Health Care Professionals *vs* Other Professionals: Do They Have Different Perceptions about Health Care Waste and Dangerous Products Pictograms? Some Findings Using a Digital Device in Field Survey

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Abstract. This paper presents a part of a wider research about GHS symbols comprehensibility. Here, a field survey was conducted using a digital device, instead of traditional platform – printed paper. Participants were health care professionals and other professionals and a comparison among the results about these groups is presented and discussed.

Keywords: symbols, comprehensibility testing, ergonomics.

1 Context

Comprehensibility of symbols used worldwide is a wide area for research.. Once these symbols must be comprehensible and understandable for all individuals, different tests according American National Standard Institute's Criteria for Safety Symbols (ANSI Z535.3, 2011) have to be conducted. In this paper, GHS - Globally Harmonized System of Classification and Labelling of Chemicals Symbols are studied.

The system called "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)", addresses classification of chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets. It aims at ensuring that information on physical hazards and toxicity from chemicals be available in order to enhance the protection of human health and the environment during the handling, transport and use of these chemicals. The GHS also provides a basis for harmonization of rules and regulations on chemicals at national, regional and worldwide level, an important factor also for trade facilitation (UNECE, 2013).

Hesse et al (2010) confirm that "sweeping globalization over the past several decades can be viewed as a double-edge sword. On the one hand, it has given rise to unparalleled economic growth and opportunity as products and services are increasingly freely traded among many different countries throughout the world".

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As presented by Kalsher & MontAlvão (2010) "one goal of existing research on this topic has been to determine how people assign blame for injuries sustained through the use of or exposure to consumer products and how various entities associated with either the production or use of consumer products view responsibility for safety."

These authors also argue that because contextual information shapes perceptions and attributions, this suggests that decision makers in a legal context (e.g., jurors, judges) may attribute responsibility for accidents on the basis of the amount and type of information accessible to them.

This paper gives a continuity of a research considering cross cultural aspects in this context, as presented in Hesse et al. (2010), when an experiment was conducted with 312 non-student participants; comprising a U.S. and Brazilian samples. Now, a new experiment was conducted, considering health care professionals and other professionals/non-students participants.

The objective in this research – and the idea of including the health care professionals - began with the ideas of health communication and its implications on patients, teams and risk management. Once GHS symbols affect everyone, does health care professionals must be more aware of them? Their perception about how others will understand information can be more accurate? This research tried to find some answers for these questions.

2 Method

2.1 Participants

A total of 60 participants (30 males and 30 females) were recruited (M = 35.6 years; SD = 11,6). Samples from two population pools were collected: 30 were health care professionals (12 males and 18 females) and 30 comprised other professionals (14 men and 16 women).

Considering both samples, the average age of participants was 36.5 (SD = 11.3) and 36.6 (SD = 12.0), respectively, as shown in Table 1. It´s important to point out that the sample "other professionals" comprises the all kind of subjects, that aren´t students, but that don´t work in health care area.

Table 1. General demographic data

Sample	Sample	Age (*M*)	Std deviation (*SD*)
Health professionals	30	36,5	36,6
Other professionals	30	11,3	12,0
Total	60	-	-

2.2 Procedures and Materials

As suggested by United Nations (Annex 6, Comprehensibility testing methodology, UNECE, 2013), questionnaires and experimental tests can be conducted to evaluate signal words, colors and size of GHS pictograms, as well the comprehension of hazard symbols.

First step consisted on fulfill an informed consent. Just after that, participants were answered a general interview, about demographic and other data as a basis for analysis as age, gender, occupancy and if they have some familiarity with some of these two groups of symbols: pictographs used in Brazil to identify health care waste and GHS pictographs.

Just after the general interview, volunteers were asked to evaluate, using the comprehension estimation procedure (ANSI Z535.3, 2011), five pictographs used in Brazil to identify health care waste and eleven GHS pictographs. In this phase a digital device in this field survey.

All tested symbols are shown in Figures 1 and 2. Is important to mention that in both groups of symbols there are one pictograph that is used represent 2 distinct products. Considering the group of symbols to identify health care waste, the same pictograph is used to represent *Biological waste* and *Perforating-cutting* waste.

When considering the groups of symbols to identify GHS pictographs, we have 2 repetitions: the same pictograph is used to represent *Carcinogens* and *Reproductive toxicity*, and *Flammables* and *Pyrophoric liquids*.

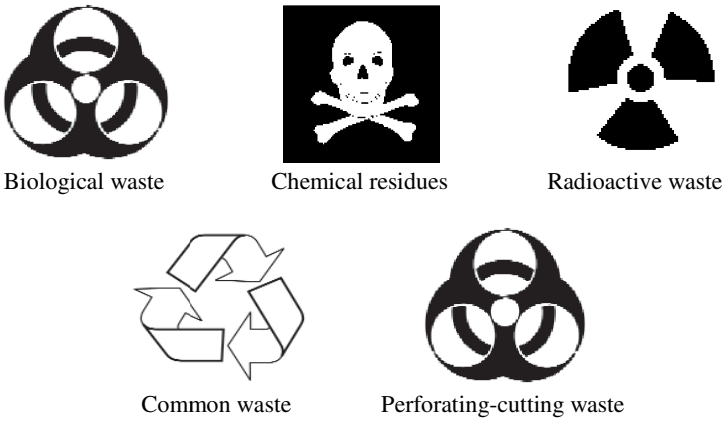

Fig. 1. Five pictographs used in Brazil to identify health care waste, tested in this research


Acute toxicity, dermal


Acute toxicity, oral


Carcinogens/ Carcinogenicity


Compressed gas


Corrosive to metals


Explosives


Flammables


Hazardous to aquatic environment


Oxidizing liquids/solids


Pyrophoric liquids


Reproductive toxicity/ mutagenicity

Fig. 2. Eleven GHS pictographs, tested in this research

It´s important to say that health care professionals are familiar to health waste pictographs, even all volunteers answered that aren´t directly involved with health care waste.

For each pictogram, with a subtitle with its description and after provided with the context in which each of the pictograph would likely be seen, participants were asked to estimate in their perspective, the percentage of people in Brazil who would comprehend its intended meaning. All of them were presented in black and white to avoid interferences related to color usage.

According to Hesse et al (2010) the comprehension estimation procedure is beneficial because it is less expensive and time consuming than the open-ended procedure.

3 Some Results

Symbols and pictograms are considered acceptable if 85% of the study participants are able to understand its meaning with no more than 5% critical confusions, according to criteria outlined in the American National Standard Institute's Criteria for Safety Symbols (ANSI Z535.3, 2011).

First, considering the evaluation of health care professionals and other professionals about health care waste symbols, it is possible to highlight a huge difference. If for health care professionals just 3 in 5 symbols meet ANSI acceptance, on the other hand ,for other professionals, none of them are acceptable. It is also important to note (as shown in Table 2), a high std. deviation - around 10%. Surprisingly, the symbol with highest acceptance for both groups of subjects was the *Radioactive waste* when it was expected that the one used for *Common waste* - that can be easily found in packages and trash cans - could achieve a better acceptance.

Table 2. Results for health-care professionals (N= 30) and other professionals (N= 30) for health care waste symbols

Category	**Health professionals**		**Other professionals**	
	Mean	(*Std Dev*)	*Mean*	(*Std Dev*)
Biological waste	86,00	10,37	27,87	11,04
Chemical residues	83,00	09,79	24,77	09,31
Common waste	83,67	10,50	26,63	04,48
Perforating-cutting waste	85,17	10,21	23,40	09,26
Radioactive waste	87,50	07,04	42,63	08,90

But results of both samples show a unity among GHS symbols acceptance, as shown in Table 3.

Table 3. Results for health-care professionals (N= 30) and other professionals (N= 30) for GHS symbols

Category	**Health professionals**		**Other professionals**	
	Mean	(*Std Dev*)	*Mean*	(*Std Dev*)
Acute toxicity, dermal	33,10	15,17	36,30	15,17
Acute toxicity, oral	51,10	14,53	56,40	15,62
Carcinogens/ Carcinogenicity	27,50	11,94	30,80	14,41
Compressed gas	19,20	15,28	23,60	14,61
Corrosive to metals	33,70	16,65	36,80	11,94
Explosives	56,70	21,46	60,10	17,82
Flammables	61,90	14,79	67,00	19,65
Hazardous to aquatic environment	41,80	15,23	48,30	15,62
Oxidizing liquids/solids	9,10	7,67	19,10	14,79
Pyrophoric liquids	25,90	12,32	29,50	14,00
Reproductive toxicity/ mutagenicity	11,80	13,20	15,30	14,32

It´s also interesting compare these results with the ones obtained in a previous research and presented in Kalsher & Mont'Alvão (2010). In this previous survey, 87 subjects answered about the comprehensibility of GHS pictograms using the same testing methodology.

It's possible to notice that non-health care professionals have similar perception about comprehensibility of GHS pictograms, as shown in Table 4.

Another important thing to comment about these two samples is about standard deviation. In 2010, in this wider sample, it´s possible to notice a higher std. deviation in results. But when comparing the standard error in both samples, they are almost the same. It can indicate that maybe the perception of subjects, in this 3-years period, changed.

Table 4. Results for non-health-care professionals (in 2013, N= 30) and other professionals (in 2010, N= 87) for GHS symbols

Category	Other professionals (in 2013)			Subjects (in 2010)		
	Mean	*Std Dev*	*St. Error*	*Mean*	*Std Dev*	*St. Error*
Acute toxity, dermal	36,30	15,17	2,77	34,70	31,25	3,35
Acute toxity, oral	56,40	15,62	2,85	53,00	39,08	4,19
Carcinogens/ Carcinogenicity	30,80	14,41	2,63	31,00	28,17	3,02
Compressed gas	23,60	14,61	2,67	21,50	24,44	2,62
Corrosive to metals	36,80	11,94	2,18	34,30	32,93	3,53
Explosives	60,10	17,82	3,25	58,60	31,34	3,36
Flammables	67,00	19,65	3,59	65,50	31,71	3,40
Hazardous to aquatic environment	48,30	15,62	2,85	46,70	34,32	3,68
Oxidizing liquids/solids	19,10	14,79	2,70	22,40	26,58	2,85
Pyrophoric liquids	29,50	14,00	2,56	27,10	28,17	3,02
Reproductive toxicity/ mutagenicity	15,30	14,32	2,61	14,50	25,74	2,76

About the health care waste pictograms, they are considered highly more acceptable for other professionals than for health care professionals.

Considering this scenario, in 2013, the symbol that presented the worst evaluation for health professionals sample was the category Oxidizing liquids/solids, that scored 9,70% (S.D.=7,67) while for non-health professionals was the one used to represent the category Reproductive toxicity/ mutagenicity , that score 15,30% (S.D. = 14,32).

On the other hand, the best evaluation was for the symbol that represents the category Flammables for both health-professionals (Mean = 61,90; S.D.=14,79) and for non-health professionals (Mean = 67,00; S.D. = 19,65). All these 3 symbols are shown in Figures 3, 4 and 5.

Oxidizing liquids/solids

Reproductive toxicity/ mutagenicity

Flammables

Fig. 3. 4. and 5. Worst and best scored GHS symbols for the studied sample. Fig. 3 (on the left) category *Oxidizing liquids/solids*, Fig. 4 (in the middle), category *Reproductive toxicity/ mutagenicity*, Fig. 5 (on the right), category *Flammables*.

4 Final Comments

Just 3 health care waste symbols met the ANSI Z535.3 criteria for correct comprehension (i.e., infectious waste, chemical waste, radioactive waste, common waste, perforating - cutting waste) when considering 85% comprehension criteria in health care professionals' sample. But when observing data from other professionals sample, all results were below 50% of comprehensibility.

But when considering results for the eleven GHS pictograms, none of categories met ANSI Z535.3 criteria in both the health care and non-health care professionals samples.

As a final comment, the idea that health care professionals are more sensitive about other people perception wasn´t confirmed. In all results, other professionals sample was more "optimistic" about general population comprehensibility. Their perception isn´t more accurate, even considering health care waste symbols.

Another important thing to mention is related to the use of a digital device while testing. When comparing to printed paper, there are no significant differences. Digital device allows better visualization once the quality of the image is better than the printed one.

5 Next Steps and Future Research

These results lead us to another questions and discussions, for example, to better understand the way that these international symbols are tested and used. It is necessary to "learn" what a symbols means, or it should be "understandable" for everyone? Do the cultural aspects are considered when they are designed? All forms of application in chemical industry (printed in paper, in adhesive, digital) are used when tested?

Pointing out some aspects that weren´t considered in this work, new questions arise as how health care professionals communicate with their patients? And how can we evaluate patient's safety communication in our scenario today? These questions lead us to future researches.

A comparison between the results using the digital device and the traditional way (using paper) for comprehensibility testing are the aim for future paper.

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