Pictograms concerning driving-impairing medicines: preference and effectiveness

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Abstract

Background

Pictograms to communicate the risks of driving under the influence of medicines were developed and studies evaluating its effectiveness were conducted. However, most studies failed to compare similar pictograms and discarded the preferences of participants known to be prone to misunderstand pictogram’s messages.

Aims

To evaluate and compare the preference for and effectiveness of two pictograms (rating and triangle pictograms) in communicating risk, in terms of understanding and intention to change driving behaviour.

Methods

This study among 270 patients visiting a pharmacy involved a 2 (rating model pictogram versus triangle model pictogram) by 3 (categories of impairment: minor driving risk versus moderate driving risk versus severe driving risk) between-subjects design. Participants (n=30 per condition) were exposed to one of three conditions in which the risk message and the risk category (category 1, 2 or 3) were manipulated.

Results

The majority of participants preferred the rating model to express warning messages and levels of impairment. Older and lower educated participants showed less preference for the rating model. Participants related the rating model pictograms to risk significantly more often than the triangle pictograms. Those exposed to the triangle model overestimated the driving risk of the pictogram reflecting a minor risk for driving and underestimated the pictogram reflecting a severe risk. 78.8% of the participants reported they were likely to change their driving behaviour.

Discussion and conclusions

Despite not fully self-explanatory in conveying warnings and safety-related information, pictograms under assessment gave good insight on the different levels of driving risks, especially the rating model pictogram, as participants’ intention to change driving behaviour increased with higher risk categories. Pictograms should consider older and lower educated
adults’ preference into account in order to effectively reinforce written and oral information given to all patients by their healthcare professionals.

**Background**

In 2005, the European Union (EU) suggested the introduction of a compulsory and harmonised pictogram on medicines’ packaging for driving-impairing medicines. Some European countries already developed pictograms showing the potential risk of driving-impairing medicines but only in France and Spain the use of pictograms on the package of such medicines is legally binding. France is the only country where a 3-tier labelling system was developed and printed on the box of all medicines depending on their level of risk (category 1 to 3, Figure 1) (AFSSAPS. 2009, Orriols et al. 2010) which can be seen as an advantage when compared to other pictograms that make no distinction between different levels of risk. A new pictogram system (Figure 1) was developed within the European DRUID (DRiving Under the Influence of Drugs, medicines and alcohol) project (DRUID project. 2006) as a proposal to communicate the risk of driving under the influence of medicines to patients.

Despite the clear advantages associated to its use, pictograms are figures representing ideas and concepts which may not always be clear to all, affecting the comprehension of the message (Wolf et al. 2006, Davis et al. 2006). Older and low educated adults are recognized to be particularly vulnerable to misunderstandings and often times have difficulties interpreting the message being conveyed (Wolf et al. 2006, Davis et al. 2006).

![Figure 1 – Triangle model (developed in France) and rating model (developed within DRUID project). The 3 pictogram categories are displayed for both pictogram systems as well as the side-text.](image)

**Aims**
The aim of the this study was to evaluate and compare the effectiveness of the rating and
triangle model pictograms in communicating risk associated with driving-impairing medicines in terms of understanding, estimated level of driving risk and intention to change driving behaviour. Additionally, it was also investigated older and lower educated adults’ preference for the same pictograms.

**Methods**

**Study design**

This study among patients visiting a pharmacy involved a 2 (rating model pictogram versus triangle model pictogram) by 3 (categories of impairment: minor driving risk versus moderate driving risk versus severe driving risk) between-subjects design. Participants were exposed to one of three conditions in which the risk message and the risk category (category 1, 2 or 3) were manipulated. The structured experiment involved 270 participants visiting 1 out of 4 selected Dutch community pharmacies located in Groningen. Inclusion criteria were matched for participants 1) actively participating in traffic with motorized vehicles; 2) aged 18 years or older and 3) being able to speak and read Dutch. The interview was carried out in Dutch and participants were interviewed in the waiting area of the pharmacy by a research associate. Data-collection stopped once 270 participants were included.

**Measurements**

Understanding of the pictogram: First, respondents were asked to give their free interpretation of the pictogram they were exposed to. Respondents’ answers were categorized as 1) not correct (low level of understanding of the meaning of the pictogram) if answers were not traffic-related nor related to the category; 2) traffic-related answers but describing a different category than the one shown; 3) traffic-related answers without a reference to the risk mentioned by the risk category; and 4) fully correct (high level of understanding) whenever participants’ answer was traffic-related with a correct reference to the risk depicted by the pictogram category.

Evaluation of the pictograms: Respondents were asked to rate the pictogram on five items with a 7-point semantic differential scale which has been used in a previous study (van Weert et al. 2011). Items related to perceived ease (1=difficult; 7=easy), clarity (1=not clear; 7=clear), complexity (1=complex; 7=not complex), ease of understanding of the pictogram (1=difficult to understand; 7=easy to understand) and level of ambiguity (1=ambiguous; 7=not ambiguous) were used to estimate respondents’ overall evaluation of the pictograms. Cronbach’s alpha of the overall scale was 0.90.

Estimated level of driving risk: Respondents could select one of the options given by a 5-point Likert scale ranging from harmless (1) to very dangerous (5). The options were, thereafter, coupled with the categories of impairment as follows: Category 0: Likert scale option 1 and 2 = very safe and safe; Category 1: Likert scale option 3 = little danger; Category 2: Likert scale option 4 = dangerous; and Category 3: Likert option 5 = very dangerous. The questions on risk perception were developed specifically for this study.

Intention to change driving behaviour: To answer the question “how likely would you change your driving behaviour if this pictogram was affixed to your medicine box?” a 5-point Likert scale was used (1 = very unlikely to 5 = very likely). Participants were also asked how they would change their driving behaviour if a pictogram was shown on the medicine box.
Answers to this question were driving equally, slightly less often, less often, much less often, and not anymore.

Pictogram preference: The pictogram preference (triangle or rating model pictograms) was investigated by asking participants “which pictogram better expresses the warning message?”. Age and education level were the main independent variables.

**Results**

The total study population was equally distributed in terms of gender (N = 137; 50.7% males). The mean age of the participants was 48.4 years-old and almost half of the respondents had a university degree (N = 123; 45.6%).

*Understanding of the pictogram*

72.2% of the participants who were shown one of the triangle model pictograms (N = 90) did not make any reference to any category of impairment, against 46.7% and 36.0% of the respondents who looked at the rating model with and without side-text, respectively. The percentage of fully correct answers (traffic related with correct reference to categories of risk) was significantly higher with the rating model pictograms when compared to the triangle one (experiment 1; $\chi^2(3, N = 180) = 23.939, p < .001$). Age and education level did not statistically influence the interpretation of the pictograms (age; $\chi^2(6, N = 270) = 6.025, p = .420$ and education level; $\chi^2(6, N = 270) = 9.250, p = .160$).

*Evaluation of the Pictograms*

Respondents were asked to rate the pictograms in items related to perceived ease, clarity, complexity, ease of understanding of the pictogram and level of ambiguity. The mean evaluation scores for each pictogram system (rating model with side-text, triangle model and rating mode without side-text) were, respectively, 5.80 (s.d = 1.12), 5.55 (s.d = 1.12), and 5.76 (s.d = 1.25). Overall, the pictograms were evaluated in the same manner by respondents. Results showed no significant interaction effects between risk category and pictograms on the evaluation of the pictograms.

*Estimated Level of Driving Risk*

The overall estimated level of driving risk (1=harmless; 5=very dangerous) was not significantly different among the pictogram systems (F(2,267) = 0.029; p = .972, $\eta^2 < .001$ ). However, results showed a significant interaction effect between risk category (category 1 and 3) and pictograms (triangle model and rating model), F(1,116)=6.062, p=.015, $\eta^2$=0.05. There was no difference in estimated driving risk between category 1 and 3 of the triangle model. However, respondents exposed to category 1 of the rating model estimated a lower level of driving risk than those exposed to category 1 of the triangle model, while respondents exposed to category 3 of the rating model estimated a higher level of driving risk than those exposed to category 3 of the triangle model.

*Intention to Change Driving Behaviour*

Considering the intention to change driving behaviour, 78.8% (213 out of 270) of the respondents stated to be likely or very likely to change their behaviour, regardless the pictogram or the category presented. The intention to change driving behaviour (considering
all categories of risk) did not significantly differ among pictorial systems (\(F(2,267) = 1.443; p = .238, \eta^2 = .01\)). Results showed a significant interaction effect between risk category (category 1 and 3) and pictograms (triangle model and rating model), \(F(1,116)=9.288, p=.003, \eta^2=0.07\). This indicates that, similarly to the estimation of levels of driving risk, respondents exposed to the lower category of the rating model were less willing to change their driving behaviour as compared to respondents exposed to the same category of the triangle model. However, respondents exposed to category 3 of the rating model were more willing to change their driving behaviour as compared to respondents exposed to category 3 of the triangle model.

**Pictogram preference**

The percentage of participants preferring the rating model (201 out of 270; 74.4%) to express a warning message was significantly higher than those preferring the triangle model (69 out of 270; 25.6%), \(\chi^2(1,270)=12.6, p<.001\). Statistically significant differences between preference for one pictogram and age were found, \(F(2, 267)=6.39, p=.002\); older adults (>60 years old) were more likely to prefer the triangle model pictogram over the rating model. This group significantly differ from middle aged participants (\(p=.035\)) and younger participants (\(p=.002\)) which have shown preference for the rating model pictogram to express a warning message. Statistically significant differences were found, \(F(2,267)=4.67, p=0.01\) between pictogram preference and education level; participants with lower education were more likely to prefer the triangle model whereas participants with intermediate and high education levels preferred the rating model pictogram to express a warning message.

**Discussion and conclusions**

Results showed that the rating model pictogram with and without side-text was associated with more correct answers than the triangle model (35.6% versus 7.8%, respectively). However, if one considers that the correct answer does not need to make reference to the category of the pictogram, the percentage of correct answers would be essentially the same in both pictogram systems (80% for the triangle model against 82.3% for the rating model). In this case, both pictograms could be considered as comprehensible according to the ISO 3864 norm (Dowse et al. 2001, Mansoor et al. 2004). This indicates that the definition of correct answers used may have been too strict. Nevertheless, it should be stressed that these pictograms alone are unlikely to provide the complete message. This relates with the fact that respondents linked the pictogram to traffic related message but the majority failed to successfully associate it to the exact risk message. This supports the idea that pictograms are relevant when used in combination with oral and/or written information, given by healthcare providers, to avoid misinterpretations of any kind (Dowse et al. 2005, Katz et al. 2006).

Regardless the type of pictogram, respondents associated higher categories with higher levels of driving risk which led to higher estimations of danger. This outcome shows that, despite the lower percentage of fully correct answers regarding understanding of the pictogram, respondents were able to link the different levels of driving risks to a pictogram category. Category 1 pictograms of the rating model were significantly less associated with danger than the homologue from the triangle model indicating that respondents tend to overestimate the lower categories of the triangle model pictogram and to underestimate the higher ones. In the authors’ opinion, this could mean that the triangle model pictogram does not fully illustrate the magnitude of risk as good as the rating model because no reference to the number of categories is made making it difficult for the target population to perceive the exact risk.
The rating model pictogram was preferred over the triangle model pictogram to express both a warning message and levels of impairment in all age groups and education levels. However, older and low educated participants demonstrated to have less preference for the more complex rating model and they were also less likely to change their opinion towards this more complicated model. This study confirmed that both age and education level are sensitive aspects to be considered when designing a pictogram to be equally well understood by older adults and those who have a low education level.

As conclusion, the pictograms in our study were not fully self-explanatory in conveying warnings and safety-related information as the majority of the respondents did not fully understand the meaning of the pictograms. The rating model pictogram generated more correct answers compared to the triangle model used in France. Despite the moderate level of understanding, respondents associated the high categories of risk to more dangerous situations, indicating a good estimation of driving risks. Moreover, in the presence of the pictograms used in this study, respondents were willing to change their driving behaviour, by driving less frequently. Future research should focus on how effective pictograms are in communicating a risk message when complementing oral or written information given to patients by healthcare providers.

References

Agence française de sécurité sanitaire des produits de santé (AFSSAPS). Medicinal products and driving (02/07/2009) - Available at: http://www.afssaps.fr/Afssaps-media/Publications/Information-in-English (last accessed April 2012).


