Classification of Parent Attitudes about Childhood Vaccines using Machine Learning Techniques *VACC2016_0135*

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Introduction

In Spain there has been growing public concerns about vaccine safety and legislation. Although hesitant parents are still considered a minority, recent outbreaks of vaccine preventable diseases have been reported in the last few years.
As hesitant attitudes follow complex patterns, new multivariate statistical techniques have been used in order to better understand its determinants in different social contexts.

Methods

- 1119 surveys were collected from parents with children under 14 years of age in the Region of Murcia (South-East of Spain), after cleaning data, 1030 were selected.
- Analysis followed four phases (Fig. 1). In brief, groups have been constructed by means of unsupervised learning techniques: correspondence analysis and cluster analysis (K-means, Ward method). At a later stage, we have confirmed the robustness of the previously constructed groups through the unsupervised classification technique: Random Forest.
All analysis were performed using R (v. 3.2.2) and reproducible research methods.
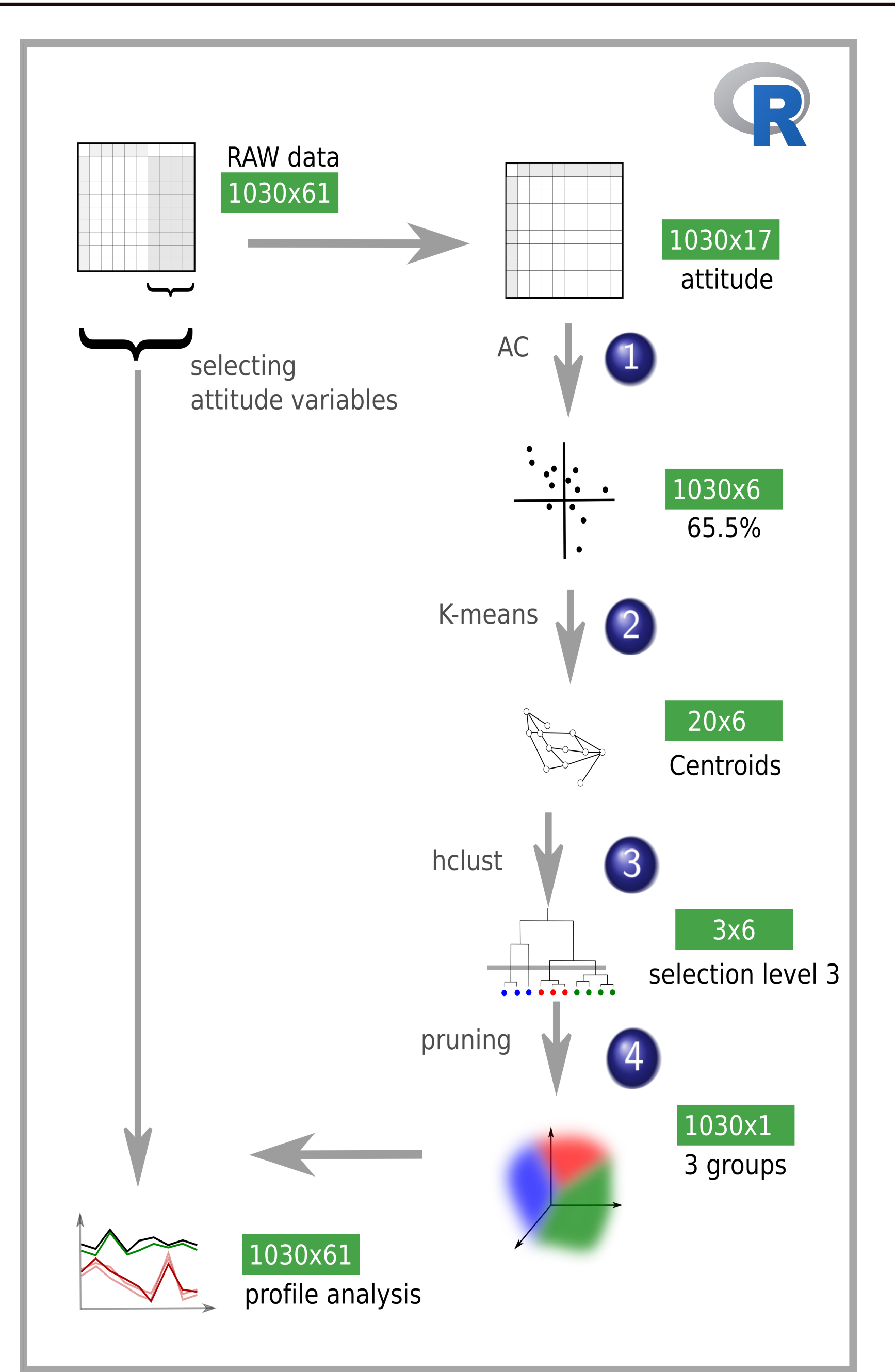

Figure 2: Mean profiles according General knowledge about vaccines and educational level of the parents. Parents with lowest educational level and lower knowledge about vaccines show higher degree of agreement in items indicating hesitancy. (*p<0.05)

Items indicating positive attitudes
1. Vaccines are necessary
2. Vaccines are safe
12. Vaccines should be mandatory

Items indicating hesitancy:
4. Vaccines increase risk of allergies
5. Vaccines increase risk of diseases
6. Link between vaccines and autism
7. Inhibit the immune system
9. natural infection immunizes better than vaccines

Results

- We have identified 3 distinct profiles of attitudes with several determinants of hesitancy (Fig. 3)
- An association has been found between concerns about vaccine safety and lower educational level and general knowledge about vaccines (Fig 2)
- Healthcare workers are considered to be the most trusted source of vaccine-related information for patients
- However, hesitant attitudes are also shown by parents working in healthcare

16i: increase risk to allergies
17i: increase risk of diseases
18i: link between vaccine and autism
19i: inhibit the immune system
20i: risk of grave/lethal secondary effects

22i: HPV vaccine safety is not clear
23i: the media is alarmist

Figure 3: Cluster profiles through several determinants of hesitancy. Significant differences in the 3 parental groups are marked with coloured labels. Cluster 3 (green line) showed hesitant attitudes.

Figure 1: Outline analysis of parental attitudes starting with the raw-data from the survey, followed by several Machine Learning techniques: (1) correspondence analysis, (2) k-means clustering, (3) hierarchical clustering (Ward method) and (4) pruning the dendrogram to analyse the profiles.
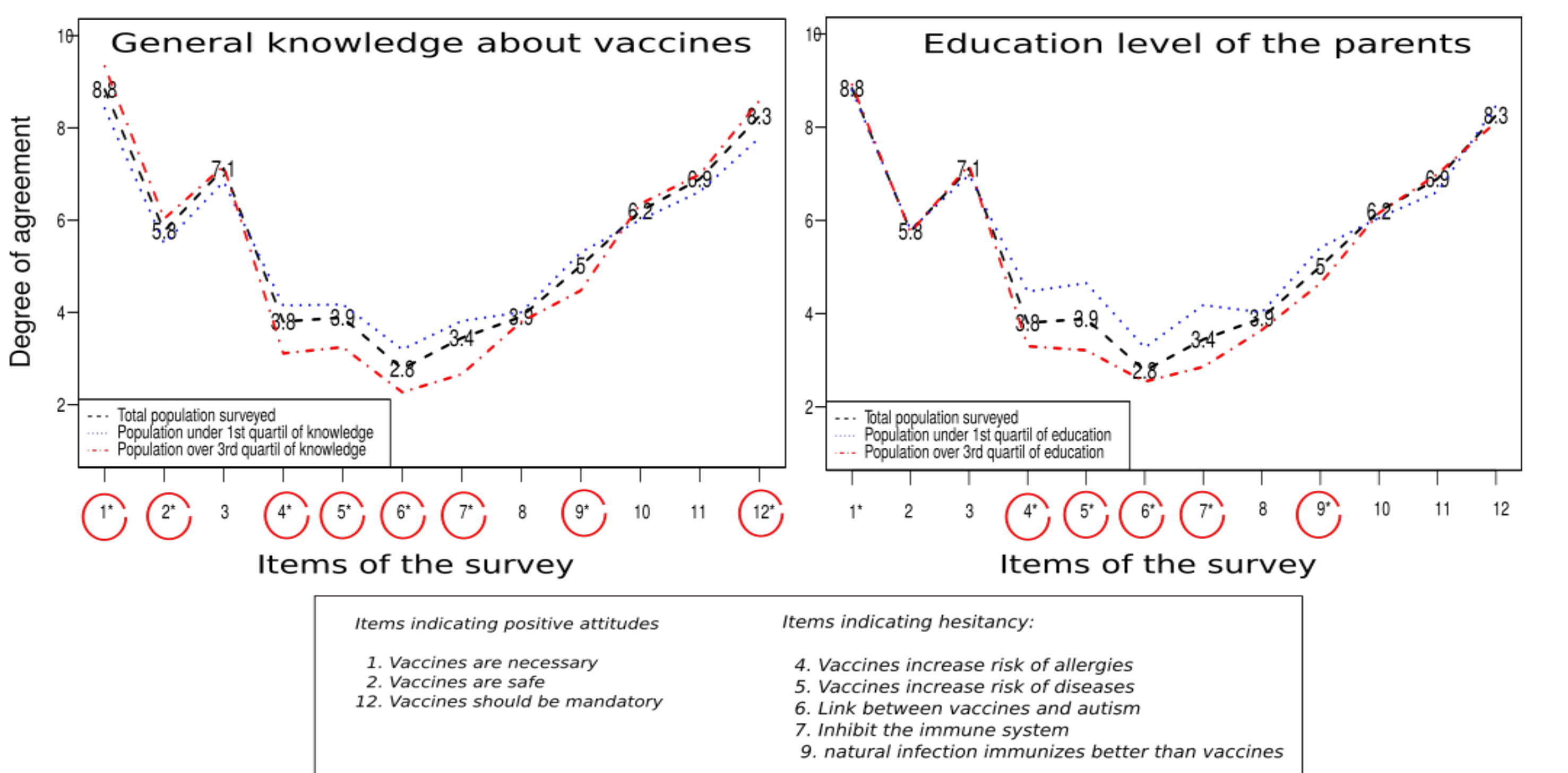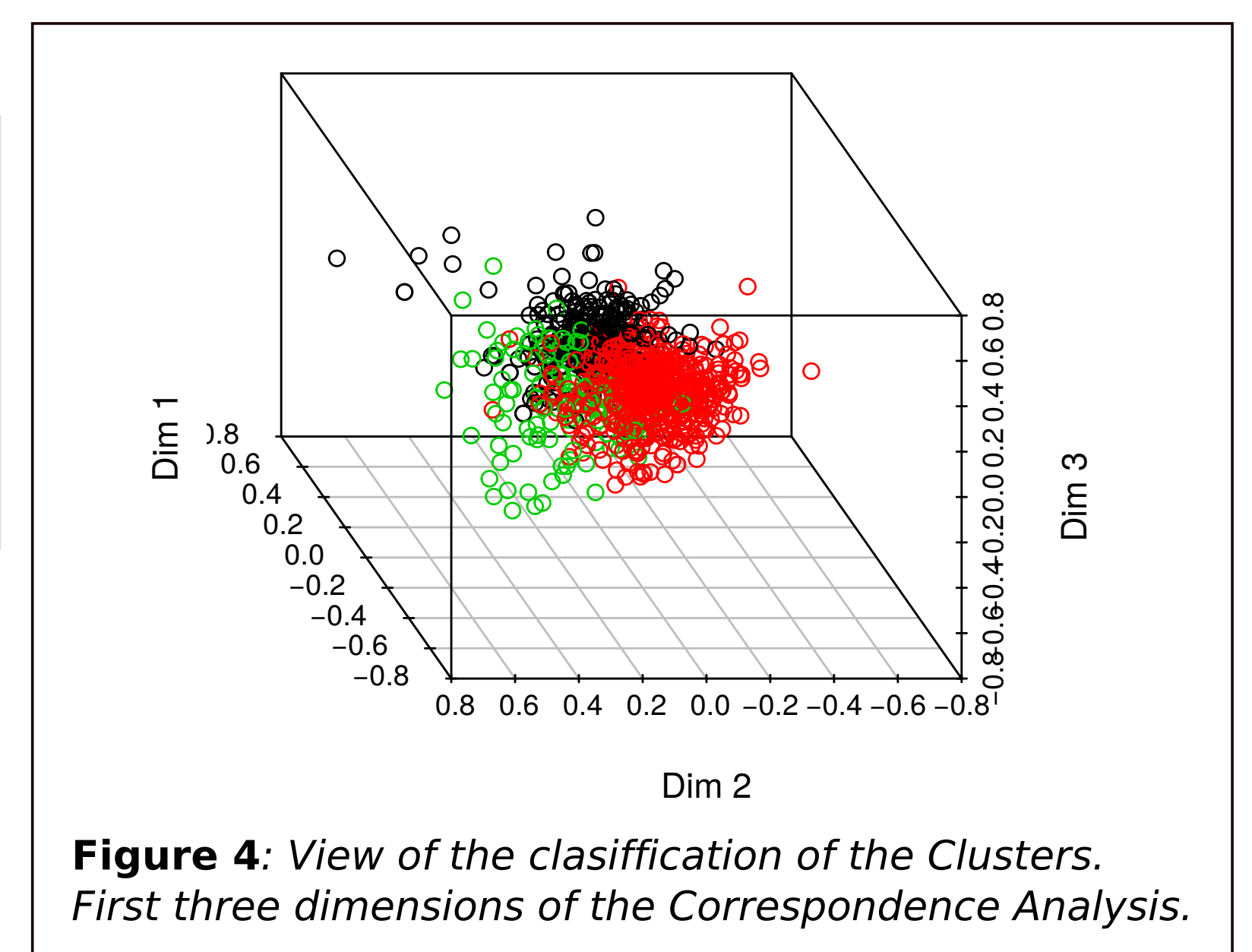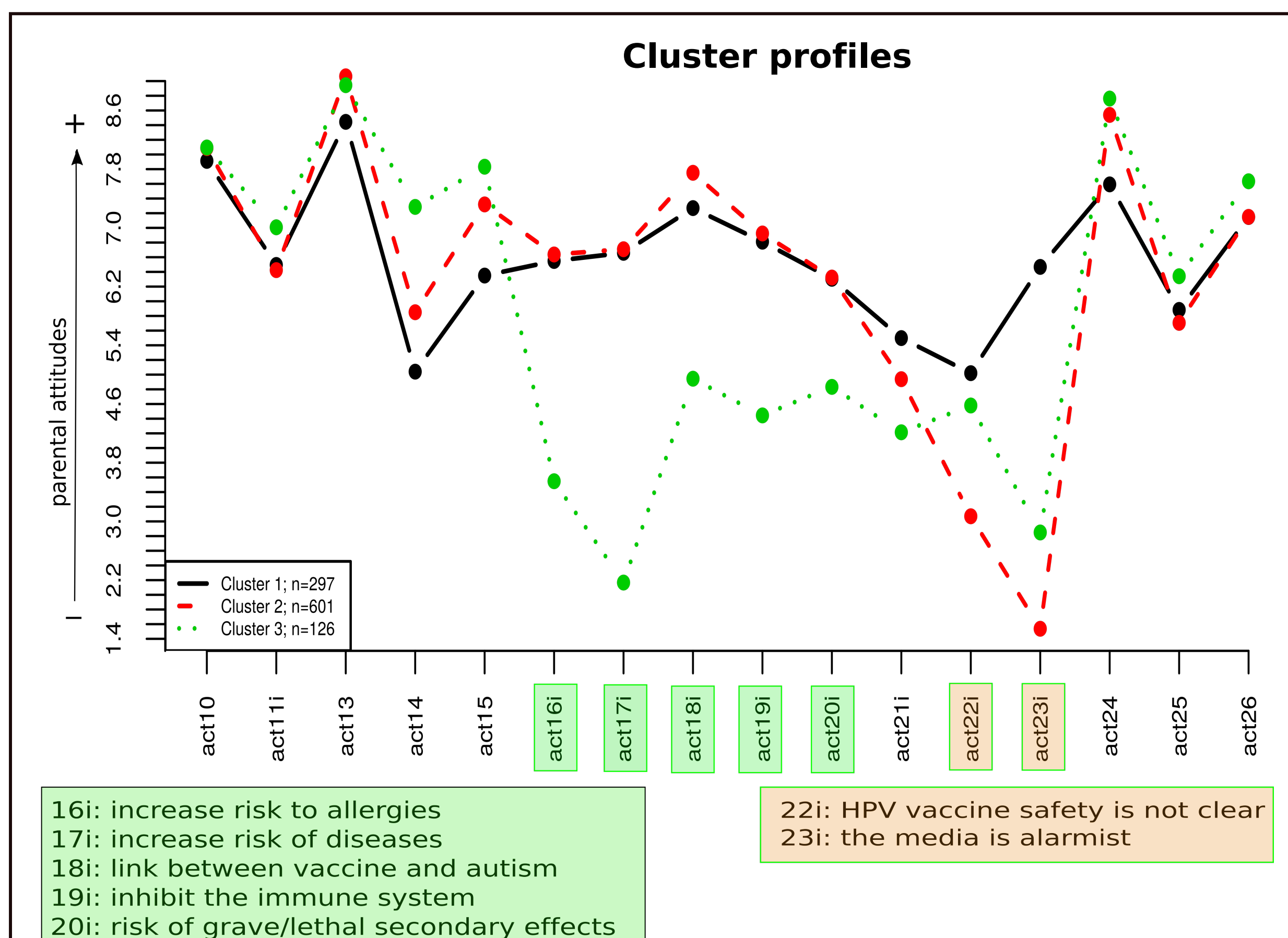

Figure 4: View of the clasification of the Clusters. First three dimensions of the Correspondence Analysis.

Conclusion

Our results confirm the presence of hesitant attitudes toward paedriatic vaccines in Murcia, that can be affecting the uptake of some vaccines such as papilomavirus.

This work contributes not only to the diagnosis of hesitant parental profiles, but also provides a set of multivariate statistical analyses that can be of great help in analysing data sets where, as in the case of vaccine hesitancy, multiple interactions take place.

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