



A novel approach for comparing patterns of foreign body injuries across countries: A case study comparing European Countries and Bosnia and Herzegovina



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ABSTRACT

Objectives: The present study aimed at analyzing the characteristics of FB injuries from Bosnia and Herzegovina (B&H), a rapidly growing newly industrialized country, and to compare them with cases from European countries.

Methods: The analysis is based on FB injury cases included in the Susy Safe registry. Cases from the Ear-Nose-Throat (ENT) Clinic, University Clinical Center of Tuzla (B&H) were compared with cases from European countries participating in the Susy Safe project. Multiple Correspondence Analysis (MCA) was performed to elucidate differences within a large data set regarding mechanisms and objects causing injuries.

Results: The results of the MCA showed that the first three dimensions explained 43% of the variability. The first dimension was identified by children hospitalized for FB ingestion, the second one by children hospitalized for FB aspiration (lower airways), and the third one by children with an FB in the ear or in the upper airways. The analysis of the median of coordinates of factors contributing to each dimension showed that the greatest difference between B&H and European countries regarded the third one. Looking at the profile of these patients, it might be suggested that the proportion of males and females and the type of activity in which they were involved at time of injury occurrence are different among the countries considered.

Conclusions: This study proposes a simple tool for assessing differences among countries in the distribution of FB injuries. This case study shows that B&H has different patterns of FB injuries in the upper respiratory tract.

1. Introduction

Foreign Body (FB) injuries in children are a relevant public health challenge worldwide. However, these injuries are predictable and preventable [1], and public health strategies are essential to address the burden of such injuries. Epidemiological surveillance plays a key role in the development of such prevention strategies. This process provides information about the type of items most frequently involved in these injuries, about the most dangerous items (those that cause the most severe complications), about socio-demographic characteristics of families of children that are more prone to choking, and clinical signs and symptoms of FB injuries (to guarantee prompt clinical attention). Unfortunately, this problem has not yet been adequately addressed [2]. Generally, studies are conducted at single-centers (e.g., hospitals), and data are derived from hospital discharge records [3]. However, it is well

known that only a small number of such injuries results in hospital admission. These injuries are often resolved at home without medical intervention or in the Emergency Department, without resulting in a hospitalization. A CATI (Computer-Assisted Telephone Interview) survey was conducted among Italian mothers to explore the hidden part of the phenomenon of FB injuries of the respiratory and digestive tract, and it was found that only 1 out of 80 injuries resulted in hospitalization [4]. Given such a framework, it is clear that the problem of FB injuries is often underestimated.

The Susy Safe project represents one of the few examples worldwide of a systematic collection of data on FB injuries in children [5] and actually collects approximately 26,000 cases.

Data from the Susy Safe registry and from international literature allows the identification of the FB most frequently involved in such injuries. As an example, among food items, those most hazardous were

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found to be nuts and seeds [6], while the non-food items that pose the highest risk of FB injury are those with a round-shape, such as coins, balls, and marbles [7].

However, it has been shown that patterns of FB injuries may differ according to the children's country of origin, since the cultural context influences items (both food and non-food) with which children come into contact. For instance, girls who wear a headscarf are more likely to choke on headscarf pins [8,9]. Regarding food items, even though nuts and seeds are recognized to be the most dangerous [6], the type of nuts and seeds involved in FB injuries may differ; it has been shown that U.S. children are more likely to choke on sunflower seeds, and children from other countries are more likely to choke on watermelon seeds [10].

It is of growing interest to have useful tools readily available to analyze such potential differences, in terms of both the FB involved and the management of injured children. Analyses of experiences in the management of FB injuries in a rapidly growing and newly industrialized country (NIC), Bosnia and Herzegovina (B&H), have shown that children choke most often on peanuts and pumpkin seeds [11,12] and ingested most often coins and metallic objects [13]. The question is how does the experience of this country compare to the experience of other European countries?

The aim of the present paper is to present a novel approach to analyze the characteristics of FB injuries reported in the Susy Safe registry from the Ear-Nose-Throat (ENT) Clinic, University Clinical Center of Tuzla (B&H) and to compare the characteristics with cases reported in the registry from other European countries.

2. Material and methods

The Susy Safe project was started in 2003 [5]. The aims of the registry are to provide an epidemiological surveillance of the phenomenon to characterize FB injuries, to analyze how socio-economic disparities may influence the likelihood of such injuries and to involve consumer associations in the promotion of awareness among adults about this public health issue.

Data are entered via a web-based form that it is accessible to ENT doctors after registration. The registry collects cases of FB injuries in children ages 0–14 years, corresponding to the International Classification of Diseases–9th revision – Clinical Modification (ICD9-CM) codes from 930 to 939, of which the following were considered in the current analysis: (931 FB in the ear; 932 FB in the nose; 933 FB in the pharynx and larynx; 934 FB in the trachea, bronchus, and lung; 935 FB in the mouth, esophagus, and stomach).

Each record reports socio-demographic characteristics of the child and his family, date and time of injury, injury type (location), FB type and characteristics (brand, size, shape), information about adult supervision at the time of injury occurrence, circumstances during which the injury occurred (what the child was doing, where the child was when the injury occurred), signs and symptoms of the injury, hospitalization characteristics (if any), procedures performed for FB diagnosis and removal, complications associated with the FB injury itself or with procedures performed for FB removal, and outcomes.

For this study, data from B&H together with data those from European countries participating in the Susy Safe project were considered (Austria, Denmark, Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, and United Kingdom). The variables included in the analysis were child demographic characteristics, injury type (according with the ICD code), circumstances in which the injury occurred (what the child was doing), adult supervision, hospitalization (if any), procedures performed for foreign body removal. This was to account for main characteristics of FB cases.

2.1. Multiple Correspondence Analysis

Correspondence Analysis (CA) is useful to analyze bivariate contingency tables, while Multiple Correspondence Analysis (MCA)

[14,15] is a statistical model that synthesizes multivariate contingency tables. MCA is a factorial technique that synthesizes the relationships among many categorical variables being analyzed simultaneously to reproduce the data using a set of synthetic factors (dimensions) through the identification of an optimal data sub-space.

An MCA analysis reveals the latent factors with the respective percentages and cumulative percentages of the total variance explained by the dimensions. Then, axes that can summarize a subspace are identified, with the aim of representing the relationships of interdependence between variables. The results are represented in a three-dimensional subspace in terms of individuals and variables.

For the purposes of this study:

- for individuals, the relative coordinates on the axes were graphically represented in a bi-plot to identify similar groups according with their characteristics identified by latent dimensions. The comparison between B&H and Europe was performed in terms of median factor loadings (coordinates) on different axes for each group to identify differences or similarities among groups with respect to latent factors.
- for the variables, the results were summarized considering the relative coordinate and contribution (square cosine) of each modality to the definition of the axis, to identify the characteristics of the latent dimension.

2.2. Statistical analysis

Descriptive statistics was reported for each variable according to the children's country of origin (B&H vs European countries). Categorical data were reported as relative and absolute frequencies; continuous data as median and I and III quartile. Wilcoxon-type tests were performed for continuous variables and the Pearson chi square test for categorical variables.

The MCA analysis was performed using FactomineR [16], ggplot2 [17] and factoextra [18] libraries within the R System [19]. Other statistical analyses were performed using the rms [20] library.

3. Results

Twenty FB injuries were reported in the Susy Safe registry from the ENT Clinic, University Clinical Centre of Tuzla (B&H), and seven thousand nine hundred sixty-two cases were reported in European children (Table 1). Sixty percent of FB injuries occurred in female B&H children, while among European children, the proportion of injuries was slightly higher among boys (52%). In B&H children, generally, the injury occurred at home while the child was playing (80% of cases); in most cases (80%), the child was actively supervised by an adult (only in four cases was the child not supervised). Additionally, among European cases, more than a half of the injuries occurred under adult supervision (56%), and children were slightly more likely to be playing when the injury occurred (56%). In B&H children, most of the FB injuries (50%) were in the nose (ICD 932), followed by pharynx and larynx (ICD 933), and mouth, esophagus, and stomach (ICD 935). Additionally, among Europeans, the FB was most often located in the nose (ICD 932) followed by the ear (ICD 931), representing 24% of the cases.

Looking at the MCA analysis, the first three dimensions were found to explain 43% of the variability. Overall, the most important contributors (in terms of percentage of explained variance) to dimension 1 are the FB in the mouth, esophagus, and stomach (ICD 935), hospitalization, and treatment other than endoscopy (Table 2). Contributors to dimension 2 were similar to those in dimension 1, regardless of the ICD type (ICD 934, FB in trachea, bronchi, and lungs, instead of ICD 935). Factors contributing the most to dimension 3 were FB injury of the ear and of the pharynx and larynx (ICD 931 and 933), gender, and activity in which the child was involved at the time of injury occurrence.

The most important contributors to each dimension allowed the

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