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Section A

Road users' socio-economic status and road safety in Denmark

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Abstract

The goal of this study is to investigate if there specific socio-economic groups in Denmark which are at increased risk to be involved in road accidents. All Danish residents in year 2000 older than 15 years (4,297,373) were considered. Age, gender, income, education, origin and criminal history were chosen to represent the subjects' demographic and socio-economic characteristics, while involvement in road accidents during the study period was used to represent his/her accident risk. The accident risk (in terms of odds ratio, O.R. and number of accidents a person was involved in) was evaluated by logistic and Poisson regression. The highest odds for being involved in road accident were found among individuals with a criminal record: O.R.=3.9 (95% CI 3.6-4.2) for persons who committed only non-traffic law violations and O.R.=13.3 (95% CI 11.7-15.1) for people with both traffic and other laws violations as compared to the non-criminal group. Young age and being a male were also associated with higher odds to be involved in an accident, while the odds decreased with increasing of the education level. The origin of the person was found not to be significant. A decreasing of the average age with increasing of the number of accident a person was involved in was observed. The paper discusses the need of specific road safety interventions targeting high risk groups.

Keywords – accident risk, human factors, socio-economic groups, road accidents

1. Introduction

Road safety is often measured in terms of the number and the severity of road accidents. In the context of systems theory, a road accident is considered to be a result from the interaction between three main elements: the vehicle, the surroundings (road infrastructure, weather conditions, etc.) and the road user.

The vehicle and the road infrastructure are man-made and, at least in principle, fully controllable. They can be designed, built, adjusted and repaired in order to avoid accidents or reduce their severity; it might be costly, but it is doable.

The road user is by far the most important, complex and difficult element to deal with [26,32]. It is believed that human factors are contributing to about 95% of the accidents [27]. An accident might occur due to, for example: mistakes, momentarily lapses of attention, misjudgments, medical conditions (i.e. stroke), risky behavior (speeding, drink driving etc.) [1,2,13,14,23,34].

The main road safety goals when considering the human factor are to prevent human mistakes and risky behavior from occurring in traffic (let us call this active safety) and limit or mitigate their consequences (the so called this passive safety). An example of active safety is the codex of traffic laws and its enforcement, while air bags in cars are an example of passive safety.

This study considers the human factor in road accidents by analyzing the socio-economic background of people involved in road accidents in Denmark. The goal is to investigate if there are specific socio-economic groups, who are at increased risk to be involved in road accidents, thus specific measures could be suggested to target these groups. Of special interest are people with criminal behavior and individuals who were involved in more than one accident, since these two characteristics indicate propensity towards high accident liability [15,26,31].

2. Data

Initially, all individuals, older than 15 years of age, residing in Denmark in the period 1993-2003 were considered in this study, in total 5,072,871 individuals. The following information streaming from a number of national registers was used for each individual: age, gender, yearly personal income, education, origin, criminal records (if any) and involvement in road accidents. By "criminal record" here is meant any law violation registered during the year. No personal data (such as name, address etc.) were available, i.e. the subjects were completely anonymous.

Only road accidents with personal injuries registered by the police were used. It should be mentioned that the accidents registered by the police are the most severe, in which at least one person was injured. We did not have information on road accidents registered by other sources (for example insurance companies). Usually, these were less severe accidents (i.e. there were no injured people, but only material damages).

Some self-reported information on individual daily traveled distance and daily transportation time collected by the national travel surveys [6] was also available for a representative sample of the study population (varying between 9,000 and 16,000 in the different years; 15,300 in year 2000). Description of the national travel surveys can be found in [6].

The dataset containing all this information over 11 years was rather large, and its detailed analysis needed large computer capacity, which was not available at the time this study was performed. Thus, it was necessary to limit the size of the data set. Therefore, we chose to use data related to year 2000 only in the detailed analysis presented here. The choice of year 2000 is random, i.e. there were neither specific reasons nor particular road safety events related to this time period. There were 4,297,373 people older than 15 years of age residing in Denmark in year 2000; 15,300 persons (corresponding to 0.36% of all) of whom were interviewed for the national transport survey. Only for these persons, information on exposure to traffic (daily traveled distance, daily transportation time) was available.

In total 13,360 people (i.e. 0.31% of the study population) were involved in 7,346 road accidents with personal injuries recorded by the police in year 2000; 13,289 of these persons were involved in one, 70 (i.e., about 0.0016% of the population) were involved in two and one was involved in three accidents. As it can be seen, road accidents are rare events on population level; and very few people were involved in more than one accident during the year.

In the following sections are described the variables used in the analysis.

2.1. Variables representing demographic and socio-economic status

The following variables were chosen to describe the demographic and socio-economic characteristics of a given person: age, gender, personal income, education, origin and criminal records (if any). The studied population was divided into categories as follow:

Age: We used four age groups: 16-17, 18-24, 25-64 and 65+ years old.

Gender: Two categories: Male and Female

Education: Four education groups were used: Basic (i.e. the mandatory education in Denmark, minimum 9 years of schooling), Medium (i.e. high school, between 9 and 12 years of schooling in total), High education (i.e. college or university degree, usually takes more than 12 years of schooling in total) and Unknown (i.e. missing information on education).

Income: Three income categories were used: low, medium and high. In order to determine the categories we estimated first the mean yearly income for each age and gender groups. Then the categories were defined as follows:

- Low: income < 0.5 * mean
- Medium: 0.5 * mean <= income <= 2.0 *mean
- High: income > 2.0 * mean

Origin: The purpose of using this information was to account for potential differences in traffic culture between native people and foreigners. Three groups were used: Dane, foreigner (born outside Denmark and holding other than Danish citizenship), descendent (born in Denmark, who's both parents hold other than Danish citizenship).

Criminal history: It is assumed that people with criminal records exhibit risky behavior also in traffic and therefore have higher likelihood to be involved in a road accident. The population was divided into four groups according to its record of committed law violations: no law violation was recorded, only traffic laws violations recorded, only other than traffic laws violations recorded, both traffic and other laws violations were recorded.

2.2. Variables representing exposure to traffic

Among other factors, the probability of being involved into road accident is also a function of the exposure to traffic, for example, how long distance is traveled or how much time a person spends in traffic. (Obviously, if an individual stays only at home, the probability to come in a road accident is nearly 0.)

Detailed data on how much each person is exposed to traffic does not exist, but some self-reported data on the daily traveled distance (in km) and on the daily transportation time (in minutes) were collected by telephone interviews during the national travel surveys. Thus, exposure information on individual level is available only for very limited sub-set of the population (15,300 persons in year 2000).

Daily traveled distance: Three categories were used: short, medium and long. The categories were defined similarly to the income ones. First, for the persons for whom this information was available, the mean daily traveled distance was estimated for each age and gender groups. Then the categories were defined as follows:

- Short: daily traveled distance < 0.5 * mean
- Medium: 0.5*mean<=traveled distance<= 2.0 *mean
- Long: daily traveled distance > 2.0 * mean

Persons for whom this information was non available were assigned randomly to one of the three groups in a way to preserve the proportions between the groups observed among the interviewed.

Daily transportation time: Three categories were used: short, medium and long. The categories were defined in the same way as for daily traveled distance (see above).

2.3. Variables representing the accident risk

By "accident risk" here is denoted the probability to be involved into a road accident. In our study, the accident risk was represented in two ways:

- By a binary variable Y (with values 1 or 0) which represent the involvement in accidents. For each individual the number of involvement in road accidents during the study period was counted. If the person was involved in at least one accident during the year, the variable was set to 1, otherwise it was set to 0.
- By the number of accidents, n, a given person was involved during the study period.

At the present, the responsibility for the accident is not taken into account, neither the type of road user (driver, passenger etc.) nor the severity of the injury; only the probability of being involved into a road accident is modeled.

3. Statistical analysis

As already mentioned above, only persons older than 15 years, who can travel independently, are considered in this study. The underlying assumption is then, that each individual is equally exposed to road traffic, and therefore (at least in principle) each individual has the same probability to be involved in a road accident.

The purpose of the analysis conducted here is to determine if there are any differences in the accident risk among individuals belonging to different socio-economic groups.

Regression models are widely used to analyze the relation between given response Y, and a set of independent (the so-called predictors) variables, since these models are relatively simple and easy to interpret [12]. Regression analysis is aiming to explain as much variation as possible in the response variable by the set of the chosen predictors.

We used logistic regression to evaluate the accident risk (i.e. the probability to be involved in at least one road accident), Y, given a set of predictors X:

$$P = \text{Prob}\{Y=1 | X\}=[1 + \exp(-X\beta)]^{-1} \quad (1)$$

where

$$X\beta = \beta_0 + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 \; ... + X_\kappa\beta_\kappa \quad (2)$$

The regression coefficients, β_0, β_1, β_2.., β_κ, are estimated by the maximum likelihood method.

The set of predictors used here consist of the demographic (age, gender), the socio-economic (income, education, origin, criminal offences) and the exposure (daily traveled distance, daily transportation time) categorical variables described in the previous section.

In this model, the accident risk was modeled by the binary variable, Y, which was set to 1 if a given person was involved in at least one road accident; otherwise it was set to 0 (see section 2.3).

The logistic model was preferred here, because it is a direct probability model, which does not require assumptions about the distribution of the predictors [12].

Since the predictors used here are all categorical variables, the output of the logistic regression is better understood if (1) is transformed into a linear model in respect to $X\beta$ using the logit function:

$$\text{Logit}(P)=\log[P/(1-P)]= \alpha + X\beta = \alpha + X_1\beta_1 + \; ... + X_\kappa\beta_\kappa \quad (3)$$

where α is a constant (called also intercept).

In this way is obtained a linear regression model in the log odds that Y=1. The coefficient β_i is then giving the change in the log odds per unit change in X_i [12], the so-called odds ratio (O.R.).

The null hypothesis then can be written as:

$$H_o: \beta_i = 0, \text{ for } i = 1, 2, \ldots, k \quad (4)$$

i.e. no changes in the log odds of Y = 1 (accident risk) are observed when X_i changes.

The number of accidents in which a person was involved during the year is modeled by a Poisson regression:

$$Log(n) = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 \ldots + X_\kappa\beta_\kappa + \varepsilon \quad (5)$$

where n is the number of accidents a person is involved during the year. $X_1, \ldots, X_\kappa$ denote the independent variables mentioned before, α is a constant (the intercept) and $\beta_1, \ldots, \beta_\kappa$ are the regression coefficients. The same set of independent variables as in the logistic regression was used, but in the Poisson model they were treated as ordinal, not categorical variables. The regression coefficients then represent the change from the lowest to the highest value of given variable. The null hypothesis was again expressed by equation (4), i.e. the number of accidents is the same across the different levels of the independent variables. All calculations and analyses in this study were performed with the SAS software [28].

4. Results

In Table 1 are listed the average income (in Danish Crowns, DKK), the average daily traveled distance (in km) and the averaged daily transportation time (in minutes) by age and gender group in year 2000. The population distribution as well as the number of involved in road accidents for the different demographic and socio-economic groups is given in Table 2.

As a first step we attempted to build a regression model using only the 15,300 people participating in the national transportation survey, since exposure information was available only for them. But, when considering the number of categories of the independent variables (predictors), the data should be tabulated into 10,368 cells. When also the two categories for the response variable are taken into account, then the number of cell raises to 20,736 cells. Studies on the limiting sample size for regression models had shown that, for the fitted regression model to be reliable there should be at least 10 or 20 observations in each cell [12].

Tab. 1 - Mean income, daily traveled distance (in km) and transportation time for age group and gender

Age Group	Gender	Mean Income (DKK)	Mean daily traveled distance (in km)*	Mean daily transportation time (in minutes)*
16-17 y	Male	22,247	19	37
	Female	16,914	27	51
18-24 y	Male	123,436	40	53
	Female	99,129	30	49
25-64 y	Male	293,300	45	52
	Female	208,245	33	45
>=65 y	Male	166,924	21	32
	Female	124,921	14	24

*Data available for 15,300 persons

Tab. 2 - Population distribution and accident involvement
in the different demographic and socio-economic groups

Demographic and socio-economic group	Number of persons	Number of involved in road accidents
Age (4 groups)		
1: 16 – 17 years	109,469	445
2: 18 – 24 years	438,877	2,923
3: 25 – 64 years	2,957,486	8,767
4: >= 65 years	791,541	1,225
Gender (2 groups)		
1: Male	2,104,802	9,165
2: Female	2,192,571	4,195
Education (4 groups)		
1: Unknown (missing)	316,641	639
2: Basic (9 years of schooling)	1,488,866	5,835
3: Medium (9-12 years of schooling)	1,699,848	5,158
4: High (> 12 years of schooling)	792,018	1,728
Origin (3 groups)		
1: Dane	3,996,804	12,336
2: Foreigner	279,664	890
3: Descendent	20,905	134
Criminal record (4 groups)		
1: None	4,167,548	10,098
2: Only traffic law violations	80,907	2,377
3: Only other law violations	43,901	615
4: Both traffic and other violations	5,017	270
Income Groups (3 groups)		
1: Low (< 0.5 * mean)	702,992	2,421
2: Medium	3,376,100	10,208
3: High (> 2.0 * mean)	218,281	731

This means that in our case we should use at least 207,360 observations (i.e. individuals) in order to obtain a reasonable fit for the regression model. Therefore, a sample consisting only of the 15,300 persons participating in the national transport survey will produce only indicative results. That is why, the total sample, i.e. 4,297,373 observations were used in the regression models.

The results of the logistic regression are given in Table 3.

The global null hypothesis (all regression coefficients are 0, i.e. there are no any differences in the accident odds between the different groups) was rejected ($p < 0.0001$; Wald $\chi^2 = 16942$). The R^2 of the model was 0.003; the goodness-of-fit was evaluated by a Hosmer and Lemeshow [12] test ($\chi^2 = 38.2$, $p < 0.0001$).

Young people (under 25 years of age) had higher odds (20% for the 16-17 years group and 86% for the 18-24 years group) to be involved in accidents as compared to the reference group (25-64 years of age); while the seniors (age above 64) had about 40% lower odds then the reference group.

Males had 75% higher odds as compared to female group, when all other socio-economic conditions were similar.

The odds of being in an accident seem to decrease with increasing the education level.

Tab. 3 - Results of the logistic regression: Odds Ratios (O.R.) to be involved in an accident

Variable (p-value)	Odds Ratio (O.R.)	95% Confidence Interval
Age (p < 0.0001)		
16 – 17 years	1.20	1.08 - 1.32
18 – 24 years	1.86	1.78 - 1.95
25 – 64 years (reference)	1.00	---
>= 65 years	0.61	0.57 – 0.65
Gender (p < 0.0001)		
Male	1.75	1.69 – 1.82
Female (reference)	1.00	----
Education (p < 0.0001)		
Unknown	1.10	1.01 – 1.21
Basic	1.32	1.27 – 1.37
Medium (reference)	1.00	----
High	0.86	0.82 – 0.91
Origin (p = 0.07)		
Dane (reference)	1.00	----
Foreigner	0.93	0.86 – 1.00 *
Descendent	1.09	0.92 – 1.30 *
Criminal record (p < 0.0001)		
None (reference)	1.00	----
Only traffic law violations	9.53	9.1 – 10.0
Only other law violations	3.90	3.6 – 4.2
Both traffic and other violations	13.30	11.7 – 15.1
Income (p < 0.0001)		
Low	0.88	0.84 – 0.92
Medium (reference)	1.00	----
High	0.86	0.80 – 0.93
Daily Traveled distance (p = 0.69)		
Short	0.99	0.96 – 1.03 *
Medium (reference)	1.00	----
Large	1.02	0.96 – 1.08 *
Daily Transportation time (p = 0.54)		
Short	1.00	0.96 – 1.04 *
Medium (reference)	1.00	----
Large	1.03	0.98 – 1.08 *

* Non significant, since the confidence interval contains 1.0

People with only the Basic education level had about 32% higher odds than the reference group (Medium education level), while people with High education had about 14% lower odds compared to the reference group. Individuals with unknown education level had about 10% more chances to be involved in an accident than the reference group.

The origin of the individual was found to be non-significant (p=0.07) for the odds of being involved in a road accident. By far the most “dangerous” were the people who committed law violations. Individuals with only traffic law violations had more then 9 folded odds to be involved in an accident; persons with only other than traffic law violations had almost 4 times higher odds, while the “hard core” (i.e. individuals with both traffic and other law violations) had 13 times higher odds as compared to people who did not commit any law violations.

Tab. 4 - Results of the Poisson regression: number of accidents

Variable (p-value)	Regression coefficient [std.Err]	95% Wald Confidence Interval	χ2
Age ($p < 0.0001$)	-0.40 [0.01]	-0.42 ; -0.37	1004.3
Gender ($p < 0.0001$)	-0.64 [0.02]	-0.68 ; -0.61	1140.9
Education ($p < 0.0001$)	-0.12 [0.01]	-0.14 ; -0.09	106.4
Origin ($p = 0.02$)	-0.09 [0.03]	-0.14 ; -0.03	9.6
Criminal record ($p<0.001$)	1.01 [0.02]	0.98 ; 1.03	7212.1
Income ($p < 0.0001$)	0.14 [0.02]	0.10 ; 0.17	59.2
Daily Traveled Distance* ($p = 0.48$)	0.01 [0.02]	-0.01 ; 0.03	0.5
Daily Transportation Time* ($p = 0.45$)	0.01 [0.01]	-0.01 ; 0.04	0.6

* Non significant, since the confidence interval contains 0.0

Both the low and high income groups had a slightly smaller odds (12% and 14%, respectively) that the medium income one.

The daily traveled distance and the daily transportation time were found not to be significant ($p=0.69$ and $p=0.54$, respectively).

The very small number of persons (71) involved in more than 1 road accident during the year made it very difficult to obtain a reasonable fit for the Poisson regression model ($p = 1.0$). The results of the Poisson regression are given in Table 4, but given the small number (and therefore the large uncertainties in the model) they should be treated only as indicative.

The number of accidents a person was involved in decreased with increasing of the age and the education level, while it increased with increasing of the income. The largest coefficient is that related to criminal behavior, where the "hard core" (persons with both traffic and non-traffic law violations) is more likely to be involved in a large number of accidents. In general, the results of the Poisson regression are in good agreement with those of the logistic regression.

5. Discussions

In this study we have found that different socio-economic groups had different odds of being involved in road accidents.

For the first time, in our knowledge, an attempt is made to link information on a person's criminal history to road accident record on a population level.

Young people (under 25 years of age) had higher odds to be involved in road accidents as compare to the reference group (25-64 years old), which is in good agreement with previous studies [2,23]. The 16-17 years old group had 20%, while the 18-24 years old had 86% larger odds to be involved in road accidents.

Since the 1980's [9,10,11] the young road users were put in focus in Denmark. Many initiatives and programs were performed to target this group [9,10,11]. Despite the efforts, the group still shows higher odds to be involved in accidents as compared to other age groups. One of the possible explanations can be the lack of experience [16] and that the risk taking (as attitude trait) of young people is in general higher as compared to other age groups [24]. It might be also tentatively linked to a combination of psychological immaturity (according to Costa & McCrae (1990) [5], the personality of an individual stabilizes in the late 20-ies) and limited experience, especially for motor vehicle drivers [7,15,16,31]. A Spanish study among young drivers [18] had shown that the number and the type of accidents during the first year of driving were related to cognitive profiles measured before they got a driving license. However, the lack of data did not allow us to include driving experience in our models. In the future, studies linking measures of the psychological maturity of an individual to his/her accident propensity should be conducted to test the hypothesis of psychological immaturity. A possible road safety measure addressing the age-related accident risk could be to increase the legal age limit for driving license. However, more research is needed to address this issue.

We found that men had 75% higher accident risk than women. Many previous studies had shown that males are, in general, much more likely to have risky behavior [3,20,24] than women. Men are also found to be more prone to overrate their driving skills [29]. The road safety efforts in Denmark (mass media and educational campaigns, police enforcement, driving license courses, etc.) targeting risky behavior and risk-taking attitudes are, in general, directed to all residents, but nevertheless, the gender related difference in accident risk is persisting. Maybe, specific measures should be considered targeting men in particular. For example, it had been shown than improving of the driving education had a positive effect on accident risk [4,25]. Thus, gender-differentiated driving license courses might be introduced. Another possibility can be to consider the adoption of gender-differentiated age limits for driving license and/or road safety campaigns. However, further research is needed to address these topics.

A decrease of the odds to be involved in a road accident was observed with increase with the education level, when all other socio-economic and demographic conditions were similar. A longitudinal study among 241 individuals in Spain had shown that education level was a predictor for serious accidents [18]. For the moment we cannot give a plausible explanation for this finding. Maybe people with higher education are more aware of the dangers related to traffic. In our opinion, more studies, including in-depth interviews, are needed to find an appropriate explanation of this fact.

However, the most “risky” (or dangerous) group is that of people with criminal behavior. The odds of this group range from 3.9 to 13.3 (for people with “only” non-traffic law offenders to people with violations of both the traffic and other laws) as compared to individuals without any law violations. Previous studies had shown a relation between criminal tendencies and the involvement in road accidents [19,30,33]. In the future, it would be interesting to study if a further differentiation of the accident risk can be linked to the severity of the law violation(s). The group of people with criminal behavior most probably represents the so-called “hard core” group, i.e. people who do not respond to standard road safety measures, such as mass media campaigns, police enforcement etc. It is obvious that very specific efforts are needed in order to decrease the risky behavior in traffic of this group. An attempt on improving the driving attitude of criminals during their jail period gave positive results [26].

It was also found that the origin of the person is not a significant predictor for the individual’s accident risk. Thus, the hypothesis that foreigners might have different traffic culture (different driving style or attitudes in traffic for example) than the natives which might result in different accident risk was rejected. One possible explanation might be that when people move to live in another country, they very fast adapt to the native traffic culture, therefore no significant differences in their accident risk would be observed.

Surprisingly, the variables representing exposure (daily traveled distance and daily transportation time) were found non-significant. One explanation could be that, since this is self-reported information, the degree of imprecision might mask possible associations.

In addition, this information was available only for very limited number of persons (0.36% of the study population).

Our approach to randomly assign the persons for who this information was missing to given exposure group might not be the right way of dealing with this problem. Further efforts are needed to account for these data.

However, when considering the total number of accidents in a given country, Oppe [21,22], for example, had shown, that the number of accidents initially increases with the increasing of exposure, then it “flattens” and after that the accident number is starting to fall, despite the fact that exposure continues to increase. This might be explained by the fact that there is a kind of “learning curve” on a societal/nation level, i.e. the society is adapting by, for example, introducing new legislation, improving road & vehicle quality and design etc. in order to reduce the risk connected to the increased exposure to traffic. On individual level, which is the level considered in our study, the process is probably similar: some of the risk of a given person to be involved in road accident is compensated by the acquired experience gained by higher exposure to traffic. As mentioned, in our study we did not have good data on the individual exposure to traffic, thus we cannot categorically reject nor confirm the significance of exposure to traffic to the individual’s accident risk. Since only few people were involved into more than one accident during the year, it was not possible to study in detail this group. In order to collect more information about repeated involvement in accidents, a longer observation period should be used. The huge amount of information and the (for the moment) limited computer capacity did not allow us to build a model over the whole period (1993-2003) for which data are available.

We used logistic and Poisson regression models, which are commonly used for binary and count response variables, respectively [12]. These models were preferred here, because they do not require assumptions about the distribution of the predictors or of the mean [12,13].

The small R^2 value of our logistic regression model indicates that the chosen set of independent variables ‘explains’ only a small proportion of the variation. This is not surprising, since it is not possible to describe all the complexity of a human being by a limited set of variables. Additional information (such as car ownership, driving experience, traveled kilometers etc.) when available, could improve the model. It also should be stressed that the independent variables used here are neither an exact measure of individual’s socio-economic conditions nor do they fully characterize the intricate human attitude in the daily activities, including traffic. That is why we consider our regression models only as indicative and not as exhaustive models.

The strength of our study is the large sample size and the unique possibility to link personal information on socio-economic variables and on criminal behavior to road accident records on a population level. The main limitations are connected to the fact that some important data, especially those related to the individual’s exposure to traffic were non available. Another limitation is related to the degree of underreporting of road accidents. Here we used only accidents with personal injury registered by the police. We did not have data on accidents registered by other sources than the police. Thus the accidents used in our analysis might well be only the “top of the iceberg”. If the police records are supplemented with data from, for example, insurance companies, hospitals, etc., then (we believe) it might be possible to build a better model, especially for people who were involved in more than one accident.

We would like to stress again, that in our study we considered only the human factor in road accidents. Accident statistics by the type of road design & environment or other external conditions was out of the scope of this article. These statistics for Denmark are published regularly by the Danish Road Directorate (www.vd.dk) and Statistics Denmark (www.dst.dk).

Studies on factors contributing to road accidents had found that less than 10% of these factors can be attributed to road design and road environment, while more than 80% were related to the road user (human failures, mistakes, risky behavior etc., [25,17,8]). Thus, our hypothesis is that for a given road user, personality and behaviour in traffic are more significant as road accident risk factors than the exposure to traffic or the road environment. We would like to solicitate more studies on this topic.

6. Conclusion

In conclusion, we have found that people with different socio-economic background had different accident risk. We hope that the findings of this study could be used as the basis for further, more detailed investigations. Additional detailed information, especially on the individuals' exposure to traffic, is essential to be included in order to refine the regression models.

In addition, our results might help advocating for and promoting the design of specific road safety measures targeting the high-risk groups of the population.

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