic groups. Other studies grouped areas by level of injury risk and compared socioeconomic characteristics across risk levels. The findings of the reviewed literature suggest that injury risks increase with socioeconomic deprivation.
- Borrell et al. (2005) studied the differential distribution of traffic injury mortality by educational level in nine European settings – including Belgium – among people older than 30 years during the 1990s. They found higher death rates in all settings for men with a low educational level. On the contrary, female traffic injury mortality showed no inequalities in the majority of settings. In Belgium, women with a lower educational level and of the youngest age group however showed an increase in traffic injury mortality. In a preceding study (Borrell et al., 2002) in Barcelona, the same link between educational levels and traffic injuries was found.
- Chen et al. (2010) found a higher risk of crash-related hospitalization for young drivers from low socioeconomic status areas in New South Wales, Australia. This higher risk was independent of driving exposure and rural-urban differences.

- Whitlock et al. (2003) investigated in New Zealand the association of socioeconomic status with motor vehicle driver injury. The association between injury and occupational status was strong, with participants in the lowest occupational status group being four times as likely to have experienced a driver injury during follow up as participants in the highest group. The association with educational level appeared to be weaker, with those participants who had been to secondary school for less than two years being twice as likely to have experienced a driver injury during follow up as those who had been to university or polytechnic. By contrast, there was little evidence of an association between driver injury risk and neighborhood income.
- Children (0-15 years) from the lowest socioeconomic group in the United Kingdom are more than 4 times more likely to be killed as pedestrians than their counterparts in the highest socioeconomic group (Townsend & Davidson, 1982 – cited in Christie, 1995).
- In Israel, Factor, Mahalel and Yair (2008) investigated the accident involvement of participants over 16 years old who had a driving license. They found an association between drivers' socioeconomic status and involvement in road accidents: the more education and the higher a driver's socioeconomic status, the lower was the probability of involvement in a severe or fatal accident.
- There are differences in road traffic injuries during childhood and youth between socioeconomic groups in Sweden, and this applies to pedestrians, cyclists, moped riders, motorcyclists and car drivers (Hasselberg, Laflamme & Ringback Weitoft, 2001; Laflamme & Engström, 2002). The injury risk of children of lower socioeconomic groups is higher than that of intermediate and high social groups. Socioeconomic injury risk differentials increase when young people drive motorized vehicles.
- Hasselberg, Vaez and Laflamme (2005) reported that in Sweden both consequences and circumstances of road-traffic crashes are unequally distributed across young adult car drivers according to socioeconomic position. They divided the participants according to socioeconomic position of origin (based on that of the parents) and according to socioeconomic position of destination (based on own educational attainment). The results were evident in the case of socioeconomic position of origin, and even more so for socioeconomic position of destination. Drivers with low educational attainment were at greater risk of severe injuries, and showed excess risks of crashes of all kinds.
- Hasselberg and Laflamme (2004) investigated the social risk distribution for traffic injuries among Swedish children aged 1-14 as pedestrians, bicyclists and car passengers. They used three measures of socioeconomic position: social class, education and disposable income. Compared to children from intermediate and high-level salaried employees, the children at greater risk of pedestrian injuries were those of unskilled workers and those of parents in the unspecified group (e.g. students, housewives, persons on sickness and disability pensions, long-term unemployed). Bicycle-related injuries were overrepresented among all groups with the exception of the self-employed and farmers. Injuries as car passengers were overrepresented among all groups with the exception of the children of skilled workers. Children of parents with a relatively low education showed higher risks of injury as pedestrians, bicyclists and car passengers than children with relatively highly educated parents. Likewise, low disposable income in the family increased the risk of injury in all categories of road users.

- Similar results were found in an extensive review of research articles of road traffic injuries (Laflamme, Burrows & Hasselberg, 2009). Low socioeconomic position at the area or individual level seems to increase the risk of being injured in traffic.
- Zambon and Hasselberg (2006) examined whether there were socioeconomic differences among young motorcycle drivers (aged 16-25) involved in road-traffic injuries in Sweden, with regard to age and injury severity. They found that low socioeconomic positions increased the likelihood of getting injured in a crash – a pattern that was the same for both minor and severe injuries – without giving rise to a higher risk of severe outcomes. Socioeconomic differences were observable for both minor and severe injuries, but did not increase with level of severity.
- In France, Lenguerrand et al. (2008) obtained somewhat deviating results. In their study, managers were more involved in crashes than unskilled workers and there was no statistical difference between the road crash involvement of skilled and unskilled workers. But the results are not relevant for subjects with certain professional status (farmers, the self-employed and company directors) or for professional drivers, because these subjects are not present in the companies from which the participants were recruited (the French national electricity and gas companies Electricité de France and Gaz France). Moreover, the calculated risks relate to specific age categories (between 49 and 64 for males, between 54 and 64 for females) and the fact that subjects were drawn from the same companies results in the same lifestyles and the same access to the health system. In order to properly explore the effects of social position on the road safety of adult road users, information gathered among the whole road population is preferable.
- Motor vehicle accidents represented a greater risk of death among men from least privileged socioeconomic level than among men from most privileged socioeconomic level in three cities in Spain (Nolasco et al., 2009). However, the risk ratio of death was only statistically significant in 2 of the cities. And for women, an inconsistent pattern was found.
- Hippisley-Cox et al. (2002) examined hospital admission data for injury from 1992 until 1997 for children aged 0-14 years in Trent Region (UK). They found for wards with the highest deprivation scores a much higher rate of pedestrian injuries, burns, scalds and poisoning than for the wards with the lowest deprivation scores.
- In Sweden, parental socioeconomic status (occupation of head of household) is a strong determinant of road traffic injuries in children and youth (Hjern & Bremberg, 2002).

Socioeconomic characteristics and ethnicity also seem to influence the types of accident people have.

- Factor, Yair and Mahalel (2010) explored the homology between drivers' social characteristics (economic and educational capital) and their involvement in specific types of motor vehicle accident. Their research shows that different social groups indeed tend to be involved in motor vehicle accidents of different types and severity.
- In the study of Hasselberg, Vaez and Laflamme (2005) the greatest socioeconomic differences were found for overtaking or front-on collisions and for single-vehicle crashes (also the ones with higher crash morbidity ratios). For

other types of crashes the differences between socioeconomic groups were smaller.

- Norris, Matthews and Riad (2000) found that black respondents (drivers aged 19-88) in the USA were no more likely than white respondents to have accidents, but when they did, they tended to have accidents that were more severe. In contrast, respondents with post-secondary educations had marginally more motor vehicle accidents but fewer of these were serious. With reference to situational variables, they found an increased risk for minor accidents rather than serious accidents among participants who were residents of larger cities, who were employed, and who had lived at their current addresses less than 5 years. A different pattern was observed for financial stress. In this case, economically secure persons not only had fewer motor vehicle accidents but the ones they had were less serious than those of persons who had financial concerns.

Based on the above mentioned literature, we can conclude that it has been demonstrated that lower socioeconomic groups and ethnic minorities are often significantly overrepresented in traffic accidents. But the factors associated with the elevated risks are only poorly documented. The World Health Organization (WHO) (Laflamme, Burrows & Hasselberg, 2009) ended its review on socioeconomic differences in injury risk (not only traffic injuries) with the thesis that the distribution of explanatory risk factors and protective factors across socioeconomic groups has been studied to a limited extent and that the literature consequently remains silent regarding the nature of the mechanisms lying behind socioeconomic differences in injury mortality and morbidity. The authors also mentioned that the socioeconomic patterning of injuries can be influenced by a variety of mechanisms and that mortality and morbidity differentials across people from different socioeconomic backgrounds are a reflection not only of individual mechanisms but also of contextual ones. All this also applies to the cultural differences that are found.

In this report, we bring together relevant research about the mechanisms that could explain the differences in road accident involvement. To do so, we broadened the scope from traffic safety not only to different kinds of injuries (what the WHO also did) but to the health research literature in general. Although several studies have shown that injuries are among the causes of illness and death which are most related with social and economic determinants (Ferrando et al. 2005), there are also socioeconomic and cultural differences in prevention and cure of diseases, food-safety, environmental risks and so on. The roots for all these differences might well be the same. As suggested by Hyder and Peden (2003): documenting differences in health status between socioeconomic groups and exploring relations with poverty allow for a better understanding of the determinants of road-traffic injuries and a more directed approach to solutions.

Culture, socioeconomic status and health are often vague but at the same time comprehensive concepts that need elaboration to be useful in research and models. Highlighting them in the first chapters (Chapter 1-4), we will at the same time clarify a lot of terms used in the literature (e.g. deprivation, ethnicity, traffic culture, gradient in health…) and try to find out how some of them can be operationalised in research. At the end of the health chapter (Chapter 4) the concepts will finally be assembled in a model of mechanisms underlying differences in health. In the last chapter (Chapter 5), we will implement the reasoning of the health chapter in the field of traffic safety, search for

mechanisms of differences in that field and take a look at several accident models which are rooted in the preceding concepts and model chapters.

1. CULTURE

1.1. Definitions

1.1.1. Culture

Culture is the blended patterns of human behavior that include language, thoughts, communications, actions, customs, beliefs, values and institutions of racial, ethnic, religious or social groups (Centers for Disease Control and Prevention).

Culture is the collective programming of the mind that distinguishes the members of one group or category of people from others (Hofstede, Hofstede & Minkov, 2010 – cited in Duan, 2012).

Culture has been defined by Bealer, Willits and Kuvlesky (1965 – cited in Ward, 2007) as the belief (value) structure, shared ideals and directives for action that are embodied by a community.

The above definitions emphasize two aspects of culture. First the fact that it concerns groups or communities that are distinct from each other. The distinction can be racial or ethnic, religious, social. Second the nature of the differences, going from language and communications, over actions and customs, to the inner belief structure that programs the mind.

Schwartz (2006) views the prevailing values in a society as the most central feature of culture. These values express shared conceptions of what is good and desirable in the culture, the cultural ideals. Cultural values shape and justify individual and group beliefs, actions and goals. Institutional arrangements and policies, norms and everyday practices express underlying cultural values in societies. For example, a cultural value emphasis on success and ambition may be reflected in and promote highly competitive economic systems, confrontational legal systems and child-rearing practices that pressure children to achieve. Because prevailing cultural value orientations represent ideals, aspects of culture that are incompatible with them are likely to generate tension and to elicit criticism and pressure to change. The author also stresses that cultures are not fully coherent. In addition to a dominant culture, subgroups within societies espouse conflicting values. The dominant cultural orientation changes in response to shifting power relations among these subgroups. Finally, Schwartz mentions societal adaptation to epidemics, technological advances, increasing wealth, contact with other cultures and other exogenous factors leading to changes in cultural values.

To explain culture's mutability, it must be seen as a dynamic process of interaction, reproducing meaning and patterns of behavior, not a static and predetermined entity containing them (Moeckli & Lee, 2007). In this opinion, culture is more than a set of values and beliefs that is implanted in the mind and guides behavior. It is the mechanism through which we come to understand ourselves and our relationship to the world. It is accounting for how groups identify themselves and interact with their environment through developing, building and using artifacts. People live in changing places and networks of relations that both create opportunities and limit options for how

they make sense of the world. The dynamic process of interaction involves diversity and social life with a fragmented character, instead of groups with ever coherent and unified identities or perspectives. In this respect Schwartz, Moeckli and Lee emphasize that culture is always an effect of power, because it is reproduced through social relations. They give the example of the American Mothers Against Drunk Driving (MADD) in the 1980's. This organization was able to transform the public perception and social practice through grassroots activism that incited the president to announce a Presidential Commission on Drunk Driving, to set aside federal highway funds for state-level anti-drunk driving initiatives, to enact state-level anti-drunk driving bills and pass the Federal 21 Minimum Drinking Age Law.

1.1.2. Ethnicity and ethnic minorities

For Towner et al. (2005) **ethnicity** refers to groups of people who share a relatively homogeneous culture through kinship and/or particular situations.

In the context of health it means a group that people belong to because of shared characteristics, including ancestral and geographical origins, cultural traditions and languages (Bhopal, 1997).

Culture and ethnicity are related but not identical terms. Culture is seen as a catch-all term for those aspects of lifestyle that might be shared within ethnic groups, while ethnicity is composed of 'objective' components such as nationality, skin color, country of origin of self and ancestors, religion (Steinbach et al., 2010).

Ethnicity based on origin is a narrow definition, in which it is almost equal to the concept race. Because of the negative connotation of race (according to Nazroo (1998) an artificial construct, used to justify the hierarchical ordering of groups of people and the exploitation of "inferior races") and the accompanying taboo surrounding research into race, this narrow definition has been questioned. A broader definition of ethnicity includes self-identification with the cultural traditions of the group, which provides strength and meaning (Nazroo, 1998). Ethnicity becomes an identity and underlying ethnic groups we find real collectivities, common and distinctive forms of thinking and behavior, of language, custom, religion and so on, in other words modes of being (Modood, 1996 – cited in Nazroo, 1998). In this sense, the distinction between culture and ethnicity gets more blurred. In some circumstances the identification of areas with their ethnic-minority residents can allow the development of strong community ties, enhance political influence and provide resistance to racist attacks, all of which could act to improve health outcomes (Smaje, 1996; Halpern & Nazroo, 2000 – cited in Davey Smith, 2000). Here ethnic concentration is important. Such concentration potentially acts as a buffer against prejudice and racism, provides role models, accords status to individuals for skills or knowledge not acknowledged outside the community, offers social and moral support and provides resources for the recreation of community (Ahmad & Bradby, 2007).

Ahmad and Bradby (2007) mention that positive and negative connotations of contemporary ethnicity persist anyway. Ethnicity can be a marker of identity, a vehicle for community mobilization but still also an indicator of disadvantage, discrimination or privilege.

Ethnic identity cannot be considered as fixed, because culture is not an autonomous and static feature in an individual's life. Cultural traditions are historically located, they occur within particular contexts and change over time, place and person, influenced by internal and external factors, locally and globally (Nazroo, 1998; Karlsen & Nazroo, 2002). In addition, ethnicity is only one element of identity. For example, gender and class are also important and in certain situations may be more important than ethnicity (Nazroo, 1998). The significance of ethnicity depends on the context within which the individual finds him/herself and it is also the context that restricts and affects the behavioral choices.

Thomson, Tolmie & Mamoon (2001) point to problems of defining **ethnic minorities** in a country. While populations who have recently migrated to a host country may easily be defined as ethnic minorities, definition is confused by the fact that the term is often ascribed to indigenous minorities as well. Thus the Maori of New Zealand are generally referred to as ethnic minorities. Non-indigenous but long-established groups (for example, the American black population) may also be considered minorities often by contrast to groups of much more recent arrival in the host country. The issue arises as to how the term ethnic minority should be defined; why it should be applied to some groups but not others; and at what point an ethnic minority becomes merely a facet of the majority culture. The authors state that there appear to be no universally accepted defining criteria, but that use of the term seems to reflect the extent to which a population's linguistic, cultural or religious profile differs from that of the majority culture. This may, of course, persist for many generations after immigration, or indeed indefinitely. The extent to which the population perceives itself to be distinct may also be a defining factor.

1.1.3. Acculturation

Acculturation is the process by which individuals exposed to a new culture acquire the traits of that new culture (Marin & Marin, 1991 – cited in Anderson et al., 1998). Commonly, the term is used to indicate the process by which a minority group acquires the traits of the dominant culture (Molina & Aguirre-Molina, 1994 – cited in Anderson et al., 1998).

While residency is distinct from acculturation, length of residency has frequently been used to validate measures of acculturation. Because language is the key to functioning in a new culture, it is the single most important indicator of acculturation, and the major focus of many measures of acculturation (Marin et al., 1987 – cited in Anderson et al., 1998). Transition in language use may correspond to other changes in attitudes, beliefs and behavior.

A geographic transition representing a move from one country to another presents a number of economic and psychological challenges to the family, as well as a new environment with different physical hazards (Anderson et al., 1998)

Hall (1992 – cited in Karlsen & Nazroo, 2002) explores the notion of a translation of culture, which occurs where people are obliged to come to terms with new cultures surrounding them, but also wish to retain strong links with their places of origin and associated traditions, and so form a new 'hybrid' identity with aspects of each.

Williams and Collins (1995) point at the possibility that several behaviors that adversely affect health status increase with acculturation, like decrease fiber consumption, decrease breast feeding, increased use of cigarettes and alcohol, driving under the influence of alcohol and the use of illicit drugs (Vega & Amaro, 1994 – cited in Williams & Collins, 1995). This way, immigrants lose health-enhancing factors of their traditional culture.

1.1.4. Road traffic culture

Culture can be considered on a macro level, as general cultural tendencies in a society, as well as on a micro level, related to a specific activity (Nordfjærn, Şimşekoğlu & Rundmo, 2014). Examples of such a micro level are (road) traffic culture and driving culture (which are often used interchangeably, because traffic culture is mostly applied to and often confined to driving).

Traffic culture (Leviäkangas, 1998) is the sum total of factors influencing the skills, attitudes and behavior of the drivers as well as vehicles. It is the result of both the larger cultural inheritage which is carried inside us and the present state of environment including economy, political climate, values respected etc. So important factors include the social environment, cultural traditions and the political context (Factor, Mahalel & Yair, 2007).

Driving culture is the social norms of driving, codes of driving behavior, which proliferate among drivers in a given environment (Factor, 2008; Zaidel, 1992 – both cited in Moran, Baron-Epel & Assi, 2010). This can vary even across cities in the same country. People who have lived in more than one city often comment that driver and pedestrian behavior varies markedly from one city to another (Robertson, 1983 – cited in Lund & Aarø, 2004).

On a larger scale, cultural forces also give form to driving safety by defining social norms regarding acceptable numbers of driving-related deaths and the amount of resources that should be devoted to driving safety research, regulation and enforcement (Moeckli & Lee, 2007).

The centre of the mechanism of traffic culture in a country or in a region consists of formal and informal rules, norms and values (Özkan, 2006). There is a set of formal rules, mostly applied and enforced by authorities, and education to familiarize with them. Legislation, engineering and educational systems are based on ecological factors (e.g. economy, geography), societal and cultural factors. Furthermore, road users share informal rules, norms and values as a result of exposure and interaction with other road users. These informal rules define the acceptable and necessary road user behaviors and performance, and also some choices of engineering practices. Once the legislation, engineering and educational systems are established, the societal norms and values and formal and informal rules will be reinforced and the boundaries of road user behaviors will be determined.

One important aspect of the above mentioned informal rules is that they must be transmitted, and imitative behavior provides a method for this transmission (Arthur, 2011). Looking at other drivers, drivers gather information as to what proper conduct is

and subsequently incorporate that into learned behavior. This way, the information becomes part of the beliefs, values and ideas people bring to the driver's seat each time they get behind the wheel. Many places and groups may have developed unique informal rules distinct to others, so we find definable driving cultures indigenous to different locations or driving populations (Moeckli & Lee, 2007). By the way, people not only gather information about what acceptable driving behavior is, but also about what constitutes risk and to which degree they can mitigate risk through the vehicles they drive. The perceived norms that influence the willingness to engage in risky behaviors or willingly choose best safety practice can be referred to as **safety culture** (Atchley, Shi & Yamamoto, 2014). **Risk perception**, or perceived risk, refers to a subjective assessment of the probability of a specified type of accident happening and how concerned people are with the consequences. To perceive risk includes evaluations of the probability as well as the consequences of a negative outcome (Sjöberg, Moen & Rundmo, 2004). The notion that people are more likely to behave cautiously when they perceive themselves as vulnerable to risks has received empirical support (e.g. Ulleberg & Rundmo, 2003).

Between and within countries, differences exist in the institutions that set the formal rules for traffic behavior. It is possible that different licensing and training criteria may play a role in differences in road crashes and injuries between nationalities (Quddus, Noland & Chin, 2002). Moran, Baron-Epel and Assi (2010) report that there are differences in traffic enforcement between Arab and Jewish communities in Israel. The police enter Arab villages and towns to enforce traffic laws infrequently, but they do enforce traffic laws in Jewish cities. In rural Arizona in the USA, the 22 Indian reservations have an autonomous legal status, each with separate traffic laws and differing levels of resources devoted to enforcement (Campos-Outcalt et al., 2003). In most low- and middle-income countries the police lack training to deal with traffic regulations and they often lack the resources to conduct the enforcement (World Bank, 2002 – cited in Nordfjærn, Şimşekoğlu & Rundmo, 2014). For instance enforcement of existing traffic laws by police and other agencies in Pakistan is weak and in general, confined to post-crash situations when damage has already been done (National Transport Research Center, 1989, 1990 – cited in Ghaffar, Hyder & Masud, 2004). Where law enforcement is more lenient, this can influence rates of speeding, seatbelt use, driving under the influence of alcohol etc.

One aspect of culture that is worth being highlighted, and may well be implied but is not explicitly mentioned in the above definitions of traffic culture, is language or communication. Klempe and Rundmo (2007) indicate several main categories of application of culture in psychology, of which culture as sets of values, beliefs and behaviors is probably the most common. Culture as communication or exchange of symbols is another, and in our view for traffic psychology evenly important, application of culture. Communication in traffic situations occurs not only verbally or written, but also through symbols and signs, sounds and body language. Geertz (1973 - cited in Nordfjærn, Şimşekoğlu & Rundmo, 2014) defined road traffic culture as symbol use. It is assumed that communication by symbols is subject to variation and that different countries have developed their own way of communication by symbol use in traffic. In some countries people may, for instance, be more focused on sounds signaling danger in the road traffic system, while drivers in other countries may focus more on visual and written elements, such as road traffic signs.

Within this context, we can place research about the understanding of traffic signs. Despite the international standardization of traffic signs, signs are not always understood by persons outside of the countries in which they are used, ultimately presenting safety concerns for a percentage of the global population (Shinar et al., 2003). Ward, Wogalter and Mercer (2004) draw attention to the cross-cultural differences in traffic signs. They investigated in the USA comprehension levels of 100 international road signs and the effect of brief sign training with the associated meaning on subsequent comprehension. A sign that is not understood indeed not only fails to convey the appropriate message but also may generate confusion type errors that could result in diverting attention from the driving task. The results indicated that American drivers do not comprehend a relatively large number of the international road signs. Only 17 of 100 signs met the 85% comprehension level. Sign training did increase the number of signs meeting or exceeding this comprehension level to 58 of the 100.

To summarize: driving in different countries is influenced by the traffic environment on the one hand and cultural factors (formal and informal norms and values, communication system) on the other hand. When people leave their country of origin, the traffic environment changes, but the cultural factors they carry with them remain. Therefore, it is likely that behavior of drivers originating from different countries might still be different though they are sharing the same traffic environment (Bener, Özkan & Lajunen, 2008). When people travel and need to drive in a foreign country, it is very likely that they drive the way they do in their own countries. Failure to adjust to the new driving environment may cause serious car accidents (Huang et al., 2006).

Differences in traffic culture between countries urged Leviäkangas (1998) to say that all nationalities differ from each other as far as traffic culture is concerned and it would be intellectually dishonest to say that some culture is better than another, although one culture may be safer than another.

Some examples of different traffic cultures:

- Zhang et al. (2006) conducted focus groups in China and in the USA. The objective of this research was to understand how Chinese drivers view safe driver characteristics and safe driving and to identify similarities and differences in the views and behaviors of Chinese and USA drivers about safe driving. According to the data, participants in China mentioned a lot of characteristics relating to a driver's personal skills, experiences and physical capabilities, such as quick reaction ability, good driving skill/experience, high intelligence and education, age and gender, and ability to drive different types of vehicles. On the other hand, the participants in the USA did not mention much about the driver's skills, but rather more about characteristics relating to how to deal with signal systems, the vehicle, the environment and other vehicles. The characteristics USA participants discussed concentrated more on practical safe driving guidelines, including the use of signals and blinkers well ahead of time, proper seat adjustment for the driver, the importance of not being under the influence of impairment-causing substances, knowing his/her limitations, being aware of everyone around them, the use of mirrors, to stop at stop signs, use lights in rain or anytime, use safety belts for both drivers and passengers, and proper pedal control. The Chinese drivers did not understand the importance of some typical driving operations, such as using lights whenever needed (after sunset, when changing lanes or directions, and driving in bad weather) and using a safety belt.

- Kouabenan (1998) and Dixey (1999) show that culturally determined bias (traffic culture) seems to affect the perception of risk and the causes of traffic accidents. Based upon research carried out on causal attributions of traffic accidents in the Ivory Coast and in Nigeria, they show in particular that fatalistic beliefs and mystical practices in African countries influence the perception of accidents and consequently incite one to take more risks and neglect safety measures. A similar fatalism in accommodation of risk and driving behavior is found in northern Alberta (Canada) rural residents by Rothe and Elgert (2003). And Vasconcellos (1999) gives notice of the fact that one of the major barriers to traffic accident prevention in Brazil is that most people still see these accidents as fatalities or an unavoidable cost of development.
- Özkan et al. (2006) used the Driver Behavior Questionnaire (Reason et al., 1990; Lawton et al., 1997) to compare driving styles cross-culturally and their relationship with traffic culture among British, Dutch, Finnish, Greek, Iranian and Turkish drivers. Concerning the driving styles cross-culturally, drivers from Western/Northern European countries reported higher scores on the ordinary violations, especially on speeding on a motorway, than drivers from Southern European/Middle Eastern countries. The authors say that this might reflect reality, but also the fact that drivers in countries with strong enforcement are more aware of their behavior and ordinary violations as risky and illegal behavior and thus more inclined to report them. In Turkey for example, the speed of traffic flow on many roads is much higher than the speed limit. Consequently, drivers do not see their speeding as a serious offence as the Western Europeans might do. In contrast, drivers from Southern European/Middle Eastern countries scored higher on aggressive violations and errors. Aggressive violations contain an interpersonally aggressive component. It is possible that the Southern traffic context is more prone to interpersonal conflicts, because of less developed infrastructure, lack of respect for rules and problems with enforcement. Ambiguities in traffic environment and enforcement increase the likelihood of conflicts, which in turn, may increase the general stress level and likelihood of errors in traffic, especially in Iran.
- Xie and Parker (2002) extended this kind of research to China and suggest that some culturally specific beliefs, including the sense of social hierarchy, tendency to challenge legitimate authority and belief in interpersonal networks, could be important in determining Chinese drivers' tendency to commit driving violations.

1.2. Elaboration in health research

1.2.1. Culture and road traffic culture

When significant systematic differences are found between countries it does not necessarily mean that these differences could be attributed to variation in culture (Rundmo, Granskaya & Klempe, 2012). Therefore, it is important to explicitly measure culture in cross-country studies, in order to be able to assess its influence. Culture is a complex construct to define and operationalise in a valid and appropriate way, especially in order to predict risky behaviors and accidents by cultural characteristics (Nordfjærn, Jørgensen and Rundmo, 2012). Elaborating the concept of culture is necessary in order

to find underlying mechanisms that explain the connection between culture and traffic accidents.

One could make a complete socio-cultural analysis across different countries, and relate that to safety culture. Such an analysis would need to examine culture from a variety of levels (Atchley, Shi & Yamamoto, 2014). We will sum up a few frameworks containing a number of cultural dimensions that can be studied in this respect.

a) Culture's Consequences (Hofstede)

For purposes of management, Hofstede (1980, 1999 – cited in Lund & Aarø, 2004) developed a theory of work values (Schwartz, 2006), based on a study among employees in a multinational company from about 50 countries on three continents. He considered the following five dimensions sufficient to distinguish among cultures (Duan, 2012):

1) *Power distance*: the extent to which the less powerful members of a society expect and accept that power is distributed unequally.
   The fundamental issue here is how a society handles inequalities among people. People in societies exhibiting a large degree of power distance accept a hierarchical order in which everybody has a place and which needs no further justification. In societies with low power distance, people strive to equalize the distribution of power and demand justification for inequalities of power.

2) *Individualism/collectivism*:
   The high side of this dimension, called individualism, can be defined as a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families. Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty. People from birth onward are integrated into strong, cohesive in-groups.
   A society's position on this dimension is reflected in whether people's self-image is defined in terms of "I" or "we".

3) *Masculinity/femininity*:
   The masculinity side of this dimension represents a preference in society for achievement, heroism, assertiveness and material rewards for success. Society at large is more competitive. Its opposite, femininity, stands for a preference for cooperation, close relationships, modesty, caring for the weak and quality of life. Society at large is more consensus-oriented.

4) *Uncertainty avoidance*: expresses the extent to which the members of a society feel uncomfortable with uncertainty and ambiguity.
   The fundamental issue here is how a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? Countries exhibiting strong uncertainty avoidance maintain rigid codes of belief and behavior and are intolerant of unorthodox behavior and ideas. Weak

uncertainty avoidance societies maintain a more relaxed attitude in which practice counts more than principles.

5) *Long-term pragmatic/short-term normative orientation*: expresses how a society maintains some links with its own past while dealing with the challenges of the present and the future.
Societies who score low on this dimension (short-term orientation), prefer to maintain time-honored traditions and norms while viewing societal change with suspicion. They have a strong concern with establishing the absolute truth, are normative in their thinking (Atchley, Shi & Yamamoto, 2014). Those with a culture which scores high (long-term orientation), take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future. These people believe that truth depends very much on situation, context and time (Atchley, Shi & Yamamoto, 2014). So long-term orientation stands for the fostering of virtues oriented toward future rewards, the opposite pole, short-term orientation, stands for the fostering of virtues related to the past and present.

Every country has a score in each dimension. Within each dimension, the extent of cultural difference between two countries is revealed by the distance between their scores. Hofstede (1980) and Allik & Realo (2004) obtained data on the first four cultural dimensions, while adjusting for the income levels, development and social capital in over 50 countries (Nordfjærn, Şimşekoğlu & Rundmo, 2014).

Aspects of these dimensions will probably influence social norms with regard to safety behavior, which would accordingly vary considerably among countries (Lund & Aarø, 2004).

b) Basic Human Values (Schwartz)

To reveal the cultural orientations in a society, we could look at indirect indexes of underlying orientations in the prevailing culture (e.g. the themes of children's stories, the systems of law, the ways economic exchange is organized, socialization practices). They each describe a narrow aspect of the culture. When researchers try to identify culture by studying this indexes, what they seek, implicitly or explicitly, are underlying values (Weber, 1958; Williams, 1968 – both cited in Schwartz, 2006). Therefore, studying values directly is an especially efficient way to capture and characterize cultures.

Out of his studies of individual differences in value priorities and their effects on attitudes and behavior, Schwartz (2006) presented a theory of seven cultural value orientations that form three cultural value dimensions.

The value dimensions for comparing cultures were derived by considering three of the critical issues that confront all societies:

1) To define the nature of the relation or the boundaries between the person and the group

This issue brings in the value dimension *autonomy versus embeddedness.*

In autonomy cultures, people are viewed as autonomous, bounded entities. They should cultivate and express their own preferences, feelings, ideas and abilities, and find meaning in their own uniqueness. There are two types of autonomy: intellectual autonomy encourages individuals to pursue their own ideas and intellectual directions independently (important values are broadmindedness, curiosity and creativity), affective autonomy encourages individuals to pursue affectively positive experience for themselves (important values include pleasure, exciting life and varied life).

In cultures with an emphasis on embeddedness, people are viewed as entities embedded in the collectivity. Meaning in life comes largely through social relationships, through identifying with the group, participating in its shared way of life and striving toward its shared goals. Embedded cultures emphasize maintaining the status quo and restraining actions that might disrupt in-group solidarity or the traditional order. Important values in such cultures are social order, respect for tradition, security, obedience and wisdom.

2) To guarantee that people behave in a responsible manner that preserves the social fabric, engage in the productive work necessary to maintain society rather than compete destructively or withhold their efforts

The value dimension *egalitarianism versus hierarchy* is the result of this issue.

Egalitarianism seeks to induce people to recognize one another as moral equals who share basic interests as human beings. People are socialized to internalize a commitment to cooperate and to feel concern for everyone's welfare. They are expected to act for the benefit of others as a matter of choice. Important values in such cultures include equality, social justice, responsibility, help and honesty.

Hierarchy relies on hierarchical systems of ascribed roles to insure responsible, productive behavior. It defines the unequal distribution of power, roles and resources as legitimate. People are socialized to take the hierarchical distribution of roles for granted and to comply with the obligations and rules attached to their roles. Values like social power, authority, humility and wealth are highly important in hierarchical cultures.

3) To regulate how people manage their relations to the natural and social world

This issue results in the value dimension *harmony versus mastery.*

Harmony emphasizes fitting into the world as it is, trying to understand and appreciate rather than to change, direct or exploit. Important values in harmony cultures include world at peace, unity with nature and protecting the environment.

Mastery encourages active self-assertion in order to master, direct and change the natural and social environment to attain group or personal goals. Values such as ambition, success, daring and competence are especially important in mastery cultures.

Schwartz also specified a coherent, integrated system of relations among the orientations, postulating that they are interdependent. He validated the cultural orientations and the structure of interrelations among them by analyses of data from 73 countries. This process resulted in the following circular structure (Fig. 1), reflecting the

cultural orientations that are compatible (adjacent in the circle) or incompatible (distant around the circle).

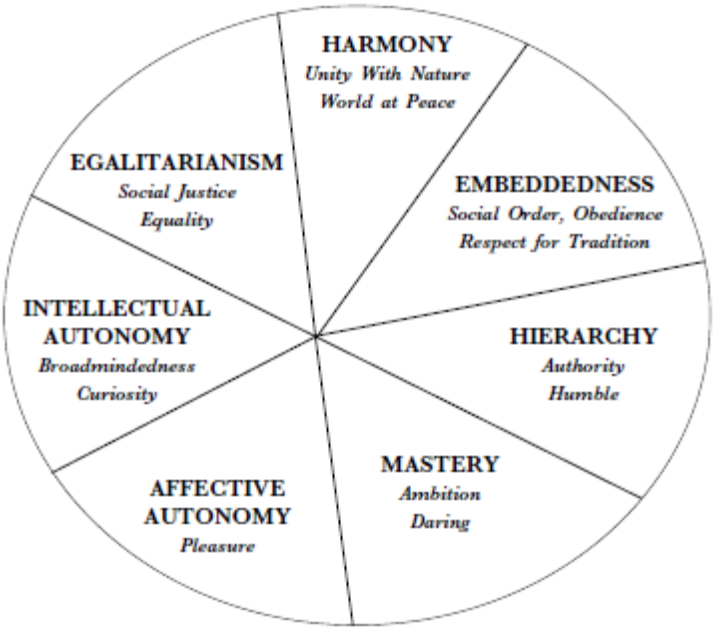

Fig. 1: Cultural dimensions: prototypical structure (Schwartz, 2006)

Based on his theory, Schwartz generated a worldwide empirical mapping of 76 national cultures that identifies 7 transnational cultural groupings with distinct cultural orientations: West European, English-speaking, Latin American, East European, South Asian, Confucian influenced, and African & Middle Eastern. Only nine cultures were located outside of their expected region. Four of these are from the culturally diverse Middle East (Turkey, Greek Cyprus, Israel Arabs and Israel Jews).

Prevailing cultural value orientations have consequences for attitudes and behavior (e.g. conventional morality, opposition to immigration, political activism) and culture mediates the effects of major social structural variables on them.

Schwartz concludes that values are particularly significant dimensions for comparing cultures because they affect so many different aspects of life. But other dimensions of cultural difference may also be important.

c) Modernization and post-modernization (Inglehart)

Inglehart (1977, 1990 – both cited in Schwartz, 2006) developed his theory of materialism-postmaterialism which he later refined to include two dimensions on which to compare national cultures (Inglehart & Baker, 2000), in order to address issues in political science and sociology about the effects of modernization.

The two dimensions in value orientations that emerged in his research (Inglehart, 1997 – cited in Inglehart & Baker, 2000) reflect cross-national polarization between traditional versus secular-rational orientations toward authority on the one hand and survival versus self-expression values on the other hand. Each society can be located on a global map of cross-cultural variation based on these two dimensions.

1) The *tradition versus secular-rational dimension* centrally concerns orientations toward authority. It contrasts societies in which religion, nation and family are highly important with those in which they are not so important (Schwartz, 2006). Traditional societies show low levels of tolerance for abortion, divorce and homosexuality; tend to emphasize male dominance in economic and political live, deference to parental authority and the importance of family life; and are relatively authoritarian. Most of them place strong emphasis on religion. People of traditional societies have high levels of national pride, favor more respect for authority, take protectionist attitudes toward foreign trade and feel that environmental problems can be solved without international agreements. They emphasize social conformity rather than individualistic striving and believe in absolute standards of good and evil. Societies with secular-rational values have the opposite preferences on all of these topics.

2) The second dimension, *survival versus self-expression*, contrasts societies in which people primarily focus on economic and physical security (survival) with societies in which security is high and quality-of-life issues are central (self-expression) (Schwartz, 2006). In the latter there is trust, tolerance, subjective well-being, political activism and self-expression. These values are linked with a growing emphasis on environmental protection, the women's movement and rising demands for participation in decision-making in economic and political life. Many people of this societies are well educated and work in the services, which demands of them more freedom of judgment, innovation and autonomous decision-making and equips them with relevant communication and information-processing skills (Schwartz, 2006). At the opposite extreme, people in societies shaped by insecurity and low levels of well-being tend to emphasize economic and physical security above all other goals, and feel threatened by foreigners, by ethnic diversity and by cultural change. This leads to an intolerance of gays and other out-groups, an insistence on traditional gender roles, and an authoritarian political outlook. At the self-expression pole, difference and change are accepted and even seen as enriching and out-groups are increasingly seen as meriting equal rights (Schwartz, 2006). The survival pole fosters materialist values, such as maintaining order and fighting inflation, while the self-expression pole fosters post-materialist values such as freedom and self-expression.

Economic development seems to have a powerful impact on cultural values: the value systems of rich countries differ systematically from those of poor countries. Industrialization promotes a shift from traditional to secular-rational values, while the rise of postindustrial society brings a shift toward more trust, tolerance, well-being and post-materialist values. Economic collapse tends to propel societies in the opposite direction.

But the influence of traditional value systems is unlikely to disappear, as belief systems exhibit remarkable durability and resilience. Values can and do change, but they also

continue to reflect a society's cultural heritage. A history of Protestant or Orthodox or Islamic or Confucian or Catholic or Communist traditions gives rise to cultural zones with distinctive value systems that persist after controlling for the effect of economic development. Economic development tends to push societies in a common direction, but rather than converging, they seem to move on parallel trajectories shaped by their cultural heritages. So, a society's culture is shaped by its entire economic and historical heritage.

Schwartz (2006) finds it striking that the mapping of national cultures renders similar cultural regions around the world using Hofstede's, Inglehart's and his own approach. At least two of the three approaches, and usually all three, identify African, Confucian, East-Central European (ex-communist), English-speaking, Latin American, South Asian and West European regions. This is amazing, considering how different the approaches are. They differ in their basic cultural constructs, in their methods of measurement (work values and attitudes; beliefs, preferences and judgments on a range of topics; abstract values or profiles reflecting individuals' important goals), in the types of sample studied (IBM employees; representative national sample; teacher and students), and in their data-gathering periods (from the late '60s into the 21st century). For Schwartz, the emergence of similar cultural regions across approaches affirms the reality of the systematic cultural value differences these approaches tap.

d) Culture as symbol exchange (Geertz)

Rundmo, Granskaya and Klempe (2012) aimed to present insights into cross-country differences in traffic risk perception and driving behavior and also how culture and cultural differences may influence perceived risk and risk behavior by comparing sample populations from different countries. To do so, they tried to define culture theoretically by conceiving it in terms of communication, such as symbol exchange (Geertz, 1973 – cited in Rundmo, Granskaya & Klempe, 2012).

Their argumentation is that communication takes place through languages, also dialects in the same language, depending on certain regions or certain subcultures. But communication is more than pure language. Within a culture there are many different sign systems used for communication, such as gestures, paintings, music and even behavior. Therefore symbol exchange also should be included when operationalising culture.

In traffic, it is inevitable that drivers will understand signals from other drivers' signs and communication concerning, for example, their behavioral intentions and indicators of driver anger. An understanding of other drivers' communication can be essential for avoiding accidents and therefore an understanding of culture as symbol exchange may be seen as relevant to traffic safety. A new measurement instrument was developed aimed at measuring culture and traffic culture as symbol exchange (Klempe, Granskaya & Rundmo, 2009 – cited in Rundmo, Granskaya & Klempe, 2012).

Nordfjærn, Jørgensen and Rundmo (2012) had the same understanding of culture as a construct manifested by differences in communication by signs, symbols and reliance upon different sources of information. They also stated that it is probable that differences in such symbol exchange between countries could relate to differences in car

accident involvement. So the authors set up a study with measures of culture as symbol exchange, to predict road traffic accidents in different countries.

The measure of culture as symbol exchange segmented into five factors:

1) *Visual culture*:
   consisted of items which measured symbol exchange related to visual stimuli such as pictures

2) *Oral culture*:
   contained items regarding cultural orientation toward sounds and speech

3) *Written culture*:
   contained test items which measured how the respondents related to written information

4) *Extroverted culture*:
   consisted of items regarding the importance of congruence between experience and learning as well as the importance of public persons to set good examples. An extroverted culture is characterized by a direct form of communication (Klempe & Rundmo, 2007)

5) *Introverted culture*:
   related to tendencies to rely upon personal individual intuition and conviction

The results showed that cultural symbol exchange was important for car accident variability and that cultural practice as heuristically measured by the culture as symbol exchange may have more applicability in Sub-Saharan Africa than in Norway.

The authors think that the culture as symbol exchange is a promising framework for the study of cultural differences concerning road traffic safety. They suggest for future studies to include additional symbols relevant for cultural interaction, and also use symbol items which are more directly targeted to road traffic behaviors. Such items could for instance relate to the importance of sounds (e.g. horn honking) and visual information (e.g. light use and traffic signs) within the road traffic system.

The latter is exactly what Rundmo, Granskaya and Klempe (2012) did. Besides indicators to measure culture in general, they used indicators to specifically measure traffic safety culture.

The dimensional structure found for traffic culture was the following:

1) Written culture
- What I read about dangers, I take seriously
- I consider a written request to be particularly serious
- I prefer reading what the law says on right and wrong in traffic
- I enjoy following press debates concerning traffic regulations

2) Auditive culture
- While in traffic, I'm especially aware of the sounds around me
- I react strongly to sounds signalizing danger
- It is important to look for signs of danger

3) *Oral culture*
   - I enjoy hearing about what others consider right or wrong in traffic
   - I take oral corrections of my behavior in traffic seriously
   - I consider an oral request to be particularly serious

4) *Extravert culture*
   - Prompt reaction to road signs is very important
   - I act according to the image of traffic that I see
   - In traffic, I usually behave as others are likely to expect me to
   - I'm especially aware of how other people behave in traffic

5) *Conscientious culture*
   - When someone honks their horn, I think I've done something wrong
   - Few sound indicate that traffic is running smoothly

6) *Introvert culture*
   - If everyone followed their own convictions, traffic would run smoothly
   - People's behavior can change in dangerous situations

Their analysis showed that a total of 18 indicators measured the six dimensions of traffic safety culture. The results also showed that traffic culture as symbol exchange contributed significantly to explained variance in risk behavior.

e) Cultural Theory (Douglas and Wildavsky)

The first component of cultural theory (Douglas & Wildavsky, 1982 – cited in Oltedal & Rundmo, 2007) is the functionalist belief that adherence to specific patterns of social relationships generates distinctive ways of looking at the world, referred to as "cultural biases", and vice versa, that adherence to a particular world view legitimizes a corresponding type of social relations (Marris, Langford & O'Riordan, 1998).

To identify different types of cultures Douglas and Wildavsky developed the so-called grid/group typology (Fig. 2). "Group" refers to the extent to which an individual is incorporated into bounded units. The greater the incorporation, the more individual choice is subject to group determination. "Grid" denotes the degree to which an individual's life is circumscribed by externally imposed prescriptions. The more binding and extensive the scope of the prescriptions, the less of life that is open to individual negotiation (Thompson, Ellis & Wildavsky, 1990 – cited in Marris, Langford & O'Riordan, 1998). According to Rippl (2002) "group" stands for social commitment and group attachment (interest and identification regarding group relations), "grid" for control (shaping of social relations by social differences or hierarchic structures).

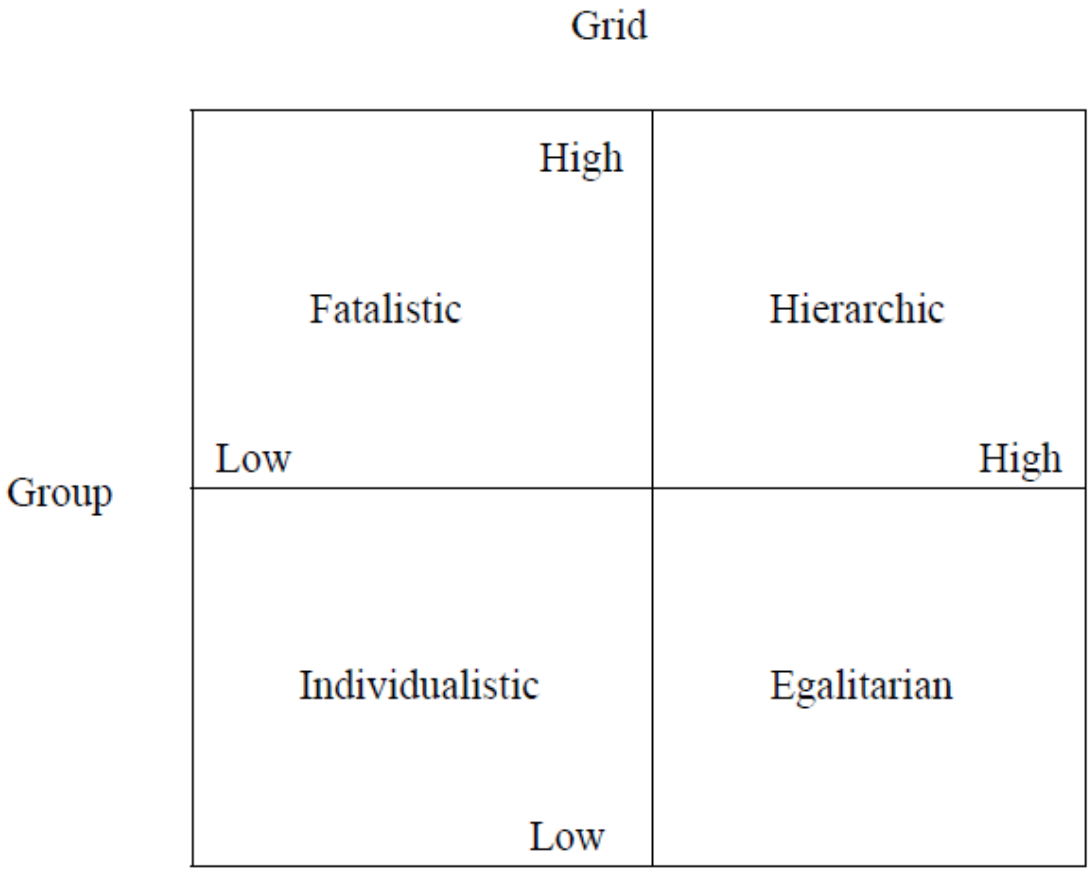

Fig. 2: Douglas' grid-group model (Oltedal et al., 2004)

The theory claims that all individuals adhere to one of four broad cultural groups, defined by the strength of the "grid" and "group" characteristics of their social relations:

1) *Individualistic* (low group and low grid):
people who emphasize individual freedom

2) *Hierarchic* (high grid and high group):
people who support the "natural order" of society

3) *Egalitarian* (high group but low grid):
people who strive to reduce inequalities between people

4) *Fatalistic* (high grid but low group):
people who feel they have no way to influencing their environment and hence become withdrawn and indifferent

Each cultural group consists of a characteristic behavioral pattern, which includes concrete observable social relations and actions as well as the social structure. Furthermore, each group has a cultural bias, which refers to a cognitive system that includes attitudes and values, a socially shared worldview that determines the individual's perceptions (Rippl, 2002).

Cultural theory claims that risk perception can be predicted by cultural adherence and social learning. For each of the four worldviews, cultural theory offers clear hypotheses about modes of risk perception (Rippl, 2002):

- Individualists perceive risk as opportunity. New technologies, for example, are viewed more as possibilities and less as dangers. They fear risks that could limit their freedom.
- Persons with hierarchic orientations are assumed to accept risks as long as decisions about those risks are justified by governmental authorities or experts. They fear risks that threaten the social order, however.
- Egalitarians are assumed to oppose risks that will inflict irreversible dangers on many people or on future generations. They distrust risks that are forced on them by the decisions of a small elite of experts or governmental authorities.
- Fatalists have a strong orientation toward socially assigned classifications, but without a group identification. They try not to know and not to worry about things that they believe they can do nothing about.

According to Douglas, individuals are not supposed to vary on the different worldviews, they should rather belong to one of them. But difficulties in creating groups based on cultural theory's worldviews have been a recurring problem. The typical subject shows mixed cultural adherences (Marris, Langford & O'Riordan, 1998; Sjöberg, 1995 – cited in Oltedal & Rundmo, 2007). The same individual is both hierarchic, egalitarian, individualistic and fatalistic, perhaps depending on the present situation. Hence, the majority of any sample is likely to be filtered out when those who adhere to only one culture are to be compared. This makes it difficult to obtain reliable results as to how important cultural adherence really is in risk perception. Through the adoption of another approach concerning cultural theory the problems related to allocating subjects to the cultures might be solved. By using cluster analysis the subjects are grouped based on their scores on each of the cultural adherences, not just one of them. This ensures that most of the subjects can be included in the subsequent analyses. Those who show similar patterns of cultural adherence will be clustered together. The groups can then be compared on different aspect of risk perception (Oltedal & Rundmo, 2007).

1.2.2. Ethnicity

Within the context of health research, Bhopal (1997) points to the many conceptual and technical problems of research into ethnicity and health. He states that the literature is littered with elementary errors: inventing ethnic groups, not comparing like with like, lumping groups together and not adjusting for confounding factors. In other words: it is very difficult to define ethnicity in a valid way.

Bradby (2003) is rather pessimistic and says that if researchers continue to try to capture the complex and contextual detail of ethnicity, it may become clear that the general concept of ethnicity covers such a wide and specific range of experiences as to render it of limited use in making comparisons through time or across cultures. What he might imply is that ethnicity should be elaborated further, on several levels, like the concept of culture in the previous paragraph (1.2.1).

We firstly cite a few recommendations that the mentioned authors give to improve the value of ethnicity as an epidemiological variable in research. Bradby points to the shortcomings of fixed-response categories from which respondents have to choose their ethnic group: the reproduction of racialized categorizations (which reflect the historical injustices against black and minority groups), overemphasis of homogeneity within groups and contrast between them, and failure to offer terms with which people identify and which can express complex identities. Self-assigned ethnic group avoids some of these difficulties by allowing multiple affiliations to be described, but introduces the costs of processing free text. Furthermore, the context-dependent nature of individual ethnic identity makes comparison problematic.

Senior and Bhopal (1994 – cited in Bhopal, 1997) advise among other things the following:

- Ethnicity's complex and fluid nature should be appreciated
- The limitations of methods of classifying ethnic groups should be recognized, and reports should state explicitly how such classifications were made
- Investigators should recognize the potential influence of their personal values, including ethnocentricity
- Research on methods for ethnic classification should be given higher priority
- Ethnicity's fluid and dynamic nature means that results should not be generalized except with great caution

Bhopal (1997) adds that in the absence of consensus on the nature of ethnicity, researchers must state their understanding, describe the characteristics of both the study and comparison populations and provide and justify the ethnic coding.

We conclude that in every study where ethnicity is defined in the narrow way (thus ignoring the taboo and grouping people according to e.g. country of origin of self or ancestors), ethnicity should at the same time be elaborated using a framework for culture. In this way, the original "objective" ethnic categories get meaning, can be fine-tuned and adapted, and go beyond the malign concept of race.

1.2.3. Acculturation

In the definition paragraph (1.1.3), we mentioned that language is the major focus of many measures of acculturation.

We found an example in Anderson et al. (1998), who defined acculturation among Hispanic adults who resided for less than five years in the USA by the use of English language. Each category of English language use was analyzed as a proportion of Hispanic adults, age 18 to 64 years:

- The number of Hispanic adults who spoke English at home was estimated as the number of Hispanic adults minus the number of adults who spoke Spanish at home.
- The authors defined *bilingual* as adults who spoke Spanish at home and reported that they spoke English very well.
- *Some English* was defined as adults who spoke Spanish at home and reported that they spoke English well.

- *Little or no English* was defined as adults who spoke Spanish at home and reported that they spoke English not well or not at all.

2. SOCIOECONOMIC CHARACTERISTICS

2.1. Definitions

Different terms are used by different authors to describe or investigate socioeconomic characteristics. A variety of terms, such as social class, social stratification, social or socioeconomic status are often used interchangeably, despite their different theoretical bases and, therefore, interpretations (Galobardes et al., 2006a). In the literature, there is far from a consensus on the definition of socioeconomic status or social class (Bollen, Glanville & Stecklov, 2001). In this paragraph, we try to reconcile and settle the definitions we found.

2.1.1. Socioeconomic position or status

Centers for Disease Control and Prevention define **socioeconomic status** as a composite measure that typically incorporates

- *economic status*, which is measured by income
- *social status*, measured by education
- *work status*, measured by occupation

Solar & Irwin (2007) use the term social position for the composite of the same three indicators. We prefer the term socioeconomic position, to keep straight the distinction with social class or status.

Economic status, social status and work status are related but do not overlap (Adler, 1994 – cited by CDC). Educational level concerns differences between people in terms of access to information and the ability to benefit from new knowledge, whereas income concerns differences in access to scarce material goods. Occupational status encompasses both these aspects, and also includes the benefits accruing to specific jobs such as prestige, privilege and power (Kunst & Mackenbach, 1995 – cited in Hasselberg & Laflamme, 2003 and 2004).

Each is considered an indicator of socioeconomic status. Dahlgren and Whitehead (2006) decide they all function reasonably well as indicator in European societies, though they all have their drawbacks. In practice, the choice is often limited to what is most readily available in a country's routine information systems. Bollen, Glanville and Stecklov (2001) state that in practice, indicators of socioeconomic status are often used interchangeably as functional equivalents based on the availability of measures. Krieger, Williams and Moss (1997) indicate for instance that education is a popular measure of socioeconomic status because it is easy to measure, applicable to persons not in the active labor force and stabile over adult lifespan (regardless of changes in health status). Educational level among adults who have completed their schooling is not affected by occurrence of serious illness, which can force individuals to work at jobs below the level of their normal occupations or otherwise cause their incomes to decline. But there are objections against the idea of education as the best or most valid measure of socioeconomic position:

- The very fact that educational level generally is stable over adult lifespan may, for some study purposes, be a disadvantage, because stability may preclude capturing the changes in economic well-being in adulthood. Contrasts between fixed educational level and fluctuating socioeconomic resources most likely will become even more important in the future, in light of growing trends in corporate downsizing, increasing job insecurity and changing occupational structure of the economy (Kuhn & Wooding, 1994 – cited in Krieger, Williams & Moss, 1997).
- Because the span of educational levels is far less than the range of income or wealth, educational level may be a less sensitive measure.
- Education is less predictive than class position of ownership of capital assets (Western & Wright, 1994 – cited in Krieger, Williams & Moss, 1997).
- Educational level does not have a universal meaning. Rather, its economic and health implications are related to age, birth cohort, class position, ethnicity and gender. There is a growing homogeneity within younger cohorts and decreasing variability in years of education relative to income, and economic returns for a given level of education are not the same for everyone (e.g. higher for managers as compared to workers, for whites as compared to non-whites and for men as compared to women).

Comparable objections are made against occupation as preferred socioeconomic characteristic: occupations may not comparably capture disparities in working and living conditions across divisions of ethnicity and gender (e.g. black workers are paid less in the same occupations as their white counterparts) and occupation-based measures cannot readily be used for social groups outside of the recognized paid labor force (unemployed adults, homemakers, persons employed in informal or illegal sectors, children and retired adults) (Krieger, Williams & Moss, 1997).

In the paragraph about the measurement of socioeconomic status in health research (2.2.1), we will take a closer look at several other authors who don't agree with the interchangeability of measures of socioeconomic status.

Galobardes et al. (2006a,b) mainly reaffirm the three measures income, education and occupation, but extend the definition of socioeconomic position by presenting an array of indicators within a life course framework (Fig. 3).

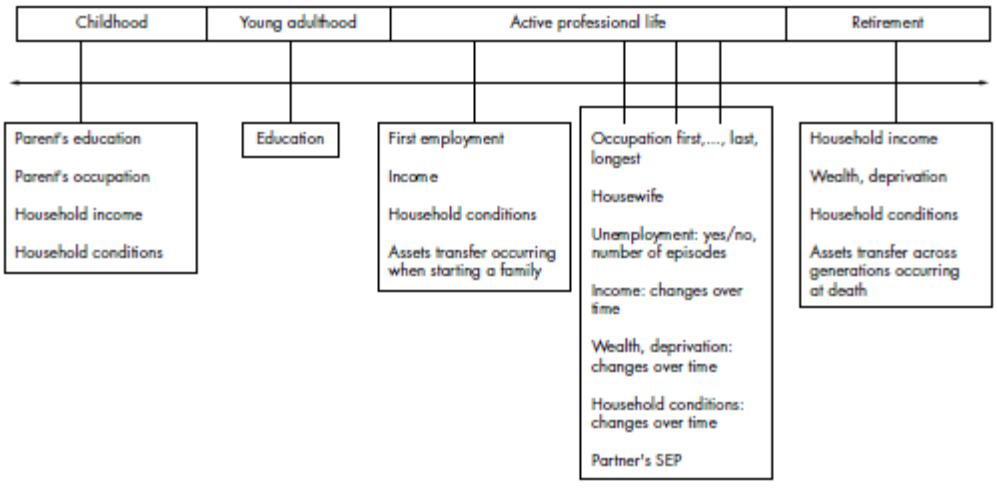

Fig. 3: Examples of indicators measuring life course socioeconomic position (Galobardes et al., 2006a)

These authors present a comprehensive list of indicators of socioeconomic position used in health research. A description of what they intend to measure is given together with how data are elicited and the advantages and limitation of the indicators. Where possible, they present also the interpretation or mechanism that may be of particular relevance to each indicator, but this is difficult because most of the indicators are strongly correlated, as mentioned earlier. For example, despite education reflecting some particular aspects of socioeconomic position such as possession of a richer score of knowledge, it does, at the same time, help determine a person's adult occupation and income, and therefore shares with these other indicators some of the effects on other aspects of life. This is particularly evident when a life course approach is considered.

Krieger, Williams and Moss (1997) refer to the diverse components of economic and social wellbeing (e.g. occupations, income, wealth, education) as socioeconomic position. They see socioeconomic position as an aggregate concept that includes:

- *resource-based* measures:
  the actual resources people have, e.g. school degree, place to call home, income, social participation in family and society
  Terms used to describe inadequate resources include poverty and deprivation.
- *prestige-based* measures:
  access to and consumption of goods, services and knowledge
  Terms that can be used to describe differences between people in this respect are advantaged-disadvantaged.

Oakes and Rossi (2003) interpret socioeconomic status as differential access (realized and potential) to desired resources and as a function of

- material endowments: earned income, investment income, real property, other fungible goods and call that *material capital*
- skills, abilities and knowledge, which is *human capital*
- one's social network and the status, power, trustworthiness and abilities of its members and call that *social capital*

Shahabudin, Lee and Low (2012) provide empirical evidence on the use of the capital components as measure of socioeconomic status of adolescents in Malaysia and compare their use with the traditional measure of parental socioeconomic status (income, education and occupation) for the social status of adolescents. They conclude that the material, human and social capital are suitable as an alternative or as an additional measure to the existing conventional measures of socioeconomic status in the literature.

2.1.2. Social class or status

Social class is strongly determined by occupation (Bartley & Ferrie, 2001). This may stem from the close association of the concept with the work of Marx. A key axis in the work of Marx is the means of production (e.g. factories, land) (Marx & Engels, 1848, 1978 – cited in Bollen, Glanville & Stecklov, 2001; Galobardes et al., 2006a). For Marx, in industrial capitalist societies the primary classes are the owners of the means of production, the bourgeoisie on the one hand and the workers, the proletariat on the

other hand. There is an inherent conflict between exploited workers and the exploiting owners who control the means of production (Galobardes, Lynch & Davey Smith, 2007). From this perspective, people of the same social class share a similar position in their relationship to the means of production (Bollen, Glanville & Stecklov, 2001).

Wright (1985 – cited in Galobardes et al., 2006a,b and in Bollen, Glanville & Stecklov, 2001) elaborates the exploitation inherent in the social relations of production. Specifically, he categorizes workers according to three axes: ownership, authority and expertise. According to the interplay of these three, he gets 12 social classes, which are represented in Fig. 4.

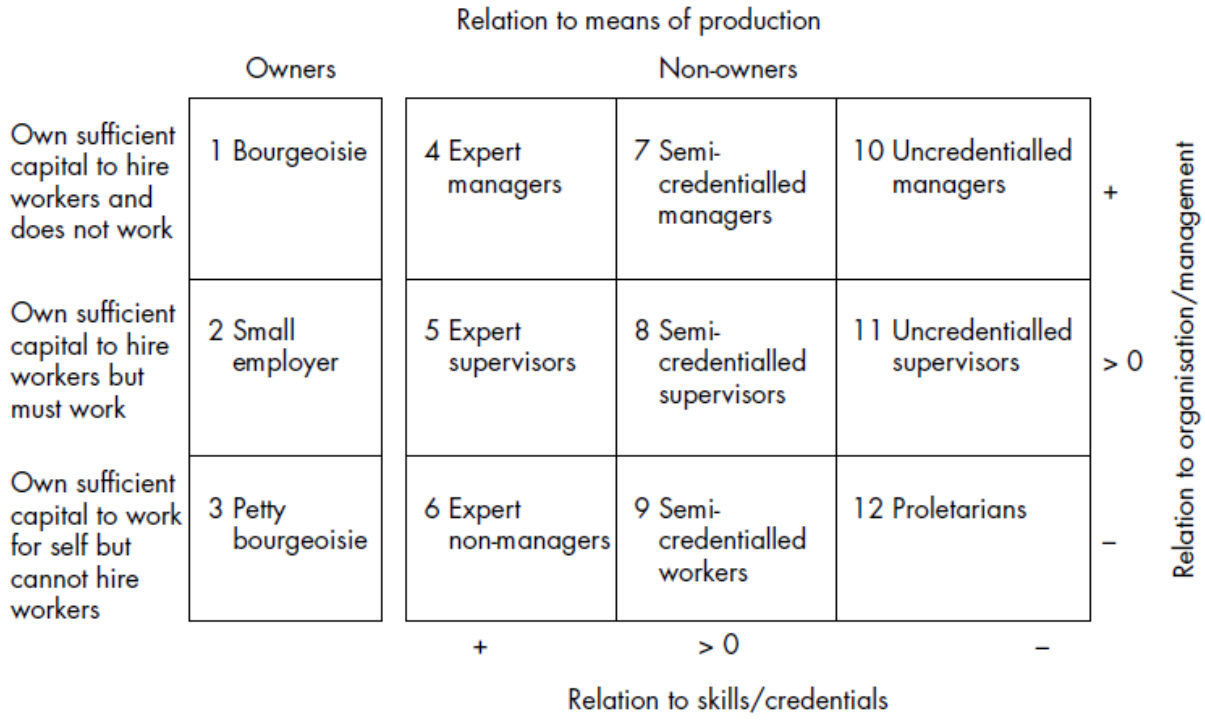

Fig. 4: Wright's social class classification (Galobardes et al., 2006b)

Cells 1 and 2 represent the capitalist class, cell 3 the petty bourgeoisie or self-employed, cells 4 to 10 include contradictory class locations, and cells 11 and 12 the working class. People in the contradictory class locations belong simultaneously to the capitalist and the working class (capitalist in terms of controlling skills and credentials and exploiting workers; workers because they do not own capital assets and are controlled by capitalists).

Accordingly, more recent definitions of social class or status refer to social groups arising from interdependent economic relationships among people. People of a similar social class have the same location within the economy (as employer/employee/self-employed/unemployed; and as owner/non-owner of capital, land or other forms of economic investments) and have similar educational credentials and skill assets (Krieger, Williams & Moss, 1997) or a certain prestige of birth (Toivanen, 2007).

An example of social status classification based on occupation, is the British Registrar General's scale (e.g. Bollen, Glanville & Stecklov, 2001; Christie, 1995) with five social classes: professional workers, managerial workers, skilled non-manual and manual

workers, partly skilled manual workers, unskilled manual workers. Many researchers define specific occupation based social classes, more or less according to the purpose of their study, for example Lenguerrand et al. (2008) who have managers, skilled workers and unskilled workers; Factor, Mahalel and Yair (2008) who study white collar/service class, blue collar and non-skilled workers; Lahelma et al. (2010) who divide white collar workers in managers, professionals and clerical employees; Hasselberg and Laflamme (2003, 2004) who have intermediate and high-level salaried employees, assistant non-manual employees, skilled workers, unskilled workers, self-employed, farmers and an unspecified population; Karlsen and Nazroo (2002) who use the categories non-manual worker, manual worker and no full-time worker; and to finalize the examples Koivusilta, Rimpela and Kautiainen (2006), who have upper white collar employees, entrepreneurs, lower white collar employees, blue collar employees and others.

Shared among these approaches is the idea of class being distinguished by categories rather than by continuums. The socioeconomic status traditions mentioned in the previous paragraph (2.1.1) represent an emphasis on continuous variables (Bollen, Glanville & Stecklov, 2001).

Instead of equating social class with economic ownership and control over the means of economic production, Bourdieu (1984, 1998 – cited in Veenstra, 2007) states that a person's social class is based on access to capitals, forms of power or resource in social life, namely economic capital (money, time, wealth), cultural capital (knowledge, education, family background, history) and social capital (social networks, connections, institutional links) (Frohlich, Ross & Richmond, 2006). He proposes mapping social space (defining social classes) by using measures of life styles, consumption characteristics, political attitudes and health behaviors (Factor, Yair & Mahalel, 2010).

Veenstra (2007) adopts this approach and defines social classes by the possession of various cultural tastes and knowledge (including familiarity with sports figures, artists, novelists and books or magazines), lifestyle practices (smoking habits, alcohol consumption, religious affiliation), parental educational background, educational capital (highest level of education), economic capital (household income, home ownership), social capital (trust in community members, perceptions regarding the trustworthiness of politicians, sense of belonging in the community, loneliness, degree of networking with neighbors, volunteerism, voting) and occupational type. Social groupings of people that might be predictive of social classes are:

- Professional class: well educated (as are their parents), wealthy, professionals and high-level managers, distinctive cultural practices pertaining to physical activity (e.g. aerobics, kayaking, yoga/tai-chi, running and weight training), distinctive cultural tastes (familiarity with specific magazines, books and artists), likely to participate in a range of clubs and associations
- Middle class: skilled clerks and salespeople, supervisors and middle managers, moderately well educated (community college or university credential), quite high household income, distinctive cultural tastes, like to engage in an occasional bout of drinking but generally choose not to smoke, trust other members of the community and politicians, voted in the last federal election, like to spend time socializing with neighbors
- Working class: few educational credentials, work in unskilled and semi-skilled manual occupations, far from wealthy, heavily smoking and drinking as only

cultural practices, live in moveable dwellings, nonexistent relationships with neighbors, negligible participation in the civil space via volunteering
- Class of solitude: poor, rent accommodation in temporary living situations, young and single, separated or divorced, not obviously associated with any specific occupational categories, lack of belonging to the community.

Social classes described in this way tell more about the people belonging to them than an occupational description does. It illustrates that social classes rest also on mode of living, education or prestige of birth and on the positive or negative privileges associated with these factors (Worsley, 1970 – cited in Toivanen, 2007). Cockerham (2005) points to the growing importance of lifestyle consumer habits as a primary source of social identification instead of work or occupation. The easier acquisition of basic material needs after World War II allowed styles of consumption to supercede occupation for signifying social similarities and distinctions for many people (Crompton, 1998 – cited in Cockerham, 2005). Scott (1996 – cited in Cockerham, 2005) observes for example that social distinctions in the British working class are determined more by consumption patterns than relationships to the means of production. This has also important repercussions for the issue of health and safety. Following this approach, health behavior can be understood in a broad social context, in which social class is recognized as playing a large part in shaping many people's health behaviors (Chin, Monroe & Fiscella, 2000).

With the Bourdieu definition of social class, we come very close to the above mentioned interpretation of socioeconomic status from Oakes and Rossi, comprising material, human and social capital (paragraph 2.1.1). This illustrates the intertwining of the concepts social class and socioeconomic status, and partly explains the confusion in the literature defining and using them.

Rubin et al. (2014) have a clear solution to distinguish between the two as separate concepts. In their view, socioeconomic status refers to one's current social and economic situation. This is relatively mutable, especially in countries that provide opportunities for economic advancement. In contrast, social class refers to one's socio-cultural background and is more stable, typically remaining static across generations. Hence, it is possible for a working-class person to have a relatively high socioeconomic status while remaining in a stereotypically blue collar occupation. Perhaps because social class is more stable than socioeconomic status, it is also more likely to be associated with intergroup power and status differences that act as the basis for discrimination and prejudice (Ostrove & Cole, 2003 – cited in Rubin et al., 2014), for which the word classism can be used (Carlson, Ladd and Rajani, 2011).

Bollen, Glanville and Stecklov (2001) view social class as the source of the above mentioned components of socioeconomic status. From this perspective, educational attainment, occupational prestige and income have a common origin in social class. Krieger (2001) has the same conviction, stating that social class is logically and materially prior to its expression in distributions of occupations, income, wealth, and education. Weber (Bartley, 2004 – cited in Galobardes, Lynch & Davey Smith, 2007) on the other hand suggests that social class is only one of the dimensions that create groups whose members share a common position with similar life possibilities. Other dimensions are education, occupation and income, which are equally important and thus on the same level as social class.

2.1.3. Social stratification

Social stratification (Solar & Irwin, 2007; Grusky, 2011) is the process of arranging groups in society within hierarchies of political power, prestige or social honor, and access to resources or valued goods.

There is a complex of institutions and structures that generate these arrangements:

- the labor market, the educational system, medical care, public health and housing distribution,
- political institutions and governance processes,
- other cultural and societal biases, norms and values

Social stratification is broader than merely dividing people in social classes or socioeconomic groups. It implies also the social processes that define certain types of goods as valuable and desirable, the rules of allocation that distribute these goods across various classes or groups, and the mechanisms that link individuals to these classes or groups and thereby generate unequal control over valued goods.

The process is determined by a society's forms of property, ownership and labor, and their connections through production, distribution and consumption of goods, services and information (Krieger, Williams & Moss, 1997).

The socioeconomic characteristics we discussed above (e.g. income, education, other aspects of standing that members of a society deem salient), are dimensions of stratification (Bollen, Glanville & Stecklov, 2001), thus all part of the comprehensive process that stratification is. Gender and ethnicity also play a role (Solar & Irwin, 2007).

2.2. Measurement of socioeconomic status in health research

Findings from studies that examine the role of socioeconomic status in health differences have provided inconsistent results. This is due in part to the lack of precision and reliability of measures that are used (Shavers, 2007). In the next paragraphs, we will highlight some of the main points found in the literature, which enable us to improve the precision and reliability of the measures that are used.

2.2.1. Choice of socioeconomic characteristic

As mentioned in the definition paragraph (2.1.1), often one characteristic (e.g. education) is chosen as indicator to assign participants to socioeconomic groups, because all characteristics are deemed interchangeable. If the central interest is to show the existence of a socioeconomic gradient in a particular health outcome then the choice of indicator may indeed not be crucial (Galobardes et al., 2006a). The conviction of interchangeability receives opposition however, when it comes to explore the mechanisms that underlie differences in health or injury.

Toivanen (2007) warns that different socioeconomic characteristics measure different underlying phenomena and tap into different causal mechanisms in relation to health

and should therefore not be used interchangeably as indicators of a hypothetical latent social dimension. Rather, the choice of an indicator of socioeconomic status should depend on how one assumes socioeconomic status is linked to health differences (Bartley et al., 2000; Lynch & Kaplan, 2000 – cited in Toivanen, 2007; Galobardes et al., 2006a; Shavers, 2007).

In the absence of a clear assumption of such link, using more than one measure may help to clarify the causal pathways by which social disadvantage leads to poorer health and injuries (Hasselberg & Laflamme, 2003; Marmot & Bobak, 2000; Galobardes, Lynch & Davey Smith, 2007). The use of multiple measures produces a more complex view on the structural effects of socioeconomic status (Cubbin, LeClere and Smith, 2000a; Vandenheede et al., 2014). The nature of socioeconomic status is multidimensional, which implies that it cannot be completely measured with one variable, e.g. income or educational attainment (Cubbin & Smith, 2002). Greater attention needs to be given to modeling the joint effects of socioeconomic status variables (Williams & Collins, 1995). Galobardes et al. (2006b) summarize that socioeconomic position is key to understanding differences in health and is best considered as an umbrella term for a range of indicators and interconnected concepts. Differences in health are not an either-or, but an and-and story (Vandenheede et al., 2014).

The use of multiple measures of socioeconomic status is of particular importance when socioeconomic status is a potential confounding factor. Multiple socioeconomic status indicators, preferably measured across the life course, will be needed to avoid residual confounding by unmeasured socioeconomic circumstances (Galobardes et al., 2006a). Evidence shows that conclusions about non-socioeconomic causes of differences in health may depend on the measure used to control for socioeconomic status. This suggests that findings from studies that have measured limited aspects of socioeconomic status in this respect should be reassessed (Braveman et al., 2005).

Braveman et al. (2005) advise researchers to:

- consider plausible explanatory pathways and mechanisms,
- measure as much relevant socioeconomic information as possible,
- specify the particular socioeconomic factors measured (rather than socioeconomic status overall), and
- consider systematically how potentially important unmeasured socioeconomic factors may affect conclusions.

2.2.2. Socioeconomic status of adolescents

There is ongoing discussion about the assignment of socioeconomic status to adolescents. Most assessments of social class and socioeconomic status in adolescents have focused on objective measurements based on the income, occupation and education of adolescents' parents (Rubin et al., 2014). This is the **social class of origin** or upbringing. The question to decide is at which age young people's own achieved socioeconomic group, or the **social class of destination**, can be regarded as having become important (Hasselberg & Laflamme, 2003). Glendinning et al. (1992 – cited in Rahkonen, Arber & Lahelma, 1995) argue that analyses based solely on measures of social class of origin fail to recognize the diversity of attitudes, behaviors, activities,

employment and education that exist amongst young people. A further problem with this approach is that adolescents often do not know the income, occupation and/or education of their parents. For example, one study found that 51% of respondents were unable to complete a family income measure (Jetten et al., 2008). Hence, references to parental income, occupation and/or education can lead to problems with missing data (Rubin et al., 2014; Shahabudin, Lee & Low, 2012).

In health research, Rahkonen (1993 – cited in Rahkonen, Arber & Lahelma, 1995) found that social class based on a young person's own occupation was more clearly associated with health than measures based on their class of origin, such as their father's or mother's occupation or education. And also in 1995, Rahkonen, Arber and Lahelma concluded that the association of class of destination and health among young adults was stronger than that of class of origin. Koivusilta, Rimpelä & Kautiainen (2006) again found that the strongest associations between social position and health were observed with the adolescent's personal social position. In their research, health differences were only partly identifiable by the traditional indicators of familial social position (father's or other guardian's occupation and education).

Hasselberg, Vaez and Laflamme (2005) divide young adult car drivers according to socioeconomic position of origin and according to socioeconomic position of destination. For socioeconomic position of origin, subjects from all socioeconomic groups except farmers have an excess risk of road-traffic crashes compared with drivers with intermediate and high-level salaried employees as parents. The results are even more evident for socioeconomic position of destination. Drivers with low educational attainment are at greater risk of severe injuries, and show excess risks of crashes of all kinds.

Class of origin and class of destination are sometimes linked, because social class of origin can be a major determinant of occupational attainment and entry into further education (Rahkonen, Arber & Lahelma, 1995). But this is not always the case. Power, Manor and Fox (1991 – cited in Rahkonen, Arber & Lahelma, 1995) found that young adults who were upwardly socially mobile were healthier than the group they had left and, conversely, those who were downward mobile were less healthy than the group they had left.

Rubin et al. (2014) extend the measurement of socioeconomic status of adolescents further by stressing the subjective nature and self-definitions of social class and socioeconomic status. They argue that the use of subjective, self-definitional measures of social class and socioeconomic status alongside more objective measures provide more direct assessments that relate to adolescents' self-definition, rather than to the characteristics of their parents, and are stronger predictors of some outcome variables. An example of a measuring tool for subjective social status is the MacArthur Scale of Subjective Social Status (Adler & Stewart, 2007). Participants indicate their position on a social ladder, based on their perception of income, education and occupational prestige in relation to other people in their country or on their perception of social standing in their subjectively defined community. In fact, this extension of measuring socioeconomic status not only pertains to adolescents, but is useful in older age classes too.

2.2.3. Levels of measurement of socioeconomic status

Social class and socioeconomic status can be conceptualized and measured on different levels: the individual, household and neighborhood or community level (Krieger, Williams & Moss, 1997). Krieger and Fee (1994 – cited in Williams & Collins, 1995) emphasize that in health research, social class should be measured at all three levels, because they provide divergent information. At the individual level, class-based (occupational) measures can capture exposure to occupational health risks. Household socioeconomic status measures can provide information regarding standards of living and cultural patterns. Community level measures of socioeconomic status can provide information about neighborhood-related conditions such as exposure to environmental hazards and levels of neighborhood violence.

a) Individual level

For measures of individual social class and socioeconomic status components, we refer to the definition paragraph (2.1.1) and to the paragraph where choice of socioeconomic characteristic is mentioned (2.2.1). Different characteristics (income, education, occupation, social class) and measurement issues are discussed there.

b) Household level

For the measurement of socioeconomic status on household level, the choice of characteristic remains the same as on the individual level. One can choose income, education or occupation, social class of the household and so on. There are some additional considerations when looking at households instead of individuals.

First of all, there is the measurement of household occupational class. Each individual in the household has an own relationship to the labor market as expressed in his or her work situation. The household's relationship to the consumption market is however determined by the joined occupational positions of all its members. If families have only one person in gainful employment, this person's work situation probably is a reasonably good indicator of the family's lifestyle and standard of living and of the family members' interests and life chances. It is much less evident that this is the case when both partners in a family occupy positions in the labor market (Sørensen, 1994).

In this case, the conventional approach to measure household occupational class is that married women are assigned their husband's class, while men, married or not, and single women, retain their own occupational class. One could alternatively measure household occupational class by equating household class with the most dominant and powerful individual class position in the household, regardless of gender. This is the dominance approach developed by Erikson (1984). The principle is based on assumptions concerning which categories of occupations have the greatest influence on the ideology, attitudes and consumption patterns of the family, and also which category is the most important for a child's life prospect. Erikson takes the dominant person to be whichever one has the job with the greater impact on the life chances of the family. A job requiring high qualifications dominates one requiring a low level of qualifications, and at the same qualification level non-manual occupations dominate manual. Professionals are highest ranked. The self-employed dominate the employed (except employed

professionals) and the employed dominate the unemployed. Among the self-employed, farmers dominate others (Östberg, 1997). Yet another approach is to classify households by the actual, and at times discordant, class and gender composition of the relevant heads of household. This is called the cross-class approach. In this approach, it has been most common to introduce husband's and wife's class as additive variables in statistical models of some outcome variable, but clearly it should be possible with interaction effects to identify combinations of classes that may be of particular interest, or to test specific hypotheses about the effect of class heterogeneity within families. Some attempts have been made to construct a single measure of the family's class position based on the joint classification of husband's and wife's class (Sørensen, 1994). Sørensen concludes that if the choice between measures is made on empirical grounds, the preferred measure will be that which shows the strongest association with indicators of the family's material conditions, lifestyle, interests and attitudes of its members.

Related to household income, Cubbin and Smith (2002) give some detailed instructions. They suggest to add wealth, measured by accumulated assets such as car and home ownership and/or the value of savings and investments, in addition to income, particularly because differences in injuries are much greater by wealth than they are by income. Furthermore, they suggest to measure income of a household as a percentage of the poverty level or dividing it by the family size supported on the income (income-to-needs ratio) to standardize the resources available by family size.

c) Neighborhood level

To improve validity of studies on neighborhood level, they should employ the smallest and most homogeneous defined regions feasible, in which populations are relatively homogenous with regard to social and economic characteristics (Krieger, Williams & Moss, 1997). Differences in estimates based on individual- and neighborhood-level data depend, in part, on the degree of socioeconomic heterogeneity in the specified neighborhood and thus the extent to which a summary measure of neighborhood conditions is meaningful.

Based on Krieger, Williams and Moss (1997) we can say that neighborhood measures of social class and other aspects of socioeconomic position merit greater use in public health research and surveillance, for several reasons:

- They characterize aspects of people's living conditions not captured by individual- or household-level measures, e.g. safety, pollution, overcrowding, infrastructure and traffic, playgrounds, access to services.
- Neighborhood-based socioeconomic measures can be used for persons of all ages, from infants to retired adults, and can be applied similarly to men and women.
- They may provide a more stable estimate of people's relevant economic circumstances, as compared to more volatile income data or more static measures of education.
- Perhaps most importantly, neighborhood-based measures permit the conduct of contextual analyses, thereby gaining insight into how social class, at multiple levels, shapes population patterns of health, disease and well-being.

Increasing evidence suggests that neighborhood-based measures of socioeconomic status are correlated with injury rates (Cubbin & Smith, 2002). L. Laflamme (personal communication, December 26, 2014) warns however that the results of neighborhood-based studies can be misleading to policymakers when directly transposed at the individual level.

A widely used general measure of poverty or affluence at area level is the Townsend Material Deprivation Index (Townsend, Phillimore & Beattie, 1988 – cited in Reading et al., 1999). It is a composite value made up by adding standard scores on four separate characteristics:

- the unemployment rate
- the proportions of households in overcrowded accommodation
- the proportions of households in accommodation not owned by the household
- the proportion of households not owning a car

The index ranges from negative values (indicating affluent populations) to positive values (for poorer populations). It has been shown to be strongly related to the health status of local populations (Morris & Carstairs, 1991 – cited in Reading et al., 1999).

For the construction of a deprivation index in major Spanish cities, Domínguez-Berjon et al. (2008 – cited in Nolasco et al., 2009) proposed the following indicators:

- Unemployment: percentage of people aged 16 years or over without a job (unemployed and those seeking work for the first time),
  with respect to the total economically active population
- Low educational level: percentage of people aged 16 years and over who cannot read or write; can read and write but have less than 5 years schooling; went to school for 5 years or more but did not complete basic compulsory education,
  with respect to the population aged 16 years and over
- Low educational level in young people: percentage of people aged between 16 and 29 years with low educational level,
  with respect to the population between 16 and 29 years
- Manual workers: percentage of people aged 16 years or over, employed in services, agriculture, fishing, craftwork, skilled workers in manufacturing industries, construction, mining, installations operators and non-skilled workers,
  with respect to the employed population aged 16 years or over
- Temporary workers: percentage of people aged 16 years or over, employed in temporary jobs (self-employed part-time workers, temporary workers),
  with respect to the employed population aged 16 years or over

Using these indicators, three socioeconomic statuses can be established: SES 1 (most privileged socioeconomic level) includes all areas in which the values of the 5 indicators are below the 25^{th} percentile and SES 3 (least privileged socioeconomic level) represents all areas in which these values are above the 75^{th} percentile; the remaining areas are included in SES 2 (intermediate socioeconomic level).

3. ASSOCIATION OF LOW SOCIOECONOMIC STATUS WITH ETHNIC MINORITY

3.1. Observations of association between socioeconomic status and ethnic minority

In many health or safety studies, the difficulty is to distinguish the effects of ethnicity from those of socioeconomic group (Bly, Jones & Christie, 2005). In particular it is difficult to disentangle the relationship between low socioeconomic status and ethnic minority status (Christie, 1995). There are observations of association between minority status and different characteristics of socioeconomic status.

- In Redelmeier et al. (2011), who studied immigrants in Canada, the largest single difference between recent immigrants and long-term residents was that the recent immigrants were more likely to have a lower socioeconomic status.
- Bos et al. (2004) and Stirbu et al. (2006), who investigated and measured the magnitude of ethnic differences in mortality for a broad range of injuries among different age groups and sexes in the Netherlands, found that all ethnic minorities (Antilleans/Arubans, Surinamese, Morrocans, Turkish) were more likely to live in poorer and more urbanized areas than the native Dutch population.
- In four cities in the southeastern USA, a much larger percentage of black drivers (43%) had economic worries than white drivers (20%) (Norris, Matthews and Riad, 2000).
- Persons of color are far more likely to live in socioeconomically disadvantaged areas compared to white persons (Cubbin & Smith, 2002).
- There is evidence that non-white individuals, at least in the United States, are more likely to be exposed to health-threatening environmental conditions than are white individuals (Evans & Kantrowitz, 2002).

The degree of association between ethnicity and socioeconomic status depends on the measure of socioeconomic status that is used. For example, ethnic differences in educational attainment have been narrowing (although educational attainment gaps persist), yet ethnic differences in wealth continue to widen (Oliver & Shapiro, 1997 – cited in LaVeist, 2005).

Socioeconomic differences between ethnic groups are largely responsible for the observed patterns of ethnic differences in health status and injuries (Williams & Collins, 1995; Thomson, Tolmie & Mamoon, 2001). In statistical analyses, the effect of socioeconomic status can nullify that of ethnicity.

- In the multivariate analysis that Cubbin, Leclere and Smith (2000a) performed, ethnicity differences were eliminated with the addition of socioeconomic status in the models for motor vehicle-related deaths.
- In Israel, among Jewish children injured in a road traffic accident between 1998 and 2002, 37% were injured as pedestrians. Among non-Jewish children, this percentage was 51. But among children from low socioeconomic status townships, the frequency of pedestrian injury was similar among Jewish and non-Jewish children (Savitsky et al., 2007).

But adjustment for socioeconomic status does not always eliminate ethnic differences in health (Cooper, 1993; Otten et al., 1990; Krieger & Fee, 1994 – all cited in Williams &

Collins, 1995). Specifically is observed that within each level of socioeconomic status blacks generally have worse health status than whites. This seems also the case for traffic injuries.

- In the USA, Braver (2003) found that adjusting for socioeconomic status eliminated the overall excess mortality risk among Hispanic men relative to whites, whereas the lower average socioeconomic status of blacks accounted for much, but not all, of their overall increase in death rates per unit of travel. Death rates among blacks with high school degrees or further education were lower than among blacks without high school degrees; however, relative to whites who had completed or gone beyond high school, blacks with similar educational attainment had excessive motor vehicle occupant mortality. Although lower belt use among blacks probably explained some of their increased occupant death rates, the magnitude of the decreased belt use was far smaller than the excess fatality risk observed among blacks.
- Steinbach et al. (2010) observed in London that black children had higher injury rates than white or Asian, and that living in less deprived areas did not protect black children from higher risk.

It may be that socioeconomic factors operate differently in different ethnic groups, or that other factors come into play to create additional risk for ethnic minorities (Thomson, Tolmie & Mamoon, 2001). Simple income or education categories probably do not capture all of the differential conditions that ethnic minority groups experience (Krieger et al., 1993 – cited in Kaufman, Cooper & McGee, 1997; Nazroo, 1998). And the categories that are commonly used as socioeconomic indicators are not always the most differentiating. For instance, ethnic differences in wealth (assets) are much larger than those for income. In studies of ethnic comparisons, measures of assets instead of income are necessary for the identification of the economic status of the household (Kessler and Neighbors, 1986). Furthermore, there is the failure of most studies to consider the effects of racism. We will take a closer look at that in the next paragraph.

3.2. Racism, discrimination and exclusion

The U.S. Department of Health and Human Services (2009 – cited in Centers for Disease Control and Prevention) assumes that certain groups of people (among others migrants or ethnic minorities) systematically experience greater social or economic obstacles to health, which stem from characteristics historically linked to discrimination or exclusion. In a discriminatory context one group benefits from dominating other groups, and defines itself and others through this domination and the possession of selective and arbitrary physical characteristics, for example skin color (Krieger, 2001 – cited in Solar & Irwin, 2007).

Besides the fact that migration per se, even under the best of conditions, involves a series of events that can be highly traumatizing and that can place migrants at risk (i.e. uprooting, being separated from family and traditional values, and being placed in new social and cultural situations), for many migrants social integration is rarely easy and for some impossible. Resistance to their presence – even when their work skills are needed – often places migrants on the periphery of society. Resistance to their participation in society results from language problems and culturally-defined behavior that often

reinforces stereotypes and prejudices. Not only are migrants themselves affected, but, in many situations, their children are also discriminated against (Carballo & Nerukar, 2001).

In societies marked by ethnic discrimination and exclusion, people's belonging to a marginalized ethnic group affects every aspect of their status, opportunities and trajectory throughout the life-course (Solar & Irwin, 2007). Discrimination is translated into fewer educational and occupational opportunities, lower income, poor housing, absent social networks, hostility between sections of communities and so on (Ahmad & Bradby, 2007; Amin, 2002; Davey Smith, 2000). Discrimination can transform social status such that socioeconomic status indicators are not equivalent across ethnic groups. In the USA, there are for instance large differences related to ethnicity in the quality of elementary and high school education, whites receive higher income returns from education than blacks and Hispanics (Kessler and Neighbors, 1986) and blacks experience higher levels of exposure to work-related hazards than whites in the same jobs (Davey Smith, 2000). Furthermore, discrimination can restrict access to the quantity and quality of health-related desirable services such as public education, health care, healthy housing and recreational facilities (Kessler and Neighbors, 1986). In this sense, discrimination affects health indirectly (Miles, 1989 – cited in Karlsen & Nazroo, 2002).

However, discrimination has also been shown to have direct consequences. The experienced oppression can become internalized and damage self-esteem (Karlsen & Nazroo, 2002), may induce psychological distress that may adversely affect physical and mental health status (Kessler and Neighbors, 1986), depriving people of aspirations and expectations (Ahmad & Bradby, 2007). Karlsen and Nazroo (2002) show that experienced harassment and the perception of civil servants to be discriminatory have independent effects on self-reported fair or poor health. This makes people also highly sensitive to poor social support and not being able to compensate for exclusionary attitudes of the majority through solid and safe networks (Carballo & Nerukar, 2001; Karlsen & Nazroo, 2002). Psychological distress can lead to apathy, but also to engagement in violence and addiction (Kessler and Neighbors, 1986). Studies of this phenomenon, carried out by the International Centre for Migration and Health in the European Union (Carballo & Nerukar, 2001), indicate that children of migrants may be at high risk for drug abuse because they use drugs to demonstrate their rejection of and exclusion from so-called mainstream society.

Karlsen and Nazroo (2002) conclude that we need measures that adequately account for the different forms of social disadvantage experienced by ethnic minority groups and that we also need to explore the various ways in which racism itself can impact on physical and mental health. Although few studies have attempted to explore the role of racism in the health experience of people from ethnic minority groups, this would appear to be an important aspect of their daily lives and one that needs to be incorporated into strategies to address ethnic differences in health.

3.3. Relevance in health research

The ways in which ethnicity potentially influences health outcomes theoretically relate to components such as nationality, country of origin of self and ancestors, or religion.

Ethnic differences in health could be construed as signs of genetic differences or behavioral choices. But what is more plausible for many health outcomes, is that they are related to the associations of ethnicity with socioeconomic factors and experiences of racism (Karlsen & Nazroo, 2002; Steinbach et al., 2010), as described in the previous paragraphs. In this sense, good socioeconomic data are powerful clues about how forms of discrimination and deprivation or disadvantage, past and present, harm health (Krieger, Williams & Moss, 1997; Williams, 1996 – cited in Oakes & Rossi, 2003).

All factors and characteristics mentioned in the present chapter are often correlated and difficult to disentangle. Correlational techniques cannot specify direction of causality, leaving the researcher at something of a loss in trying to determine what causes what in the chain of events. This in turn creates difficulty in deciding which risk factors to target through interventions, in what ways, and in what order of priority (Thomson, Tolmie & Mamoon, 2001).

The most common approach to dealing with the confounding of ethnicity and socioeconomic status is to use multivariate methods, such as multiple regression analysis. However, this approach can successfully address ethnicity and socioeconomic status confounding only if there is a sufficient sample of respondents in all comparative ethnicity/socioeconomic status groups (LaVeist, 2005). The author also gives the advice to use multiple measures of socioeconomic status, because each measure has some benefits, each has limitations as well. We mentioned this already in the choice of characteristic paragraph (2.2.1).

4. HEALTH

4.1. Determinants of health

Determinants of health (Dahlgren & Whitehead, 2006) are factors that influence health positively or negatively. **Positive health factors** contribute to the maintenance of health. **Protective factors** eliminate the risk of, or facilitate resistance to disease. **Risk factors** cause health problems and diseases and can be social, economic or associated with specific environmental or lifestyle-related health hazards.

4.1.1. Classifications of determinants of health

Authors classify the determinants of health in different ways. We listed some examples of classifications:

a) Dahlgren and Whitehead

For Dahlgren and Whitehead (2006) and Centers for Disease Control and Prevention, determinants are divided in:

- factors that can be influenced by political, commercial and individual decisions:
  - *Individual lifestyle factors*: alcohol use, smoking, physical activity
  - *Social and community networks*: peers and immediate community
  - *Living and working conditions*: work environment, education, agriculture and food production, unemployment, water and sanitation, access to and quality of health care services and health insurance, housing and crowding
  - *General socioeconomic, cultural and environmental conditions* that prevail in the overall society
- factors not open to influence by political or other types of policy:
  - *age*
  - *sex*
  - *genetic or constitutional factors*

Their model for describing health determinants emphasizes interactions: individual lifestyles are embedded in social norms and networks, and in living and working conditions, which in turn are related to the wider socioeconomic, cultural and environmental conditions. This is illustrated in Fig. 5.

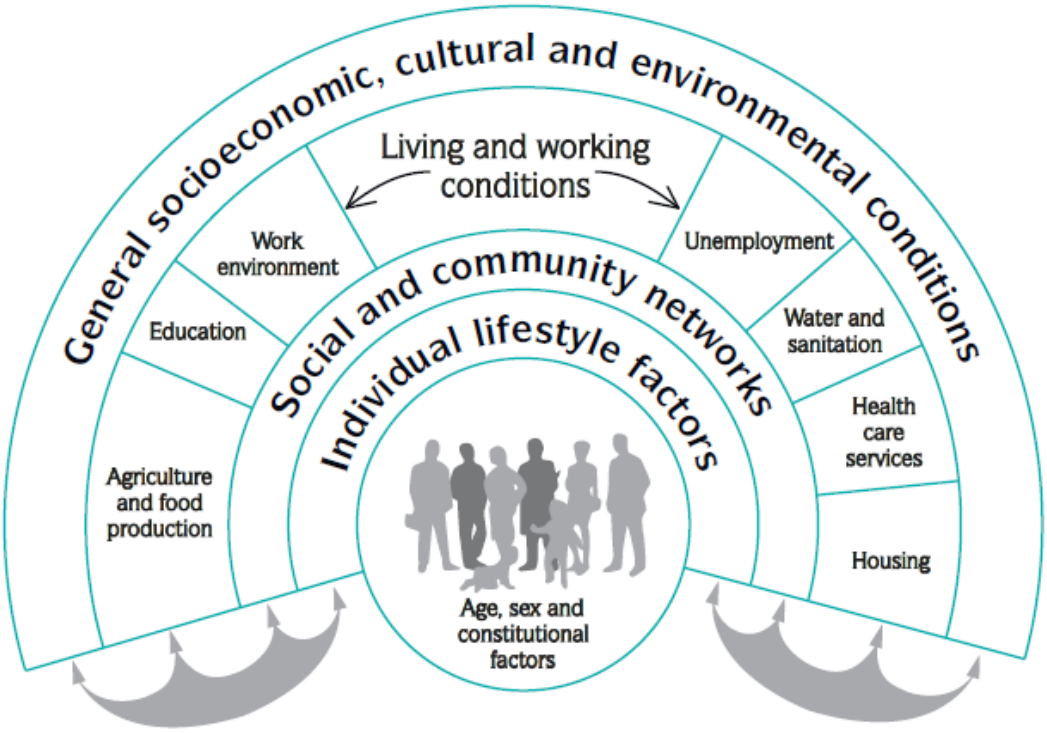

Fig. 5: The main determinants of health (Dahlgren & Whitehead, 2006)

b) Health Officers Council of British Columbia

The Health Officers Council of British Columbia (2008) uses a classification in upstream (economic policies and social stratification) and downstream (community and individual) factors that influence health. Upstream refers to the social, economic and political mechanisms which give rise to a set of socioeconomic positions, whereby populations are stratified according to education, occupation, income, gender and ethnicity. Downstream refers to the specific determinants of health which are shaped by the upstream socioeconomic positions.

Upstream factors are:

- *Macro-economic policies*: taxation, monetary and international trade policies
- *Culture, ethnicity and values*: e.g. traditional beliefs and practices
- *Governance*: form of government (e.g. parliamentary democracy), political values (e.g. welfare state) and control of corruption
- *Income*: affects the availability and quality of many health-influencing factors, including good food, shelter, education and health services
- *Social status*: level of control over life circumstances and discretion to act, which are key influences in people's health
- *Employment and working conditions*: adverse working conditions (e.g. exposure to hazards, lax safety standards, lack of control) can present health risks
- *Education and literacy*: result in health awareness, health literacy skills and socioeconomic status, all of which are related to health

- *Early childhood development*: care and cure in childhood can influence health in later life

Downstream factors are:

- *Physical (built) environments*: the distribution and quality of environmental factors (e.g. clean water, air and soil, housing) and supplies in the built environment (e.g. playgrounds, walking trails, sidewalks) affect health
- *Social support networks*: support from family, friends and community is associated with better health. The caring and respect that occurs in social relationships, and the resulting sense of satisfaction and wellbeing seem to act as a buffer against health problems
- *Social environments*: engagement with the social environment (e.g. as volunteers, as members of a community organization) helps to develop enhanced strategies to cope with changes and foster health
- *Access to effective health care services*: universally insured care, eye care, dentistry, mental health counseling and prescription drugs
- *Risk behaviors*: risky behaviors individuals engage in such as smoking, alcohol or drug use, poor dietary choices, physical inactivity, and risky sexual behavior
- *Personal health practices and coping skills*: actions by which individuals can prevent diseases and promote self-care, cope with challenges and develop self-reliance, solve problems and make choices that enhance health
- *Gender*: First of all gender has a biological influence on health. But there are also society-determined roles, personality traits, attitudes, behaviors, values, and the relative power and influence that society ascribes to the two sexes on a differential basis. 'Gendered' norms influence the health system's practices and priorities.
- *Biology and genetic endowment*: the basic biology and organizational make-up of the human body are a fundamental determinant of health

c) Macintyre, Ellaway and Cummins

Macintyre, Ellaway and Cummins (2002) suggest three categories of determinants of health which can be used in specific geographical locations:

- Compositional determinants, which draw attention to the *characteristics of individuals* concentrated in particular places
- Contextual determinants, which focus on *opportunity structures* in the local physical and social environment
- Collective determinants, which concentrate on *socio-cultural and historical features of communities*: shared norms, traditions, values and interests

Lu, Chiang and Lynch (2005) apply this categorization to traffic safety. High road traffic injury mortality in a country might be caused by a higher percentage of dangerous drivers (a compositional explanation), poorer road infrastructure or post-crash care (a contextual explanation) or lower standards of safety, e.g. less thorough policy implementation and enforcement (a collective explanation).

4.1.2. Individualistic or structural determination

Over the last several decades, epidemiological studies have been successful in identifying risk factors in health. A lot of this research has focused attention on risk factors that are relatively proximal causes of disease such as diet, cholesterol level, exercise, smoking, alcohol consumption (Link & Phelan, 1995; Frohlich, Ross & Richmond, 2006). Such individual lifestyle factors, in particular behavioral risk factors, are sometimes portrayed as freely chosen and, therefore, attributable to unhealthy individual choices (Dahlgren & Whitehead, 2006). Some authors however question the emphasis on such individually-based risk factors and argue that greater attention must be paid to basic social and structural conditions (e.g. Marmot, 2005). Cockerham (2005) for instance argues that the individualistic paradigm of health lifestyles is too narrow and unrealistic because it fails to consider structural influences on health lifestyle choices and social determination. Aspects such as material deprivation, adverse working and living conditions, environmental risks, behavior of others, early life-course have all an impact on people's behavioral possibilities and choices (Davey Smith, Blane & Bartley, 1994 – cited in Stronks et al., 1996; Kawachi, Subramanian & Almeida-Filho, 2002; Link & Phelan, 1995). The social and economic environments in which people live are of critical importance for shaping their lifestyles (Jarvis and Wardle, 1999 – cited in Dahlgren & Whitehead, 2006). Important determinants of health-related behavior are embedded in relationships that tie individuals to organizations, neighborhoods, families and friends in their community (Eng, Salmon & Mullan, 1992 – cited in Hartley, 2004). According to Kawachi, Subramanian and Almeida-Filho (2002), the weight of the empirical evidence in the health literature supports this social determinist's position.

Both positions, the individual and the structural, contain important determinants of health. Stronks et al. (1996) unite them, when they analyze three possible paths to health or disease, namely independent effects of behavioral factors, indirect effects of structural factors (through behavioral factors) and direct effects of structural factors on health. They conclude that if the indirect contribution of structural conditions through behavior is ignored, this could lead to an overestimation of the behavioral explanation. Cockerham (2005) presents a more elaborated health lifestyle model (Fig. 6) that accords individual and structural determinants a role that is consistent with their influence in the empirical world.

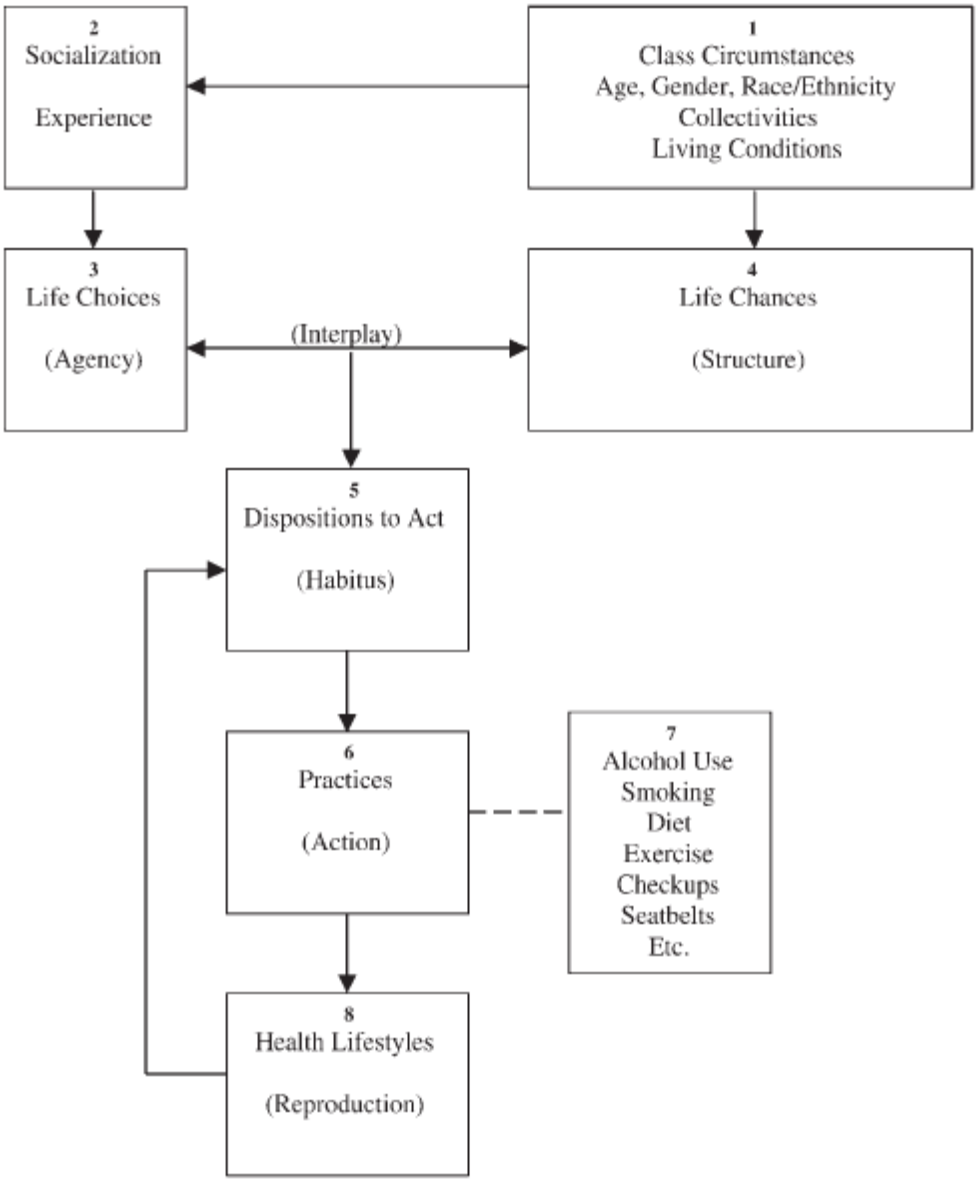

Fig. 6: Health Lifestyles Paradigm (Cockerham, 2005)

In this model **agency** refers to the capacity to choose behavior and make own life choices. **Structure** comes from four categories of structural variables: class circumstances; age, gender and ethnicity; collectivities (social relationships – kinship, work, religion, politics – with shared norms, values, ideals and social perspectives); and living conditions (quality of housing and access to basic utilities, neighborhood facilities and personal safety), which provide the social context for socialization and experience. These structural variables also collectively constitute life chances. Choices and chances interact and direct the formation of dispositions to act (**habitus**, habitual action that is intuitively followed and anticipated, a cognitive map or set of perceptions that routinely guides and evaluates a person's choices and options in particular social situations and settings), leading to practices like alcohol use, smoking, diet and other health-related actions. Health practices constitute patterns of health lifestyles, which in turn result in

reproduction (or modification or nullification) of practices through feedback to the habitus.

What we can learn from a model like this, is that both individual choice (agency) and structural determinants are equally important. There are times when structure outweighs but does not negate agency and other times when structure overwhelms agency, and these situations need to be included in concepts explaining health lifestyle practices. While agency is important, it is argued that structural conditions can act back on individuals and configure their lifestyle patterns in particular ways. Agency allows them to reject or modify these patterns, but structure limits the options that are available (Cockerham, 2005).

Without careful attention to both positions, individual and structural, we run the risk of imposing individually-based intervention strategies that are ineffective and of missing opportunities to adopt broad-based societal interventions that could produce substantial health benefits (Link & Phelan, 1995; Smedley & Syme, 2000 – cited in Health Officers Council of British Columbia, 2008).

4.1.3. Theory of Planned Behavior

When behavior is chosen and intentionally conducted, it becomes predictable. A commonly used framework to predict intentional health-related behaviors, is the Theory of Planned Behavior (Ajzen, 1985, 1991; Conner & Sparks, 2005 – cited in Ward, 2007). The original theory posits that behaviors are the result of intentions to act based on attitudes toward the object or outcome of that behavior as well as perceptions of control and subjective norms for the behavior (Ward, 2007). Later on, other variables that also influence intentions were added. This is illustrated in Fig. 7. One variable not included in the figure, but also important for intentions and behavior is risk perception (mentioned in paragraph 1.1.4). It might be included in the attitudes, or be added as a separate variable.

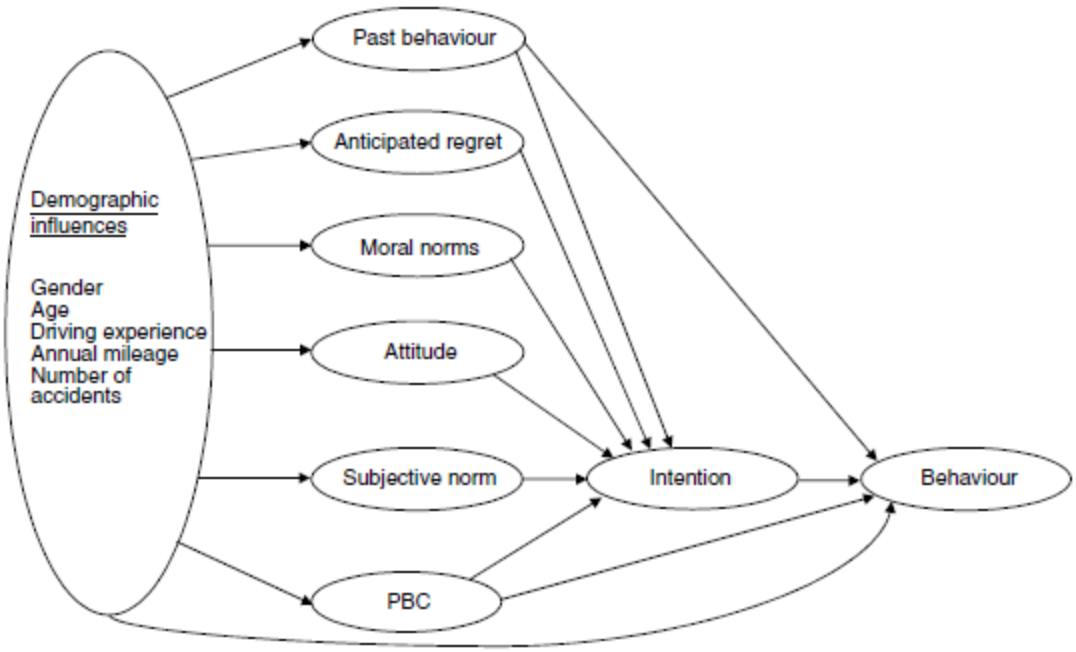

Fig. 7: The Theory of Planned Behavior and additional variables (Conner et al., 2007)

A considerable body of research supports the power of the Theory of Planned Behavior to predict intentions and behavior across a range of behaviors, including driving (Conner et al., 2007).

Ward (2007) uses the Theory of Planned Behavior for example to explain the higher incidence of fatal crashes in rural areas in America compared with urban areas. He states that many of these crashes result from the deliberate decision of the rural driver to take a risk (drinking and driving, speeding, seat belt non-use) despite perceiving a hazard and having the ability to be safe. In his study, Ward elaborates the Theory of Planned Behavior (Fig. 8) for the rural community by describing that community in terms of demography, personality and environment (in the left box), characteristics that underlie the rural traffic safety culture. That traffic safety culture is seen as a belief structure, which then fosters attitudes and driving behaviors that increase the risk of fatal crashes. The belief structure represents the perceived consequences of committing specific behavior (behavioral beliefs), expectations from significant others regarding commission of the behavior (normative beliefs) and the availability of resources to achieve the behavior (control beliefs).

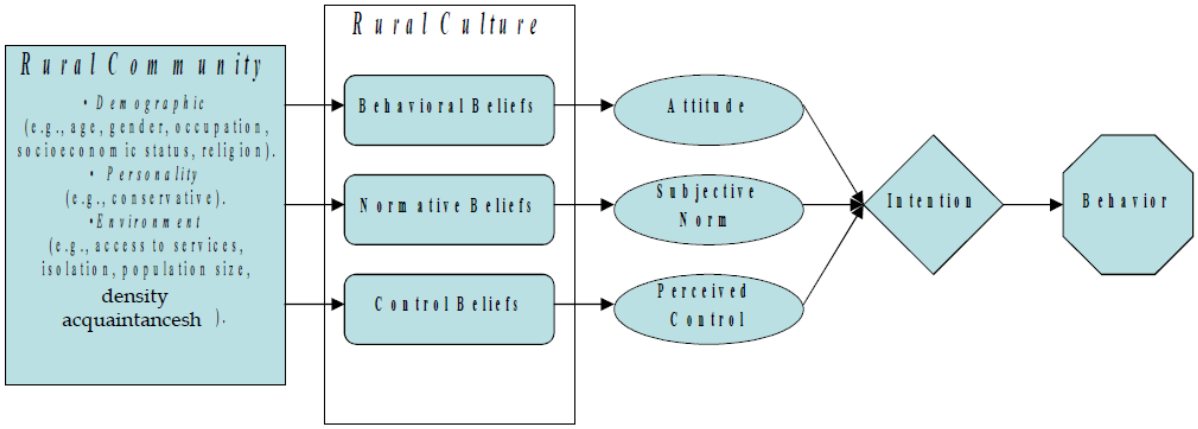

Fig. 8: Framework relating rural culture to traffic safety behaviors (Ward, 2007)

The description of the rural traffic culture as a behavioral and normative belief structure is in line with the statement of Özkan (2006) (mentioned in paragraph 1.1.4) that the centre of the mechanism of traffic culture in a country consists of rules, norms and values.

4.2. Socioeconomic and social gradient in health

The **socioeconomic gradient in health** (Kawachi, Subramanian & Almeida-Filho, 2002) refers to the worse health of those who are at a lower level of socioeconomic position – whether measured by income, occupational grade or educational attainment. The distribution of health is not bipolar (advantaged versus the rest) but graded, so that each change in the level of advantage or disadvantage is in general associated with a change in health (Blane, 1995). This inverse association between socioeconomic status and health status is robust, dates back to our earliest records and exists in all countries where it has been examined (Williams & Collins, 1995).

In rich countries with low levels of material deprivation the gradient changes the focus from absolute to relative deprivation (Wilkinson, 2005 – cited in Marmot, 2005). Relative deprivation refers to a broader approach to social functioning and meeting of human needs, to spiritual resources and psychological well-being. It is likely that material or physical needs as well as spiritual or psychosocial needs are important to the gradient in health (Marmot et al., 1997; Marmot, 2005). Therefore, we can use the term **social gradient** instead of socioeconomic gradient.

4.3. Determinants of the social gradient in health

4.3.1. Health determinants and determinants of the social gradient are not the same

The determinants of observed differences in health need to be understood before more effective policies can be formulated to construct remedies (Oakes & Rossi, 2003;

Shavers, 2007; Williams, 1990). Knowledge of the determinants of health (see paragraph 4.1.1) is necessary, but not sufficient for identifying and analyzing the determinants of the social gradient in health.

First of all, the determinants of the social gradient in health may be different from the determinants of health for the whole population (Dahlgren & Whitehead, 2006). It could be the case that the importance of determinants changes in different socioeconomic or social groups. Evidence suggests for instance that comparable stressful events have stronger negative effect on lower socioeconomic status persons than on those of higher status (Kessler, 1979). Secondly, the causes of disease and unhealthy behavior are probably inequitably distributed among the population (WHO, 2007 – cited in Health Officers Council of British Columbia, 2008; Williams & Collins, 1995; Frohlich, Ross & Richmond, 2006). Kim et al. (2000 – cited in Marmot, 2005) point for instance to the fact that relief of material deprivation in underdeveloped countries is not simply a technical matter of providing clean water or better medical care. Who gets these resources is socially determined. Thirdly, combinations of determinants may constitute mechanisms that operate in some population groups, while not in other. **Mechanisms** are the intervening variables (we would say: chains of variables) that link characteristics to outcomes (Reskin, 2003), in our case that link ethnicity, social and socioeconomic position of people to health outcomes. Possibly, there are different intervening mechanisms operating at different points in the social hierarchy: what explains the link between social position and health at the low end may not be the relevant explanatory factors at the high end (Marmot et al., 1997). In this respect, Sacker et al. (2001) found for instance there may be different pathways to health between people who are economically active and inactive. It may be important to analyze these groups separately to clarify the underlying mechanisms that generate the social gradient in health (Chandola et al., 2003).

In order to understand the determinants of the social gradient in health we thus have to focus on the distinct pathways and mechanisms by which the known health risk factors and risk conditions bring about differences in health that are observed at the population level within countries (Diderichsen, Evans & Whitehead, 2001 – cited in Dahlgren & Whitehead, 2006; Solar & Irwin, 2007). Kaplan and Lynch (1997, 2001) call this an epidemiology of everyday life, of those who have consistently low incomes, of those who have income reductions of 50% or more, of those with parents of low social class, of those who move on different occupational trajectories,… and an investigation of how these differences in the texture of everyday life translate into differences in health.

Conceptually, however, the determinants of overall population health have often been mixed up with the determinants of the social gradient in health, and both sets of determinants have been treated the same for policy considerations. The danger of such an approach is that the ensuing policy tends to be very general and is ineffective in reducing the health divide (Dahlgren & Whitehead, 2006). Numerous studies show that programs that do not set the reduction of social differences in health as an objective and only work with the general population (and the general determinants of health) almost always produce counter-productive effects. This has served the **inverse equity hypothesis**, whereby new interventions tend to increase inequities since they benefit in the first place those whose state of health is already better (Victora et al., 2000; Adler & Newman, 2002). The application of public health strategies in an undiscriminating

manner results in a potential enlargement of the gap in the health status among socioeconomic or social groups (Plasència & Borrell, 2001).

4.3.2. Mechanisms that determine social gradients in health

Following the above mentioned approach, several authors already identified mechanisms or pathways to differences in health within a country. We use the classification of Dahlgren and Whitehead (2006) to order them and add two mechanisms we found in other articles. We illustrate the classification with examples in the literature of the different mechanisms. Some examples were difficult to fit in the classification, because they involve more than one mechanism.

a) Different levels of power and resources

- Groups that are better off (defined by education, occupation or economic resources) typically have more power and opportunities to live a healthy life than groups that are less privileged. This is reflected in legal and institutional arrangements, as well as in political and market forces. The mechanism is usually stronger when the social divisions in society are wider (Dahlgren & Whitehead, 2006).
- Groups that are better off experience less adverse psychosocial effects of social position, less psychosocial stress (Dahlgren & Whitehead, 2006). Psychosocial stress can lead to ill-health through biological pathways (e.g. affecting the endocrine or immune system) and through behavioral pathways (e.g. inducing risk taking behavior) (Mackenbach, 2006).
- Frohlich, Ross & Richmond (2006) describe different levels of power and resources in the terms of Bourdieu (which we mentioned in the social class paragraph, 2.1.2): social class groups profit in a differential manner from unequal access to economic capital (money, time, wealth), cultural capital (knowledge, education, family background, history) and social capital (social networks, connections, institutional links). The authors suggest that when focusing on health differences, and the causes of these differences, power relations in the unequal distribution of resources (economic, cultural and social) are clearly implicated for much of these differences. The authors apply this to the Aboriginal people in Canada, which face sizeable differences in relation to other Canadians that extend across all health and social indicators. The Aboriginal population experiences fewer opportunities to participate in the workforce, evidenced by extremely high unemployment, social assistance and welfare rates. The lag in completion rates at all levels of education demonstrates a distinct disadvantage in terms of the opportunities that cultural capital could bring, whether this be in terms of reducing occupational opportunities and/or limiting access to information and resources that promote health. Insufficient housing and a lack of basic sanitary infrastructure all speak to a lack of economic capital. And finally, the family violence, suicide rates, social suffering and lack of control over land experienced across these

communities demonstrates a real constraint on Aboriginal people's ability to flourish and develop in happy, healthy environments.

b) Different levels of exposure to health hazards or risk factors (material, psychosocial and behavioral)

- The lower the social position, the greater the exposure to different health hazards (Dahlgren & Whitehead, 2006).
- People with the greatest access to resources have the best opportunities of avoiding risk, diseases and the negative consequences of poor health (Link & Phelan, 1995).
- Material deprivation means not only low income, but includes exposure to environmental toxicants (e.g. poor air quality, lead and other heavy metals), inadequate housing and homelessness, poor working conditions (e.g. injuries, toxic exposure) and inadequate access to healthy food and facilities for physical activity (Health Officers Council of British Columbia, 2008).
- Neighborhood socioeconomic context might affect health either directly, if simply living in a deprived neighborhood is deleterious to health, or indirectly through such mechanisms as the availability and accessibility of health services, healthy foods or recreational facilities, normative attitudes towards health and social support. Measures of neighborhood socioeconomic status can therefore be viewed as both proxies for unmeasured mechanisms or as actual exposures in their own right, or both (Pickett & Pearl, 2001; White, Raeside & Barker, 2000).
- Socioeconomic factors affect risk in the disadvantaged through increased exposure to hazardous environments, unsafe working practices, inadequate knowledge, risk taking behaviors, inability to pay for safety equipment and limited access to information and services (Towner, 2005 – cited in Sethi et al., 2006).
- Evans and Kantrowitz (2002) provide an overview of data indicating that income is inversely correlated with exposure to suboptimal environmental conditions (hazardous wastes, air pollution, ambient noise, residential crowding) and the physical quality of specific settings (housing quality, educational facilities, work environments, play areas). Each of these environmental factors, in turn, is linked to health and has effects on well-being.
- Tierney (1999) emphasizes the linkages that exist between imposition of risk and social power. In general, people of lower classes are the most likely to involuntarily face hazards. A look at toxic hazards for instance reveals how vulnerability is structured by ethnicity and political and economic power (Chavis & Lee, 1987). In many instances, toxic exposures proliferate in low-income and minority communities because residents cannot keep them out. Middle-class white homeowners have a long history of organizing politically to fight against threats. Since they have more political influence than less well-off and minority residents, they are more likely to prevail in conflicts over land use. Furthermore, minority and low-income residents may be more willing to tolerate the presence of noxious

facilities if they provide jobs. Mohai (1990) argues that African Americans are less likely to become actively involved in environmental movements. Reasons may include that those movements tend to be dominated by whites or that blacks decide to put their energies into other issues they define as more pressing. The role of the state in the creation and distribution of risks also needs to be given much greater emphasis. Some governments are only too willing to allow risks to be imposed on the poor for the benefit of elites (Tinker, 1984; Parker, 1992 – both cited in Tierney, 1999).

- Exposure to damaging agents in the environment, including lead, asbestos, carbon dioxide and industrial waste, varies with socioeconomic status. Those lower on the socioeconomic hierarchy are more likely to live and work in worse physical environments. Low socioeconomic status persons also experience greater residential crowding and noise. Effects of social environments, e.g. isolation and lack of engagement in social networks are also strong predictors of health. Access to, use of and quality of health care vary by socioeconomic status. More than 60 percent of the American uninsured are in low-income families (Monheit & Vistnes, 2000 – cited in Adler & Newman, 2002). Persons who lack insurance receive less medical care, including screening and treatment, than those who are covered and may receive poorer-quality care. Even in countries that provide universal coverage, persons with less income and education do not use health services in the same way that their wealthier, better-educated peers do (Adler & Newman, 2002).

c) The same level of exposure leading to differential impacts

- An impact differential between social groups can be explained by differences in individual behavior and social support systems at work and at home (Dahlgren & Whitehead, 2006).
- Impact differentials may also be due to the greater likelihood of low-income groups being exposed simultaneously to several risk factors that reinforce each other, for instance the combination of economic stress due to low income, cramped housing accommodation, smoking and obesity (Dahlgren & Whitehead, 2006).
- Tierney (1999) also considers the unequal consequences hazards have for different segments of society. Frequently those most exposed, the minorities, are least able to cope with risk. In general, people who lack economic resource have the most difficulty recovering when disasters occur.
- The health system plays an important role in mediating the consequences of illness in people's lives. Social stratification determines differential access to and utilization of health care, with consequences for the differential promotion of health and well-being, disease prevention, and illness recovery and survival (Health Officers Council of British Columbia, 2008). Whitehead and Dahlgren (2006) differentiate between geographic access to health services (relates to the location and, therefore, physical availability of health services in different parts of a country), economic

access (relates to difficulty in paying for care and treatment), cultural access (relates to the experience of barriers to available services, shortcomings in the respect and dignity afforded to marginalized groups by health workers, language barriers and cultural practices, barriers between professional health workers and less educated patients, where health service providers lack an awareness and understanding of the day-to-day restrictions in the lives of patients living in hardship, differences in the attention that patients from less advantaged backgrounds receive, which leads to differences in the quality of care).

d) Differences in risk perception

- Cha (2000) reviewed cross-cultural studies of risk perception in countries in Europe, Asia and North America. These studies revealed certain cultural differences in risk perception of specific hazards (e.g. vehicle accidents) in samples of 65 students from Japan, Korea and the USA. These three different patterns of perceived accident risks might indicate systematic variation in safety behaviors and safety cultures across groups.
- People's perceptions on risk are shaped by the ways in which risk-related information is communicated to them (Tierney, 1999). Moreover, those perceptions are also influenced significantly by the trust people have in public and private organizations, including the producers of hazards, the organizations providing risk information and the organizations responsible for protecting the public (Freudenburg, 1993).

e) Life-course effects

- Many events early in life generate poor health later on (Dahlgren & Whitehead, 2006).
- There is a cumulative outcome of all the pathways above as they interact and operate over a lifetime (Dahlgren & Whitehead, 2006).
- Life course effects refer to how health status at any given age, for a given birth cohort, reflects not only contemporary conditions but embodiment of prior living circumstances, in utero onwards (Krieger, 2001). Three distinct pathways are hypothesized to be relevant to life course effects:
  - Latent effects by which the early life environment affects adult health independent of intervening experience (Marmot et al., 1997)
  - Pathway effects through which the early life environment sets individuals onto life trajectories that in turn affect health status over time (Marmot et al., 1997)
  - Cumulative effects whereby the intensity and duration of exposure to unfavorable environments adversely affects health status, according to a dose-response relation (Hertzman, 1999).
- There is growing evidence that socioeconomic circumstances in early life (and even during the lives of previous generations) can influence health in adulthood (Davey Smith, 2000).

f) Different social and economic effects of being sick, which are likely to result in a downward spiral that damages health further

- Poor health may have many adverse consequences for the life and livelihood of individuals: loss of earnings from employment, loss of a job altogether, social isolation or exclusion (Dahlgren & Whitehead, 2006).
- Sick people may face additional financial burdens (Dahlgren & Whitehead, 2006).
- Health determines social position, directly or indirectly (Bartley & Ferrie, 2001). The direct influence comprises the idea that people come to be unemployed, or remain unemployed, because of a disease. The indirect pathway suggests that people come to be unemployed because of a factor that also makes them more susceptible to illness or mortality. What the factor might be is seldom spelt out in exact terms. Candidates include depression or other psychological traits, such as low intelligence, or a set of attitudes such as fatalism.
- A growing number of studies suggest that although health-driven downward social mobility (in which a person descends on socioeconomic status as a result of sickness and inability to work) occurs, it makes only a minor contribution to socioeconomic status differences in health (Fox, Goldblatt & Jones, 1985; Power et al., 1990 and Wilkinson, 1986 – both cited in Williams & Collins, 1995).

g) Societal processes that underlie stratification

- To illustrate the totality of causes of social gradients in health, Solar and Irwin (2007) developed a framework, ranging from the societal context that underlies social stratification (governance, policies, culture and values), over the dimensions of social stratification (education, occupation, income, gender, ethnicity), until the conditions (material, behavioral, psychosocial) that cause health and sickness via the divers mechanisms we mentioned so far. The framework thereby has a place for all concepts that we discussed in the culture and socioeconomic chapters as well. Factors in the socioeconomic and political context, underlying social stratification, are seen as the root causes for social gradients in health. In this framework, large-scale societal factors are thus the primary determinants of health differences. They determine not only the social categories to which people are assigned but also their exposure to risk factors and resources (Williams & Collins, 1995).
- Evaluating the various social determinants of health frameworks that have been advanced over the past 30 or 40 years, Carlson, Ladd and Rajani (2011) chose the Solar and Irwin framework above other frameworks, because it differentiates structural (stratifying) from nonstructural (intermediary) determinants of health, thereby pointing to processes in society that lie deeper than, and are antecedent to the health-related behaviors often associated with social position. This has the advantage of directing attention to fundamental social structures and processes and

seeing them as relevant targets of prevention efforts, and as distinct from the various intermediary determinants. This is important because focusing on intermediary determinants alone can improve average health indicators but fail to reduce health gradients associated with socioeconomic position. By identifying the salient policy domains involved in these processes, the Solar and Irwin framework suggests where targeted policy interventions might make a difference to the stratifying processes that ultimately result in health differences.

- Williams, Lavizzo-Mourey & Warren (1994) indicate that the macro-social factors and racism are the basic causes of racial differences in health. The risk factors and resources are the surface causes, the current intervening mechanisms. These may change, but as long as the basic causes remain operative, the modification of surface causes alone will only lead to the emergence of new intervening mechanisms to maintain the same outcome.
- We are concerned with gradients in health because they are a component and a consequence of an inequitable capitalist society, and it is this that needs to be directly addressed (Nazroo, 1998).
- Social stratification mechanisms, joined to and influenced by the socioeconomic and political context can together be conceptualized as the social determinants of health differences. Associated with social stratification, there are differential exposures to disease-causing influences in early life, social and physical environments and work experiences. Depending on the nature of these influences, different groups will have different experiences of material conditions, behavioral options and psychosocial support, which make them more or less vulnerable to poor health (Health Officers Council of British Columbia, 2008).
- Societies structure the life experiences of their members so that advantages and disadvantages tend to cluster cross-sectional and accumulate longitudinally (Blane, 1995).
- There are forms of social influence – racism and its effects – that are experienced almost exclusively by members of minority ethnic groups and which influence health through several potential pathways, not exclusively socioeconomic disadvantages (Davey Smith, 2000).
- Processes at the societal level that produce differences at the individual level are difficult to measure at the individual level. Williams and Collins (1995) discuss the example of differential political power. Although there exist psychological measures of the degree of control that people have over their lives, the deficit of political power in the hands of ethnic minorities at the societal level is not a characteristic of the individual and could only be assessed in terms of indirect consequences at the individual level. Implementation in analyses at the individual level of an effect that occurs causally at the societal level can cause difficulties, no matter how refined the measures. What does not imply that we don't have to look for the best possible measurement.

4.3.3. Model of mechanisms

Diderichsen & Hallqvist (1998; Diderichsen et al., 2001 – both cited in Toivanen, 2007) introduced the following model (Fig. 9), in which several above mentioned mechanisms that play a role in generating health differences are embedded.

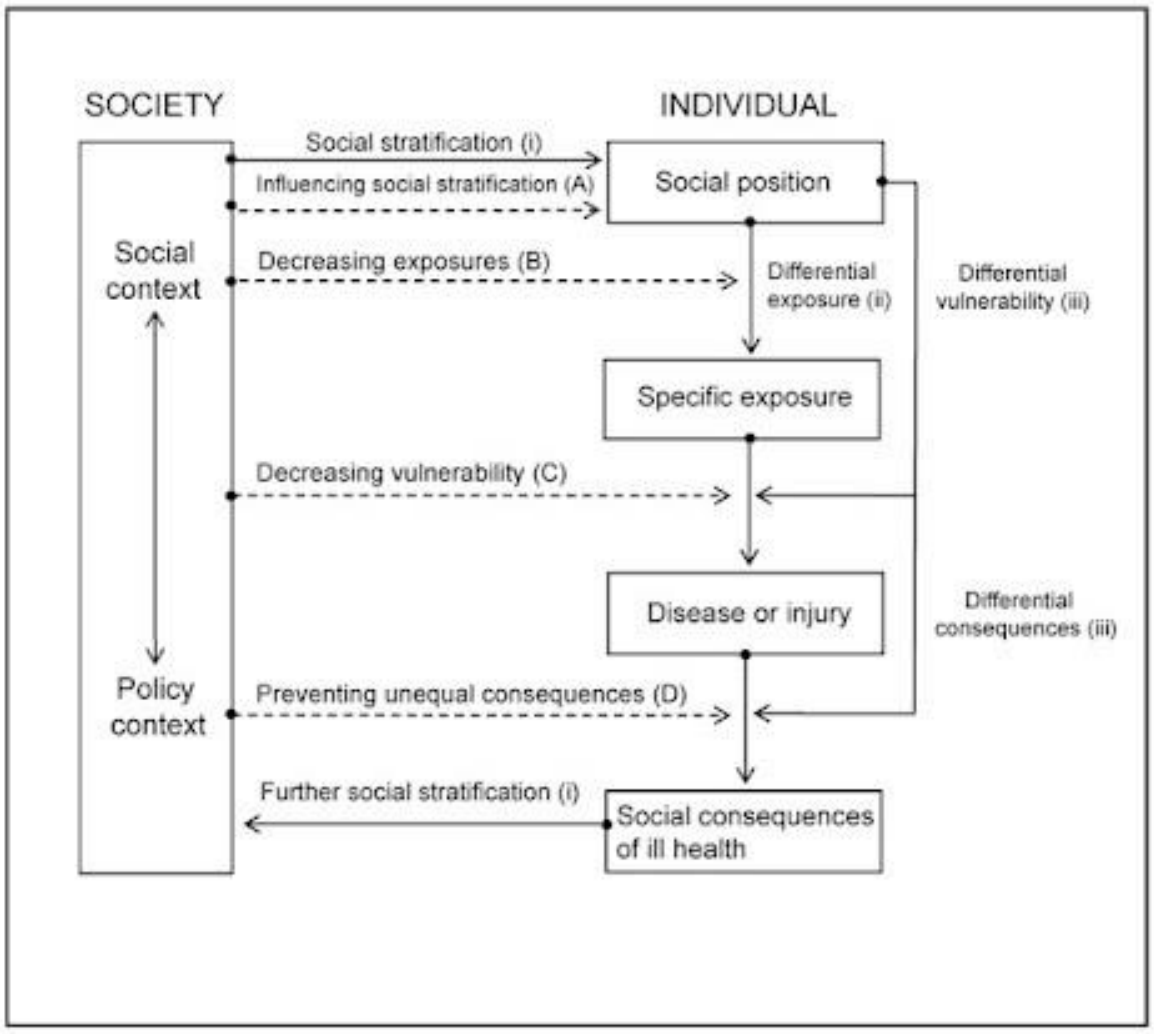

Fig. 9: Framework for the pathways from the social context to health outcomes and for introducing policy interventions (Diderichsen & Hallqvist, 1998 - in Toivanen, 2007)

I) Social stratification: power, wealth and risks are distributed along various dimensions of stratification such as educational system, occupational structure, income distribution, gender and ethnicity. Individuals are defined by their relationship to the social context and by their position in the stratification systems of a society.

II) Differential exposure: exposure to health hazards varies between social groups, and exposures seem to cluster within certain groups.

III) Differential vulnerability: social groups that are exposed to many risk factors may be more vulnerable to the effect of one specific risk factor than social groups that are exposed to fewer risk factors.

IV) Differential consequences: the consequences of ill health are more severe for disadvantaged social groups which have fewer resources for dealing with ill health.

(A) Modifying effect of social context and policy on social stratification

(B) Policies affecting differential exposure

(C) Policies affecting differential vulnerability

(D) Policies affecting differential social consequences of disease

I) Consequences of disease might also feed back into the causal pathway (Whitehead & Diderichsen, 2002)

5. DETERMINANTS AND MECHANISMS IN TRAFFIC SAFETY

Now we have described how determinants of health are classified, how differences in health take the form of socioeconomic and social gradients and via which mechanisms these gradients develop, we can pursue the same exercise concerning determinants and mechanisms in traffic safety. Doing so in this final chapter, we hope to find some answers to the original questions, formulated in the introduction of this report: why are people of different countries and cultures in a varying extent involved in traffic accidents and why are lower socioeconomic groups and ethnic minorities often significantly overrepresented in traffic accidents within a country?

5.1. Determinants of traffic safety

We start the search for determinants of traffic accidents with the well-known Haddon-matrix (Haddon, 1980) in which pre-crash, crash and post-crash general determinants of accidents and consequences are listed.

		FACTORS		
PHASE		HUMAN	VEHICLES AND EQUIPMENT	ENVIRONMENT
Pre-crash	Crash prevention	Information Attitudes Impairment Police enforcement	Roadworthiness Lighting Braking Handling Speed management	Road design and road layout Speed limits Pedestrian facilities
Crash	Injury prevention during the crash	Use of restraints Impairment	Occupant restraints Other safety devices Crash-protective design	Crash-protective roadside objects
Post-crash	Life sustaining	First-aid skill Access to medics	Ease of access Fire risk	Rescue facilities Congestion

Fig. 10: Haddon matrix (Peden et al., 2004)

This matrix encompasses determinants of traffic safety and determinants that decrease the severity of injury and diminish post-crash injury outcomes. Several examples are already in the matrix, for an extensive list of determinants we refer to Peden et al. (2004). Formulated in a negative way, for instance lack of enforcement, non-use of seat belt, absent pedestrian facilities, these determinants become risk factors for traffic accident involvement and severe consequences of accidents.

In order to highlight the cultural factors that are important in this report, we add two other models. The first is a model of accident prevention that Lund and Aarø (2004) propose. This model (Fig. 11) takes into account the wide range of human and structural factors that are present in the Haddon-matrix too, but add social norms and culture, concepts that are not explicitly mentioned in the Haddon-matrix. Attitudes, beliefs and behavior are classified by Lund and Aarø as human factors (as is done in the Haddon matrix), social norms and culture belong together with the physical and organizational surroundings to the environment.

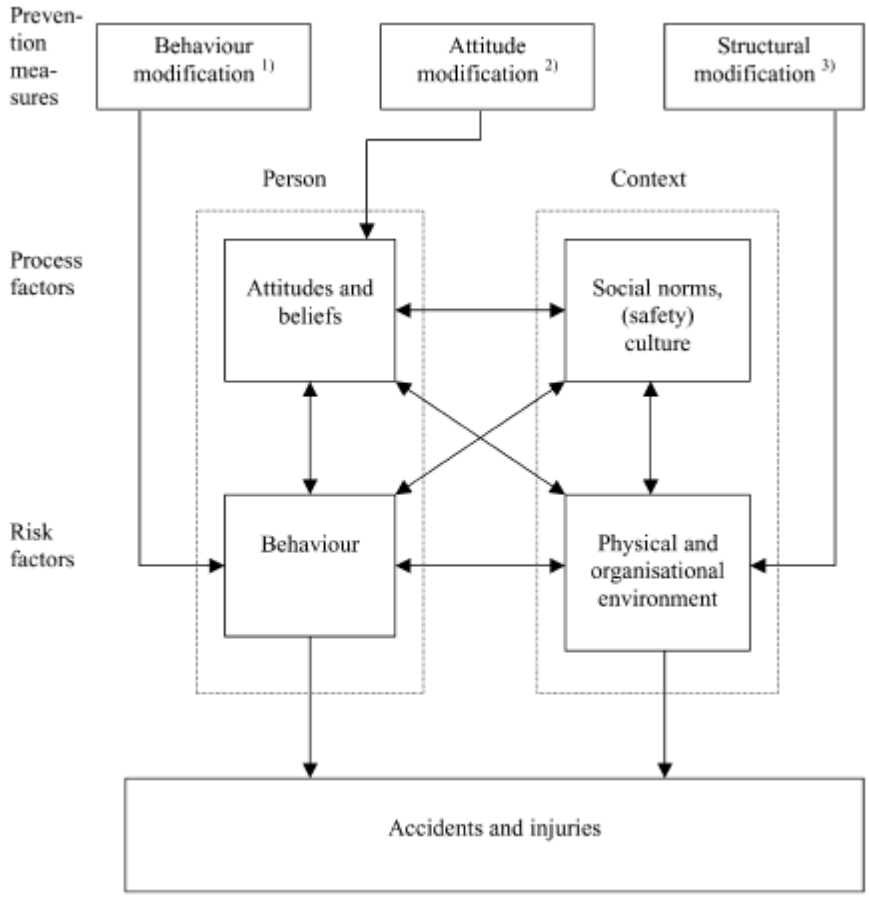

Fig. 11: A model for accident prevention (Lund & Aaro, 2004)

Another model is provided by Özkan (2006), who used a multi-level approach to investigate the differences between countries in traffic safety. He says he has developed a traffic culture framework, we would say it's an accident causation model in which traffic culture is elaborated. We could have included it in the road traffic culture paragraph (paragraph 1.1.4) but choose to include it in the present paragraph, because of the detailed description in it of environmental factors that determine traffic accidents.

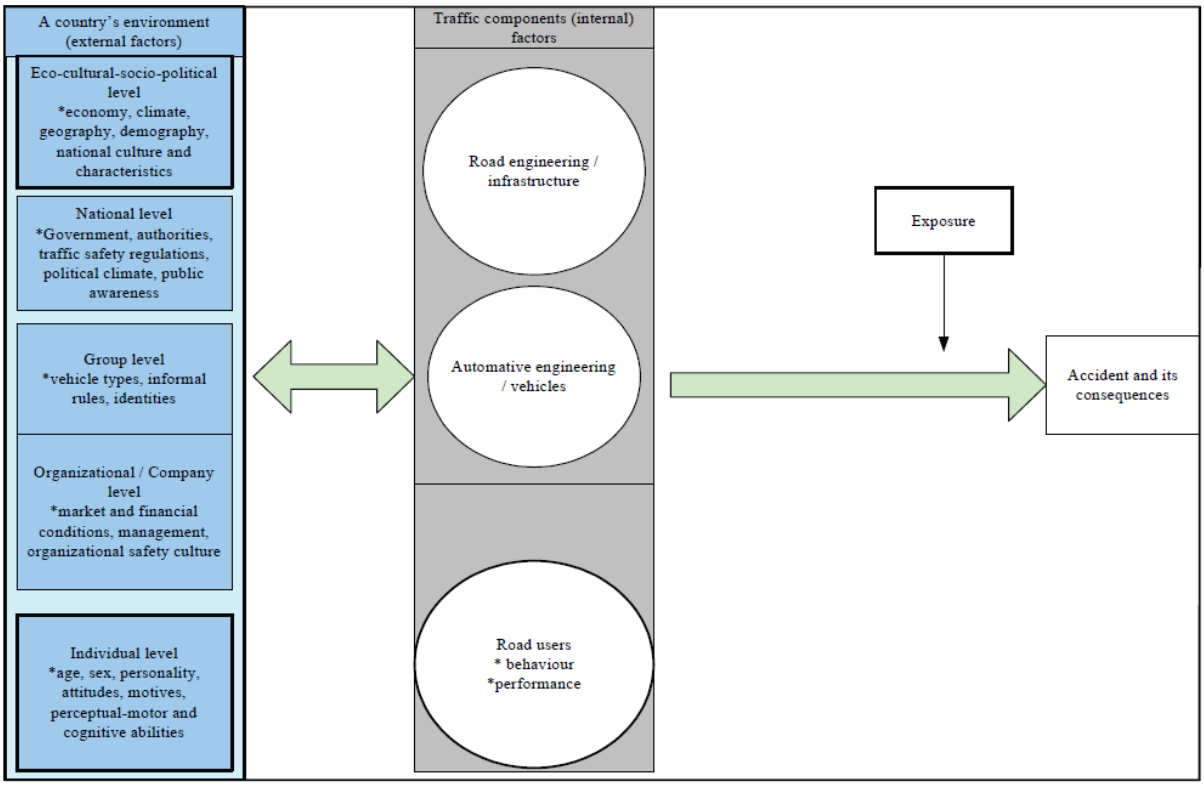

Fig. 12: A country's traffic culture (Ozkan, 2006)

Results of studies that Özkan conducted within this framework showed that economy and societal and cultural factors appeared to be important factors in the differences between countries in traffic safety. The full path from the societal and cultural factors to traffic accidents via behaviors and performance remained open at first. Investigation of these pathways is exactly what we need to get insight in traffic accident mechanisms.

5.2. Determinants of differences in accident involvement for different cultures and socioeconomic groups

5.2.1. Mechanisms of differences in accident involvement

Analogous to what we did for gradients in health (paragraph 4.3.2) we are now going to look for mechanisms that connect differences in culture and socioeconomic differences (and the interaction of these two) to differences in accident involvement. There is a link of mechanisms of accident involvement with the mechanisms of health (paragraph 4.3.2), i.e. some mechanisms of health can be applied to accident involvement too. There is also a link with the definitions and elaboration of the concepts of culture and socioeconomic characteristics of the first chapters (Chapter 1-3). In particular, the elaborations of culture and traffic culture in paragraph 1.2.1 already contain some of the mechanisms we are collecting in the present paragraph. This is also the case for the Theory of Planned Behavior, which we described in paragraph 4.1.3.

As mentioned for health, mechanisms are useful factors to consider when designing injury prevention programs or public policies. Recognition of the factors that mediate the relationship between culture, socioeconomic status and injuries might lead to effective measures to reduce differences in accident involvement (Cubbin & Smith, 2002).

Again, some examples we found were difficult to fit in the classification, because they involve several of the mechanisms.

a) Different power and resources

- Wealthy people can, to some extent, purchase safety and freedom from risk (Beck, 1992 – cited in Hasselberg & Laflamme, 2004). For example, safe vehicles are a matter of personal financial resources (Hasselberg & Laflamme, 2004).
- Deprivation (often associated with ethnicity) at household level can be associated with injury risk through lack of a car (Department for Transport, 2006 – cited in Steinbach et al., 2010) and by consequence being a vulnerable road user. Because car travel contributes to traffic volume it increases the pedestrian injury risk for those without access to a car. In this way, pedestrian injury might be viewed as a direct consequence of an unequal societal distribution of wealth (Macpherson, Roberts & Pless, 1998).
- Access to information varies by socioeconomic status. Without access to information and resources tailored to their needs, low socioeconomic status individuals are less likely to believe that injuries are preventable and also less likely to practice effective injury prevention measures (Cubbin & Smith, 2002).

b) Different levels of exposure to risk factors

- Ethnic minorities tend to live in more deprived areas, with poorer local road environments (Steinbach et al., 2010).
- Levels of exposure to traffic risks relate to the road environment (how many roads and junctions, the volume and speed of traffic) and to the individual (how often a person is on or near the road). The level of exposure is to some extent determined by the perceived dangerousness of the road environment (Steinbach et al., 2010).
- For child pedestrian injuries, an understanding of how pedestrian exposure to risk varies within and between populations may answer several of the most important etiological questions: why some population subgroups have higher injury rates than others, why injury rates vary between countries and why injury rates change over time (Roberts, 1995).
- According to Roberts, Norton and Taua (1996), it could be the case that socioeconomic, ethnic and international differences in injury rates can be explained in terms of variations in pedestrian exposure to risk. Therefore, they study Auckland data to examine how pedestrian exposure to risk varies within a population according to indices of material deprivation (car and home ownership) and ethnic group. Pedestrian exposure to risk is measured by the

number and type of streets crossed and whether the child was alone or accompanied. They find large differences in the number of streets crossed between ethnic groups and in relation to levels of car ownership. The results show a "dose response relation", with pedestrian exposure increasing as car ownership decreases. The results also indicate that ethnic differences in pedestrian exposure are not entirely attributable to differences in car ownership. Pacific Island children from families who do not own a car cross substantially more roads than do European children from families with no car. Pacific Island children are very much over-represented among the most disadvantaged groups in Auckland so that it is possible that there may be some residual confounding by factors related to socioeconomic deprivation, for example access to car travel with friends and relatives, distance to schools (housing situated close to schools may be more expensive), cultural differences in parental expectations.

- Posner et al. (2002) add that urban children participate in other activities in addition to street crossing that expose them to traffic and therefore place them at risk for traffic related injuries. The majority of injured children they interviewed routinely used the streets and sidewalks as play areas. Despite the large proportion of the streets crossed for the purpose of commuting to school, a relatively small proportion of the children were hit while walking to school. The remainder was injured either while playing outdoors or while walking to other places.
- Areas characterized by low socioeconomic status (which contain, for the most part, low socioeconomic status individuals) are more likely to expose their residents to increased hazards such as those related to traffic (increased traffic density and speed) (Cubbin & Smith, 2002).
- Several studies have examined the importance of the journey to and from school for children with respect to casualty rates. It is possible to identify various risk factors associated with the study sample. On journeys to school, children's exposure to injury risk varies with different social, economic and environmental conditions. Younger children have lower exposure levels to traffic than older children and a higher proportion of traffic accidents occur to older children on journeys to or from school. Children from deprived areas are exposed to greater risk than affluent children on journeys to or from school (White, Raeside & Barker, 2000).
- Income-related rates of child pedestrian injuries appear to be caused by differential exposure to street traffic, for example more streets to cross a day (Macpherson, Roberts & Pless, 1998).
- Rural residents have increased distances to travel (Cubbin & Smith, 2002), which means more exposure to accident risk.

c) Different consequences of risk exposure and traffic accidents

- Parents', carers' and communities' opportunity or ability to protect children from harm and children's opportunity or capacity to manage hazards are direct causes of injury in children (Towner et al., 2005). These opportunities or abilities may be culturally or socially determined.

- Rural residents have reduced access to quality trauma care, which may disproportionately affect the poor (Cubbin & Smith, 2002).
- Not all American regions have the same access to hospitals and care. The Indian Health Service only initiated an emergency medical system on Indian reservations in the 1980s. It takes about 10 years before such systems can be expected to reduce motor vehicle crash mortality (Nathens et al., 2000).

d) Differences in risk perception

- The concept of risk perception is thought to be important for traffic safety, because it may predict how drivers act out in traffic. It would be premature to conclude that the same perceptions of traffic risk persist among individuals in industrialized and developing countries, without conducting empirical examinations in both contexts (Nordfjærn & Rundmo, 2009). The results of such examination that these authors conducted indicate that Ghanaians perceive higher traffic risk than Norwegians, most notable for events which are potentially fatal and also associated with traffic as a pedestrian, bicyclist and passenger of a motor vehicle. A proposed explanation is that differences in the traffic environments and accident rates contribute to different levels of perceived traffic risk. The Ghanaian traffic environment is characterized by a considerably higher frequency of accidents and less regulation than in Norway. There are no clear defined traffic regulations in Ghana, road signs are rare and several areas lack explicitly defined speed limits, the law enforcement of traffic regulations is relatively scant and the separation between pedestrians, bicyclists and motor vehicles is poor. It could also be the case that the perceived risk in Ghana is not merely influenced by the specific traffic situation, but also related to the general danger and insecurity posed upon the individuals in their daily lives (Boholm, 1998).
- Sticher and Sheehan (2006) explain the higher incidence of road crashes in rural drivers partly by their inaccurate appraisal of risk factors associated with rural road crashes. Inaccurate information regarding crash risks could play a role.
- Hayakawa, Fischbeck and Fischhoff (2000a,b) give a good illustration of the fact that objective differences in risk environments combine with cultural influences to produce cross-national differences in risk perceptions. They examined cross-cultural differences (in Japan and the USA) of risk perceptions in the domain of traffic safety and applied this to insurance-purchasing decisions. Probably, it might also be applied to traffic behavior.

e) Societal processes that underlie traffic culture

- Macro level variables, such as political regime, urban planning, road design, regulations, population density, traffic volume and so on affect individuals directly and also constrain the choices they make (Diez-Roux, 1998). Only through international comparisons can these contextual road traffic injury risk factors in any one country be revealed. A better understanding of differences between countries could provide more information for injury prevention. Using

Borrell et al.'s data (2005), Lu, Chiang and Lynch (2005) even state that in explaining inequalities in road traffic injury mortality rates, social contextual differences between countries are more important than social group differences in any one country. This looks like the emphasis that health researchers put on societal processes for gradients in health, mentioned in the previous chapter (paragraph 4.3.2).

- Societal processes and institutions that underlie traffic culture are already described in the road traffic culture paragraph (paragraph 1.1.4). We mentioned there Quddus, Noland and Chin (2002), Moran, Baron-Epel and Assi (2010), Nordfjærn, Şimşekoğlu and Rundmo (2014), Ghaffar, Hyder and Masud (2004), Campos-Outcalt et al. (2003) to illustrate differences between road traffic cultures.
- The evaluation of safety actions by international comparison consists partly in evaluating the ability of a road safety policy of a country (safety actions, traffic safety policy) to be effective and the ability of a population of a country to accept and respect this policy (social acceptance) (Page, 2001).

f) Differences in the way belief systems (Theory of Planned Behavior) develop into behavior

- Lund and Rundmo (2009) point to differences across cultures in how important different factors of the Theory of Planned Behavior are for behavior. It is for instance possible that in different cultures the importance of attitudes for behavior is different or that the way intentions determine behavior is different.
- Lund (2006) showed that attitudes were an insignificant predictor of driver behavior in the Ghanaian public. She concluded that it is difficult to generalize the success of attitudes as a predictor of driver behavior to African countries and that it is important that more research examines whether peoples' behavior is controlled by the same determinants or whether the approaches that are applied in Western countries are culture specific.
- Attitudes to driving explain a significant proportion of variance in Norway, Russia and India, whereas this is not the case in low-income countries in Sub-Saharan Africa (Nordfjærn, Jørgensen & Rundmo, 2011).

g) Differences in symbol use, communication and expectations concerning the behavior of other drivers

- This mechanism refers to the elaboration of (traffic) culture as symbol exchange which we set out earlier (paragraph 1.2.1, d). Differences in communication are particularly relevant for drivers of foreign cultures driving in another than their home country.
- Leviäkangas (1998) mentions expectations concerning the behavior of other drivers as relevant for the higher accident involvement of foreign drivers in Finland, besides environment oriented factors (foreign traffic environment)

and other culture oriented factors. Such factors have their effect on the risk of the driver on top of the risk due to a foreign environment.

5.2.2. Models of mechanisms

We conclude this chapter with a few examples of models of accident involvement, in which several of the above mentioned mechanisms are described and investigated.

a) Social Accident Model

In the Social Accident Model (also called Social-Cultural Model) (Factor, Mahalel & Yair, 2007, 2008) every road user has a tool kit for the interpretation of the environment and for making decisions in a particular manner. It consists of social-cultural characteristics like cultural traits, norms, behavioral expectations, life styles and attitudes. The toolkit leads to specific risk taking levels and a specific degree of actual involvement in motor vehicle accidents.

Since different groups have unique cultural characteristics, which include a distinctive world view and ways of operating, the tool kits may cause drivers in different groups to interpret a given situation differently. Therefore, they possibly make conflicting decisions that may lead to road accidents.

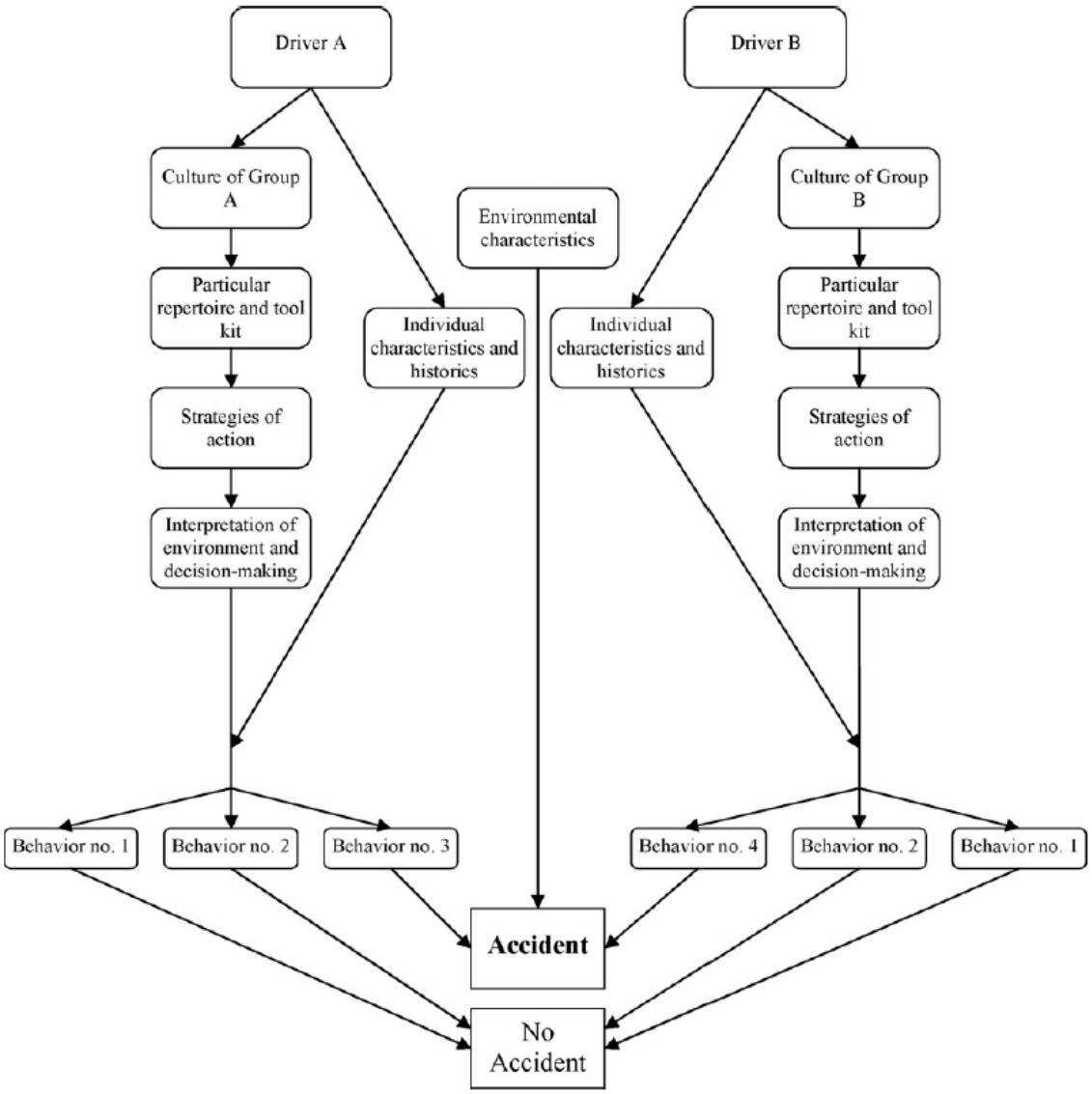

Fig. 13: The social accident mechanism (Factor, Mahalel & Yair, 2007)

It might be possible to gain an understanding of the cultural toolkit of different social groups through in-depth interviews or focus groups or through computer simulations (Factor, Mahalel & Yair, 2007). Asking drivers who were involved in collisions, about their decision making in the moments prior to the accident might also expose the influence of culture on decision making while driving (Factor, Yair & Mahalel, 2011).

b) Grounded theory and model of mechanism of unsafe driving in Arab villages and towns

To explain the unsafe driving behaviors of inhabitants of Arab villages and towns, Moran, Baron-Epel and Assi (2010) depart from these inhabitants underprivileged position in Israel. Arabs are described as a minority with a history of disadvantage in income, education and employment. To some extent, the Arabs in Israel suffer from prejudice and discrimination compared to the Jewish population.

The authors see various factors that contribute to unsafe driving behaviors in Arab villages and towns, situated at the individual, interpersonal, community and population level:

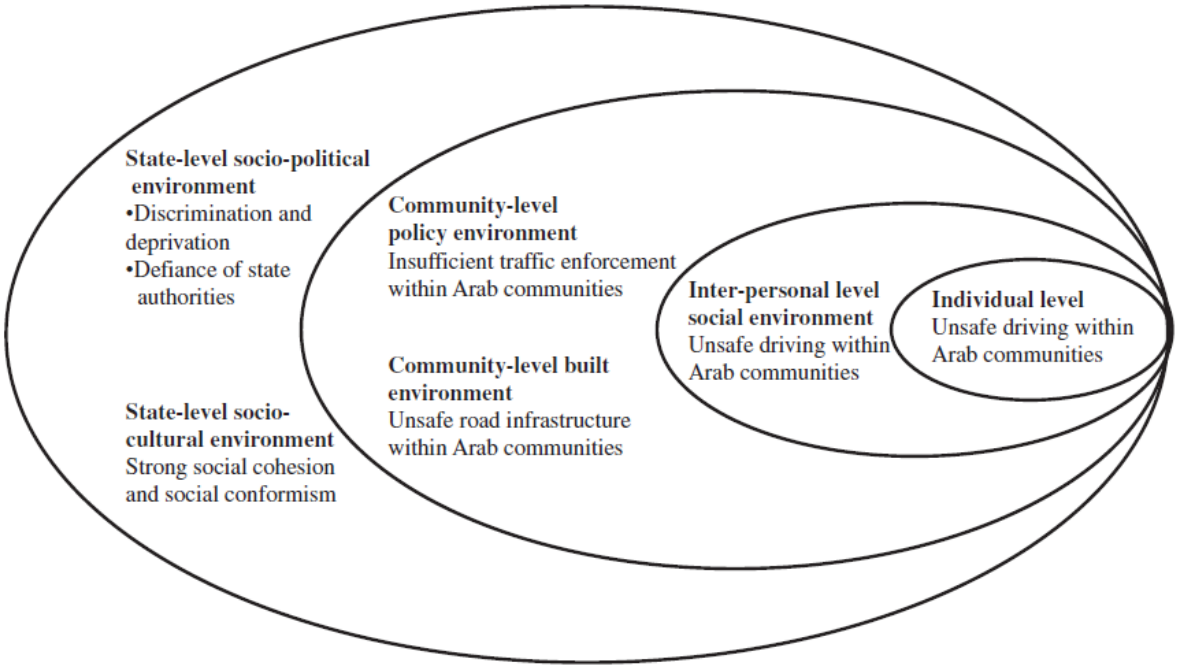

Fig. 14: Grounded theory model to explain the factors that contribute to unsafe driving behaviors in Arab communities (Moran, Baron-Epel & Assi, 2010)

To explain how these factors lead to unsafe driving behaviors and unsafe driving culture, the following model of mechanisms (Fig. 15) describes a negative feedback process in which the aforementioned factors interact via two main types of factors:

- factors at the community level and below that describe what is happening within Arab villages and towns
- factors at the state level that describe the situation of the Arab population as an ethnic minority in Israel.

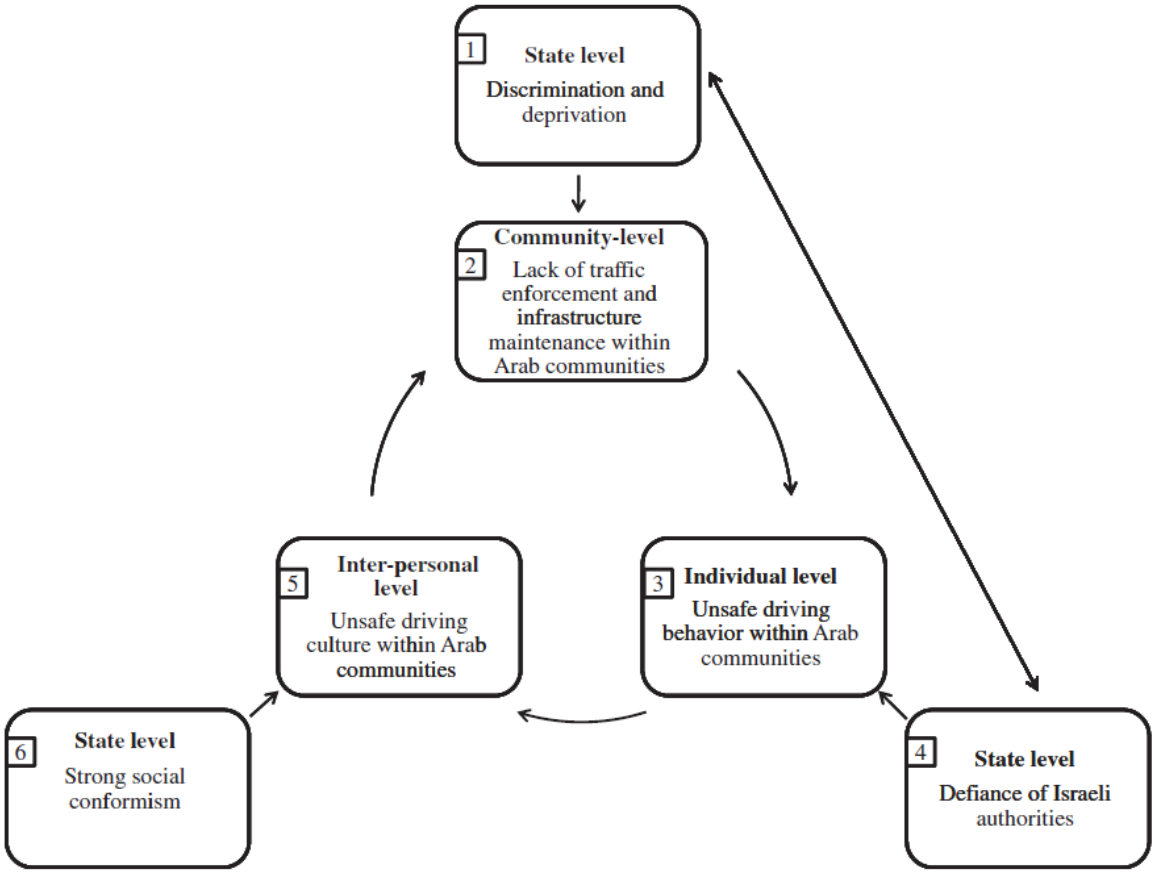

Fig. 15: Mechanism model to explain how factors at various levels contribute to unsafe driving culture within Arab communities (Moran, Baron-Epel & Assi, 2010)

According to the authors, the presented model can be taken in the context of minority populations and their relations with state authorities, and hence may be applicable to other minority populations in the world as well.

A similar model (Fig. 16) is proposed by Factor, Kawachi and Williams (2011) in the domain of health behaviors. They suggest that power relations within society, and the position of non-dominant groups, may encourage members of these groups to actively engage, consciously or unconsciously, in different everyday resistance behaviors. These acts include unhealthy behaviors (smoking, alcohol use and absence of weight control) and non-commitment to the country's laws (road safety regulations, age-related restrictions on smoking and alcohol use), which in turn result in higher rates of mortality and morbidity relative to the majority or dominant group. Because they include traffic behavior in the model and it resembles that of Moran, Baron-Epel and Assi, we present it here instead of in the health chapter.

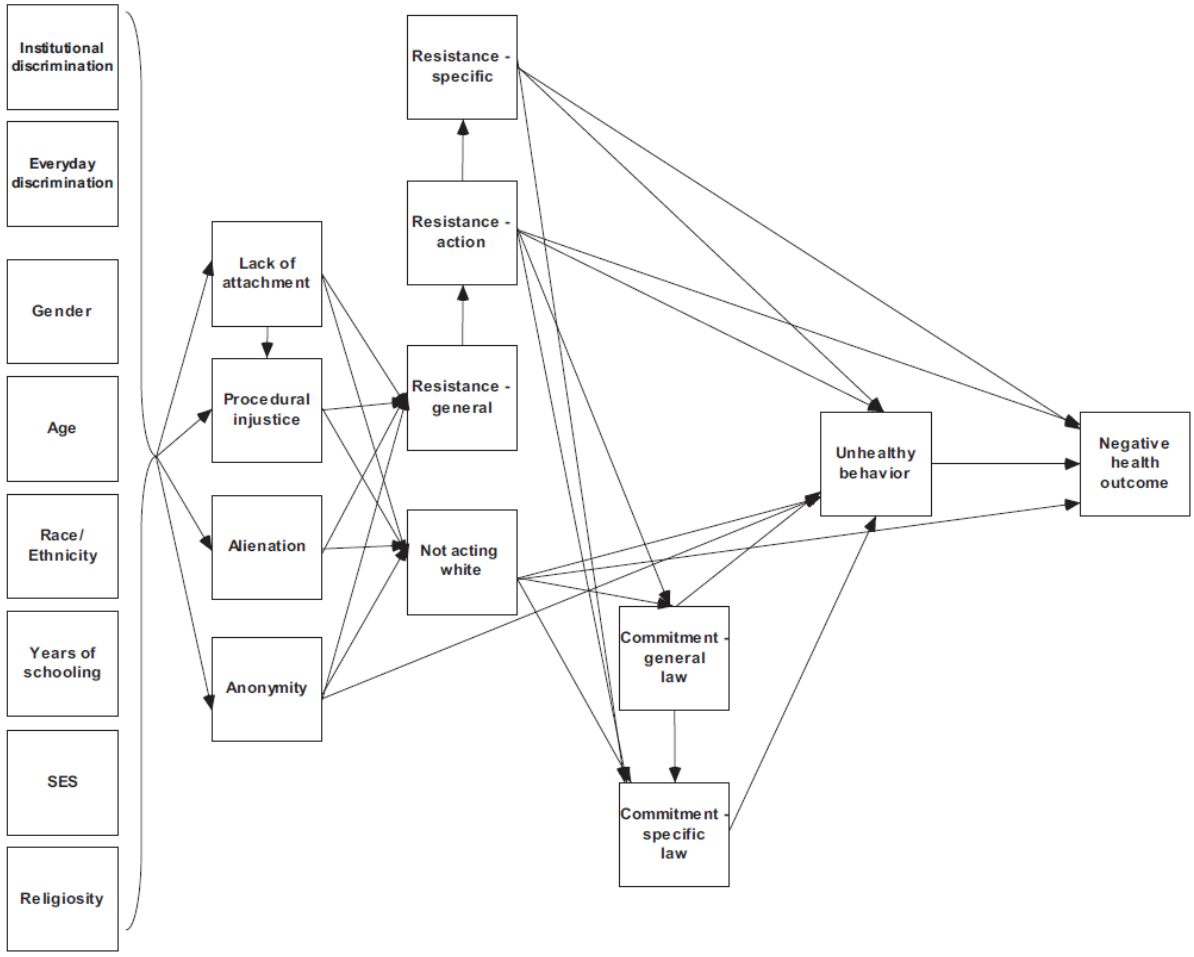

Fig. 16: Social resistance model for unhealthy behaviors among non-dominant minority groups (Factor, Kawachi & Williams, 2011)

As Moran, Baron-Epel and Assi did, the authors see this model as universally applicable. They state that minority-majority disparities in both high-risk behaviors and in health outcomes are remarkably common, despite differences in the genetic background of different non-dominant groups, and despite the heterogeneous historical contexts and events that led to their marginalization (e.g. through enslavement, colonization or immigration).

c) Model of causal pathways linking ethnicity to pedestrian injury risk

Steinbach et al. (2010) developed a model of causal pathways linking ethnicity to pedestrian injury risk.

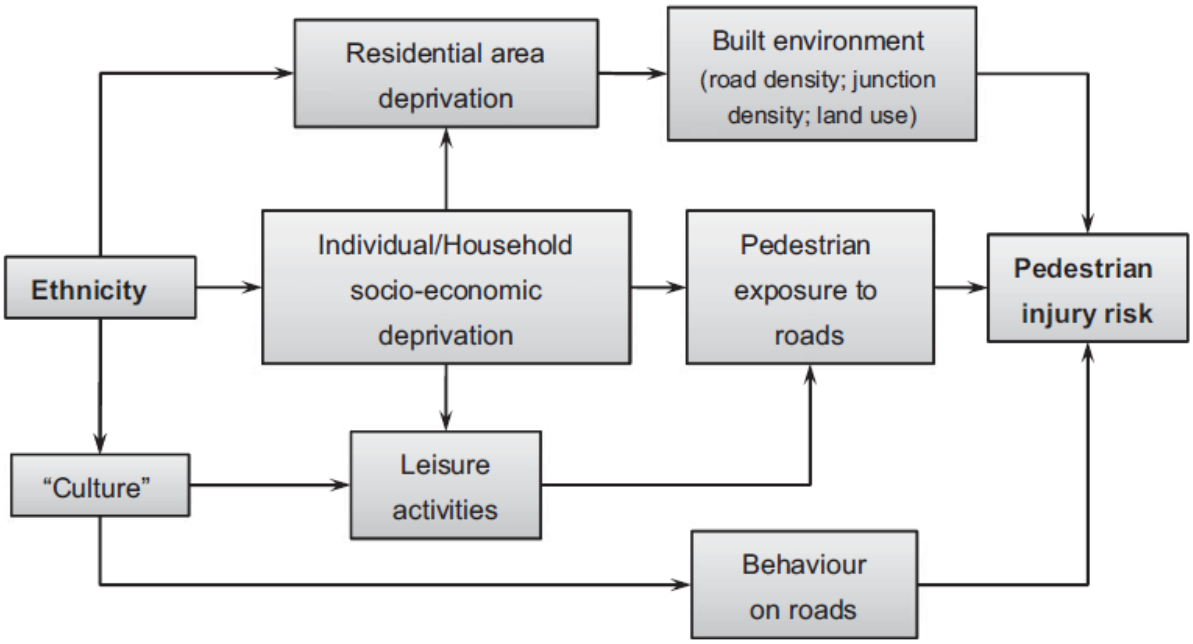

Fig. 17: Model of causal pathways linking ethnicity to pedestrian injury risk (Steinbach et al., 2010)

The determinants of the relative risk of being injured as a pedestrian include three factors: the road environment (how many roads and junctions, the volume and speed of traffic), an individual's exposure to that environment (how often they are on or near the road as a pedestrian) and their behavior on or near the roads. These three factors are interrelated, in that behavior and levels of exposure are to some extent determined by the perceived dangerousness of the road environment.

The authors see different possible pathways by which ethnicity might influence these variables:

- Ethnic minorities tend to live in more deprived areas, any difference found in pedestrian injury by ethnicity might simply be a reflection of area effects relating to local road environments (Edwards et al., 2008).
- Individual/household variables that vary across ethnic groups and are associated with injury risk as well are number of parents in the household (Reading et al., 1999; Haynes, Reading & Gale, 2003), employment status (Edwards et al., 2006), lack of a car (Department for Transport, 2006 – cited in Steinbach et al., 2010).
- Different ethnic identities may be associated with different attitudes to risk taking, which might influence road crossing behavior and consequently injury risk.
- Different ethnic identities may be associated with different preferences for leisure activities, such as those centered on outdoor, public space exposed to traffic risk.

d) Causal model for child pedestrian injury

Thomson, Tolmie & Mamoon (2001) studied child pedestrian injury in the United Kingdom. They took as point of departure those variables which are logically most proximal to child pedestrian accidents, i.e. those which define the nature of their encounters with traffic, and presented the following model:

$$\frac{\text{exposure (i.e., time spent on the street) } x \text{ degree of hazard presented by the environment;}}{\text{ability to deal appropriately with the hazard (traffic skill).}}$$

Fig. 18: Probability of an accident occurring to a given child (Thomson, Tolmie & Mamoon, 2001)

Many different factors can influence each of the three terms. At root anything that increases either of the numerators or decreases the denominator, will increase risk. Conversely, anything that works in the opposite direction will reduce risk. Concerning cultural differences in traffic vulnerability, they identify different processes that affect the numerators or denominator in a negative way for immigrant or minority status children, putting higher risks on these children.

CONCLUSIONS

Drafting this report, we have not only met the definitions of relevant concepts concerning accident involvement for different cultures and socioeconomic groups. We have also found many advices to take to heart when conducting research in that area:

- ✓ It is important to explicitly measure culture and ethnicity in cross-country and other studies, in order to be able to assess their influence and to find underlying mechanisms that explain the connection between culture and ethnicity on the one hand and traffic accidents on the other hand.
- ✓ We found several interesting frameworks containing a number of cultural dimensions that are useful to analyze different countries and to relate that analysis to safety culture.
- ✓ We found an example of elaboration of acculturation.
- ✓ We are made aware of the many possible indicators of socioeconomic position that can be used in health research.
- ✓ The choice of an indicator of socioeconomic status in health research should depend on how one assumes socioeconomic status is linked to health or injury differences. In the absence of a clear assumption of such link, using more than one measure may help to clarify the causal pathways by which social disadvantage leads to poorer health and injuries.
- ✓ Studying adolescents, it is important to distinguish between social class of origin and social class of destination. Social class of destination might provide results that are more relevant than that of class of origin.
- ✓ Social class and socioeconomic status can be conceptualized and measured on different levels: the individual, household and neighborhood or community level. In health research, they should be measured at all three levels, because the levels provide divergent information.
- ✓ Many health outcomes are related to the associations of ethnicity with socioeconomic factors and experiences of racism. It is difficult to disentangle these associations. The most common approach to dealing with the confounding of ethnicity and socioeconomic status is to use multivariate methods, such as multiple regression analysis, with a sufficient sample of respondents in all comparative ethnicity/socioeconomic status groups.
- ✓ Both individual choice and structural determinants are important to explain health and safety behaviors. Without careful attention to both positions, we run the risk of imposing individually-based intervention strategies that are insufficient and of missing opportunities to adopt broad-based societal interventions that could produce substantial health benefits.
- ✓ Our definition of road traffic culture, with emphasis on rules, norms and values, is well in line with the Theory of Planned Behavior. However, it is important to test the suitability of the theory in different cultures, because the mechanisms that are implied in it might not be applicable in all cultures.
- ✓ The socioeconomic gradient in health exists in all countries where it has been examined. Even in rich countries with low levels of material deprivation. For these countries we have to change the focus from absolute to relative (psychosocial) deprivation.

- ✓ We learnt that general health determinants and determinants of the social gradient in health are not the same and that it is important to take this distinction at heart in intervention programs.
- ✓ We have to look for methods to measure at the individual level processes at the societal level that produce differences at the individual level. Maybe focus groups are suited here?
- ✓ Several mechanisms that determine the social gradient in health were identified and illustrated. We can use them to find similar mechanisms in the field of traffic safety.
- ✓ Exploring these mechanisms, we can find answers to the questions why people of different countries and cultures are in a varying extent involved in traffic accidents and why lower socioeconomic groups and ethnic minorities are often significantly overrepresented in traffic accidents within a country.

We finally conclude that in order to find explanations for the differential accident involvement of different cultural and socioeconomic groups, we must look further than the proximal accident causes (e.g. speed, alcohol use,…) and look for mechanisms that underlie these proximal causes. And that we have to investigate how these mechanisms work in different cultures.

Reskin (2003) expresses the hope that via the systematic observation of how specific mechanisms in particular settings affect levels of specific outcomes, researchers can accumulate empirical knowledge and generalize it to more abstract mechanisms whose explanatory power extends beyond the settings they have studied. The more mechanisms are outlined and confirmed in different settings, the more we can try to remediate what goes wrong. And this serves the ultimate goal: to ensure that the injuries and risks, resulting from road transportation, are evenly distributed in the society (Plasènsia & Borrell, 2001).

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ACKNOWLEDGEMENTS

This study was realized in the context of the project INTRAS (INequalities in TRAffic Safety) within the scope of the research program BRAIN (Belgian Research Action through Interdisciplinary Networks) funded by the Federal Public Planning Service Science Policy.