Domestic Accidents: Intelligent Analysis & Prevention In Setif Region – Algeria

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Abstract: Domestic accidents are accidents that take place in the house or in the neighborhood. These accidents are considered a public health problem around the world. The aim to this study is to characterize these accidents in Setif region in Algeria. Setif is an urban environment. We considered some factors as epidemiological factors. The study involved 296984 cases according to their ages and gender over a seven-year period (2009 -2016) and the type of accidents that occurred. This survey is based on a pre-established questionnaire. As the phenomenon is considered a social phenomenon, where several factors may be the cause, an intelligent analysis is applied to process these data. The consequences of these accidents can lead to disability and reverberate throughout society. The analysis used makes it possible to take into account the uncertainties and inaccuracies related to the very nature of the risk factors of domestic accidents. It shows that the analysis of the causes of domestic accidents makes it possible to plan means for prevention. General practitioners and all health care staffs have primary responsibility. The results obtained are in agreement with the studies carried out in this field. The proposed analysis tool can help public health authorities to prevent risk factors for this type of accident

Keywords: Domestic accident, risk factors, fuzzy logic.

1. Introduction

Domestic accidents are preventable. The main predictors for all types' domestic accidents associated with individual characteristics but also with housing conditions. Technological progress, lifestyle changes and improved disease controls are reducing the number of child deaths. However, the number of accidents is increasing [1]. In order to prevent domestic accidents, the living space must meet certain conditions approved by the World Health Organization, starting with water supply and sanitation providing an appropriate environment. The habitat must provide privacy and adequate lighting in addition to ventilation and accessibility [2] [3]. Other factors may be an essential element in the prevalence of domestic accidents. These factors are linked to poverty, natural disasters, conflicts and social inequalities. People at a younger age are the most exposed either in developing countries or in rich countries. These people are increasingly exposed to toxic products, even in the form of dangerous chemicals in toys for example. The sources of threats to children are often found in supposedly safe places. Other causes are evoked such as negligence or omission of care or food or the protection of climatic conditions [4]. Sometimes these omissions are voluntary to express sanctions or abuses [5]. There are 5 million children aged 0 to 14 years that die each year worldwide from diseases related to these causes [6] [7]. Statistics report that 72 children die on Europe every day from domestic accidents. In the UK alone, estimates of deaths occurring in homes are estimated at 30% [8]. Children aged five to 10 years are noted, the incidence of home accidents is decreasing, but this category is much more exposed in areas of crowded housing and inadequate play areas [9]. Also, it has been reported that in Europe, nearly 7% of all residents were victims of domestic accidents between 1998 and 2000, with more than five million hospitalizations and 56,000 deaths [10]. As a summary, domestic accidents from a public health point of view can be taken as a major epidemic [11]. The objective of the study was to analyze these accidents in the Setif urban community in Algeria and to identify socio-demographic and household-related risk factors and to identify their prevalence and epidemiological factors. Since the effect of risk factors for domestic accidents differs from person to person and at different ages, we found it useful to apply intelligent analysis to fuzzy logic in data processing. Fuzzy logic imitates human reasoning and treats uncertain and imprecise. By this, it is perfectly adequate in our case. This can be a prevention tool once the causes are identified.

2. Methods

2.1 Study area

The study area is the city of Setif in eastern Algeria and its surroundings. This region is oriented towards the agricultural sector where it is considered one of the main cereal regions of the country. The capital of the region knows a certain dynamism in Algeria, the region enjoys major investment projects (airport, bus station, tramway). The industry is mainly represented by plastics, household appliances, chemicals, etc. Setif is also a dominant commercial center in the region.

2.2 Study population

The population of the setif region is 1,496,150 inhabitants. The number of male inhabitants is 759596 and 736554 female. The city of Setif has 288 467 inhabitants. The birth count is 26,880 males and 26,069 females. It is by that the second most populated Wilaya of Algeria [12].

2.3 Study design

The study developed consisted in the elaboration of a questionnaire inspired by the model reported by (Didem, 2006) [13]. We collected Data upon admission to hospital upon admission of the victim of a domestic accident. Pre-established questionnaire must meet the requirements in the necessary information. Questionnaire included information

on demographics and health status in general. Information about eating habits, sleep patterns, housing conditions, etc. was collected. After regrouping these data (Figure1), they are characterized by their uncertainty and imprecision. These data are not accurate. We proposed to apply artificial intelligence techniques including the principles of fuzzy logic. This reasoning mode supports these uncertainties for a result as accurate as possible.

2.4 Data analysis

Fuzzy inference is a mode of reasoning that mimics human reasoning. As such, fuzzy logic is considered a branch of artificial intelligence. Being a branch of set theory, it operates by approximate reasoning. By this, it supports uncertainties and inaccuracies of the system. In our case, the nature of the data that are considered as input and output variables of the system are of a numerical nature. In order to analyze them, it is necessary to convert them into linguistic variables. These variables are operated by "AND" and "OR" operators [14].

Table 1: *Distribution of domestic accidents by type, age and sex during 2009-2016 priod*

Age - gender / Type	0-4 ans		5-9 ans		10-15 ans		Total 0-15 ans	
	boys	girls	boys	girls	boys	girls	boys	girls
• Falls	12130	8571	14870	8618	17945	8430	44945	25619
• Skin burns	4262	3836	3386	2654	2522	2062	10170	8552
• Ingestions of caustic products	1406	1055	681	575	466	650	2553	2280
• Ingestions of toxic products	1312	1142	744	650	599	634	2655	2426
• Injuries	7805	5597	10357	6591	11901	6163	30063	18351
• F.B* in the eye	354	293	606	413	578	302	1538	1008
• F.B* in the ear	311	279	321	250	220	160	852	689
• F.B* in the respiratory tract	441	405	290	240	177	149	908	794
• F.B* in the digestive tract	676	524	526	401	354	305	1556	1230
• Other	5920	3772	4203	2933	4310	2926	14433	9631
Total	**34617**	**25474**	**35984**	**23325**	**39072**	**21781**	**109673**	**70580**

F.B*= Foreign Bodies

A system is established with three inputs (type of accident, age, gender) and an output that expresses the prevalence rate of domestic accidents. We consider that all input or output variables are fuzzy variables. From the real values recorded, a database is created which contains all possible combinations by matching the inputs to the output. The general form of inference rules is (IF ... Then). After defuzzyfication, the system generates a net value at the output after combining all the variables considered fuzzy.

Outputs = f (T, A, G)
Where : T (Type of accident)
A (Age)
G (Gender)

Proposed system

Using Matlab2017, the diagram below shows the three-input system and one output. Figure 1.

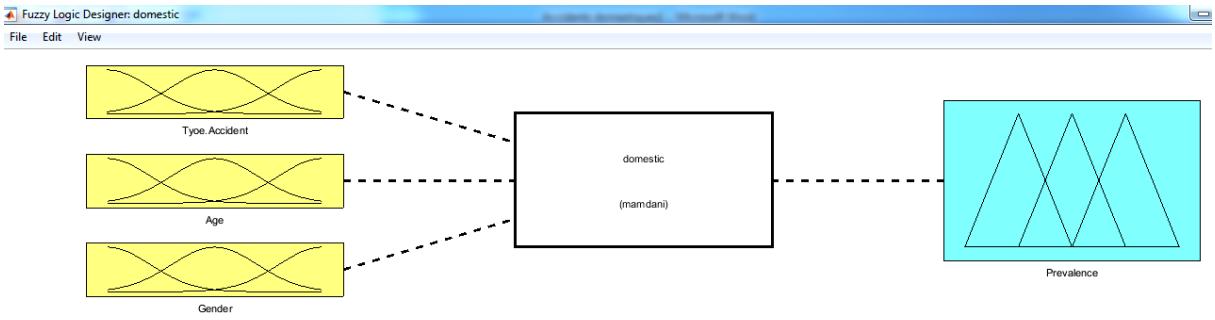

Figure 1: *Block diagram of the system*

Variables fuzzyfycation

The input variables are:

- T (type of domestic accident) some accidents are fuzzyfied, where have combination of two accidents like the fall followed by an injuries for example. Other accidents are not fuzzyfied.
- A (Age the age of the young victims) is fuzzyfied in three fuzzy intervals (baby, child, young).
- G (Gender) is fuzzyfied is not fuzzyfied. A numeric values are attributed to each sex (1 for male, 2 for female)

The output variable is:

- The prevalence of domestic accident is fuzzyfied in three intervals (low, medium, high)

The figure 2 represent a model of age fuzzyfication. All other variables are fuzzyfied in the same way.

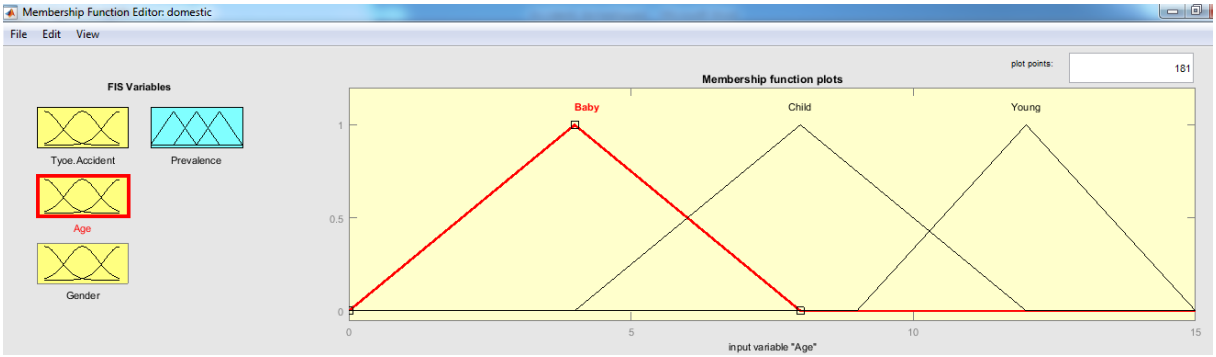

Figure 1: *Fuzzyfication of the variable "Age"*

[System]
Name='domestic'
Type='mamdani'
Version=2.0
NumInputs=3
NumOutputs=1
NumRules=31
AndMethod='min'
OrMethod='max'
ImpMethod='min'
AggMethod='max'
DefuzzMethod='centroid'

[Input1]
Name='Tyoe.Accident'
Range=[0 10]
NumMFs=10
MF1='Injuries':'trimf',[0 1 2]
MF2='Falls':'trimf',[1 2 3]
MF3='FBEyes':'trimf',[2 3 4]
MF4='I.C.Products':'trimf',[4 4 4]
MF5='I.T.Products':'trimf',[5 5 5]
MF6='Skin.Burns':'trimf',[6 6 6]
MF7='F.B.Resp.Tract':'trimf',[7 7 7]
MF8='F.B.Digest.Tract':'trimf',[8 8 8]
MF9='F.B.Ear':'trimf',[9 9 9]
MF10='Other':'trimf',[10 10 10]

[Input2]
Name='Age'
Range=[0 15]
NumMFs=3
MF1='Baby':'trimf',[0 4 8]
MF2='Child':'trimf',[4 8 12]
MF3='Young':'trimf',[9 12 15]

[Input3]
Name='Gender'
Range=[0 3]
NumMFs=2
MF1='Male':'trimf',[1 1 1]
MF2='Female':'trimf',[2 2 2]

[Output1]
Name='Prevalence'
Range=[0 110000]
NumMFs=3
MF1='Low':'trimf',[0 20000 40000]
MF2='Medium':'trimf',[30000 50000 70000]
MF3='High':'trimf',[60000 80000 100000]

Base rules

The base rules expressed by (If ... Then) form. The base rules must contain all possible combinations encountered. From the values in Table 1, the input variables are linked to the output variable. Once the system is established, the input values act directly on the value of the output variable taking into account all the uncertainties and inaccuracies inherent in the nature of these variables.

Result

In our study, we compared the measured factors with the prevalence of these accidents. It turns out that the majority of these cases are victims of these accidents due to lack of security measures in their homes. This is reported by some studies confirming it [15] [16]. Also, the majority of these accidents could have been avoided if adults had assumed their responsibilities as reported by other studies [17]. The cases where we recorded these accidents generally are found in narrow houses. Houses with a large number of rooms had the fewest domestic accidents. This confirms the results of the other studies [18]. Given the imprecise nature of the factors involved in this process, our fuzzy analysis makes it possible to overcome this.

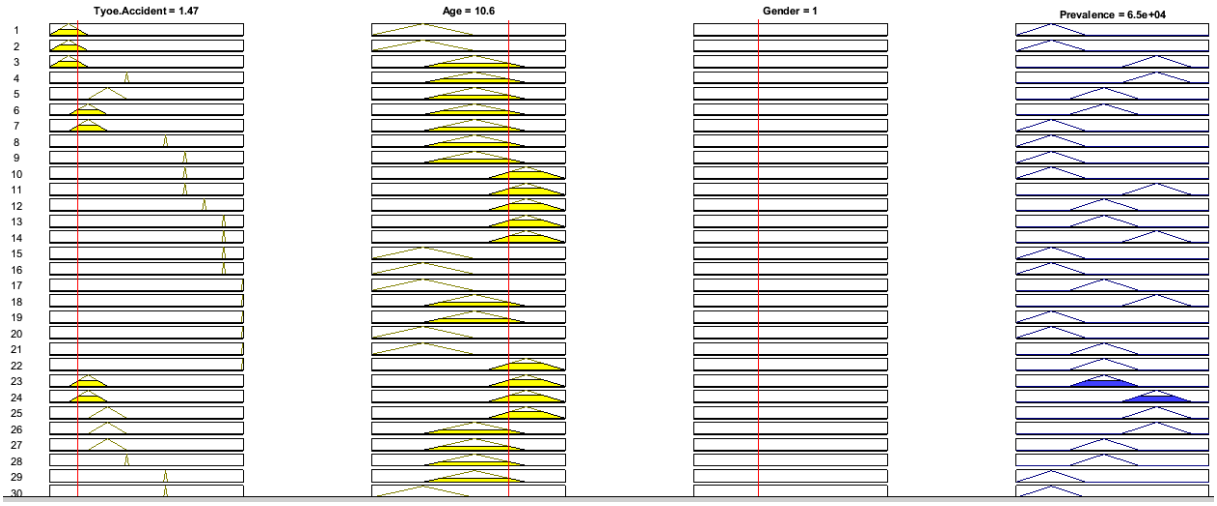

Figure 3: *Application example*

Conclusion

A broad study conducted for the benefit of public health is needed to provide a clear view of the epidemiology of household accidents involving the young population. It appears that these accidents related to domestic activities are the negligence of the basic rules of safety. It is therefore essential to focus on the educational aspect. To get an idea about the weight of each factor and its effect on the prevalence of these accidents, it is enough to randomly enter values at the input to read the exact result at the output of the system (Figure 3). The established system can be a tool for assisting public health authorities in identifying risk factors and acting accordingly as a preventive measure.

Conflict of interest

The authors declare that they have no conflict of interest

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