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## Assessing the Accidents at Work by RC(M) Association Model Analysis

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### Abstract

The occupational injuries, diseases and deaths result in high economic costs to individuals, employers, governments and society. If a State aspires to an economy aimed at productivity and efficiency, workers' welfare, research and regulation in the field of safety at work and the relative reduction of accidents at work are fundamental. Currently, in Italy, the law of reference is the legislative decree 81/2008 ((known as the Testo Unico Sicurezza Lavoro), which revised and integrated most of the decrees from the '50s onwards, by incorporating the EU Directives coordinated in a single piece of legislation that includes specific sanctions against defaulters. The aim of this work is to verify whether preventive policies, mandatory in Italy with the legislative decree 81/2008, have highlighted a real decrease in accidents at work. The analysis has been conducted using RC(M) model association, in particular the use of a summary measure and a graphical representation has been proposed to verify if association between the variables geographical area (North, Center, South and Isles of Italy) and years (from 2008 to 2018) exists. Specifically, the results have not highlighted a significant reduction of the number of accidents from 2008 to nowadays.

**Keywords:** Safety at Work, RC(M), Kullback-Leibler Information, Odds Ratios, Decree 81/2008

### Introduction

Occupational health and safety management refers to the set of preventive and protective measures to be adopted to better manage the health, safety and well-being of workers, in order to avoid or minimize accidents and occupational diseases. These occupational injuries, diseases and deaths result in high economic costs to individuals, employers, governments and society. Negative effects may include costly early retirement, the loss of skilled staff, absenteeism as well as presenteeism (when employees go to work despite illness, increasing the likelihood of mistakes) and high medical costs and insurance premiums. Research and regulation in the field of safety and health at work are relatively recent phenomena (Waring, Allen, Braithwaite and Sanda, 2015; Lynch and Vogel, 2001). In 2015, the European Agency for Safety and Health at Work has estimated the total economic burden for occupational injuries and diseases in five Countries of European Union (Finland, Germany, The Netherlands, Italy and Poland). The results have, unfortunately, highlighted that Italy is the first of these for fatal accidents and the average labour cost per accident is 55.000 €, at least twice the value of other Countries. This information, of course, casts doubt on the prevention policies adopted by Italy.

The norm on health and safety at work can be found in the Italian Constitution of December 27, 1947. Among the fundamental principles of the State, it states the protection of health in article 32 and the protection of work in all its forms and applications in article 35. After 1950 in Italy, specific legislation was born for the preventive protection of workers' health that constituted a dependent variable of the production process and work-related accidents and illnesses were considered a price to pay for industrial development. The first decrees were the DPR 547, DPR 164/1955 and DPR 303/1956 and based on a technical and mechanical organization of work, consequently safety was considered a technical problem and the laws were inspired by that line. The first interventions in the safety world were the introduction of protective systems, such as the outside of the machine to prevent contact of the worker with the moving and the dangerous parts of machinery, that of the "individual safety devices" in order to guarantee a barrier that ensured the safety worker. The adopted solution, however, turned out to be not sufficient in order to assure the concrete fine to prevent accidents effectively.

Another important moment was represented by the issuing of the Workers' Statute (law 20 May 1970, number 300), which still remains the cornerstone of the system of protections and guarantees outlined by the constitutional charter and established workers through their representatives, have the right to monitor the implementation of standards for the prevention of accidents and occupational diseases and to promote research, development and implementation of all appropriate measures to protect their health and their physical integrity.

A turning point in the concept of health and safety at work occurred in 1994 with the issuance of the legislative decree 19 September 1994, number 626, which transposed several important European directives, among which the most important is the 89/391 / EEC. Under law 626/94, the employers are required to designate occupational health and safety representatives; to maintain work place accident records; and to comply with technical requirements and standards for protection from carcinogenic, chemical, and biologic compounds. Currently, in Italy, the law of reference is the legislative decree 81/2008 ((known as the Testo Unico Sicurezza Lavoro), which revised and integrated most of the decrees from the '50s onwards, by incorporating the EU Directives coordinated in a single piece of legislation that includes specific sanctions against defaulters. The main provisions are related to the organization of thorough procedures to improve health and safety. The employer is required, in particular, to organize within the enterprise a protective and preventive service in order to identify, eliminate or reduce risk factors. The Decree also contains a number of stipulations on medical screening, designating a doctor responsible for the regular assessment and certification of employees' physical fitness to perform the tasks assigned. Another important provision concerns the election or the appointment of a workforce representative on matters of health and safety who has particular rights of information and consultation (Tiraboschi and Fantini, 2009; Tiraboschi,2016). However, all the articles are based on the principles of planning and participation of all individuals involved in improving prevention conditions in the workplace.

In this paper the analysis of Odds Ratios (OR) is used for assessing whether preventive policies, mandatory in Italy with the legislative decree 81/2008, have highlighted a real decrease in accidents at work and therefore whether the application of the decree was useful. The data used are provided by the annual report of National Institute for Insurance of Accidents at Work (INAIL) and represent the trend of accidents in Italy between 2008 (year of entry into force of the present law) and 2018 in areas of Italy (North, Center, South and Isles).

The analysis of the association between variables in a  $I \times J$  two-way contingency table is a topic widely discussed (Everitt, 1992; Agresti, 2002; Campbell 2007). Here the attention is focused on the ORs as measure of association. A complete two-way contingency table of ORs, computed, may be too large, thus for its synthesis two complementary strategies have been performed:

1. the construction of a model for frequencies that studies the ORs through the interaction between the row and column variables. The RC(M) association model for two-way contingency table belongs to this class;
2. to use a measure of synthesis of ORs.

The road map of the paper begins with the construction of a complete set of log ORs generated by a two-way contingency and continues with the application of the RC (M) association model hypothesizing a Poisson distribution for the counts of the two-way contingency table. Then a parameter estimation of RC(M) and graphical representation using a methodology based on singular value decomposition (De Rooij and Anderson 2007) have been proposed.

This paper is divided into further five sections. The notation in section 2. In section 3 is showed a theoretical description of use of Odds ratios in RC(M) association. Section 4 provides the description of a synthesis index. In section 5 are showed the results applying the two models to the data. Some final remarks are made in section 6.

### Notation

Let  $A(n_{ij})$  be a two way-contingency table that cross-classifies  $N$  units into  $I$  row categories and  $J$  column categories. Let the cell probability define by  $p_{ij} = P(I = x_i \cap J = y_j)$ , where  $x_i$  is the  $i$ -th category of  $I$  and  $y_j$  is the  $j$ -th category of  $J$  (Agresti 2002). The odds ratio (OR) is a measure of association between  $I$  and  $J$  (Altham 1970; Goodman 1979; Greenare 2009) and is defined by a complete set of ORs:

$$OR_{ii'jj'} = \frac{p_{ij}p_{i'j'}}{p_{ij'}p_{i'j}} \quad 1 \leq i \leq i' \leq I^* \text{ and } 1 \leq j \leq j' \leq J^* \quad (1)$$

where  $I^* = I(I-1)/2$  and  $J^* = J(J-1)/2$ .

If we suppose all the probabilities follow a Poisson sampling  $p_{ij} = \frac{n_{ij}}{N}$ , the ORs can be defined also as:

$$OR_{ii'jj'} = \frac{n_{ij}n_{i'j'}}{n_{ij'}n_{i'j}} \quad 1 \leq i \leq i' \leq I^* \text{ and } 1 \leq j \leq j' \leq J^* \quad (2)$$

The complete set of ORs is composed by  $\left(I^* = \frac{I(I-1)}{2} \times J^* = \frac{J(J-1)}{2}\right)$  elements and is redundant. However there exist basic sets of  $((I-1) \times (J-1))$  ORs that contain all the information about association between  $I$  and  $J$ . The principal basic sets (Edwardes and Baltzan 2000) are the local ORs defined by

$$\text{local } OR_{ij} = \frac{p_{ij}p_{i+1j+1}}{p_{ij+1j}} \quad 1 \leq i \leq (I^* - 1) \text{ and } 1 \leq j \leq (J^* - 1) \quad (3)$$

and spanning cell odds ratios defined by

$$\text{spanning } OR_{ij} = \frac{p_{11}p_{ij}}{p_{1j}p_{i1}} \quad \text{where the spanning cell is } i = j = 1 \quad (4)$$

$$2 \leq i \leq I^* \text{ and } 2 \leq j \leq J^*$$

Although these sets reduce the number of ORs from  $\left(I^* = \frac{I(I-1)}{2} \times J^* = \frac{J(J-1)}{2}\right)$  to of  $((I-1) \times (J-1))$ , there are various applications in which the number of ORs to be calculated, to verify the relationship between the two variables, is yet too large.

### RC(M) Model Association

Goodman in 1979 proposed the RC(1) association model to verify the association in a two-way contingency table. The RC(1) is defined by a set of

$$p_{ij} = \alpha_i \beta_j \exp(\theta \rho_i \delta_j) \quad (5)$$

This model is more parsimonious of log linear model for the analysis of association in two-way tables.

This model was then extended to RC(M) association model to decompose the association into M components (Goodman, 1981):

$$p_{ij} = \alpha_i \beta_j \exp\left(\sum_{m=1}^M \theta_m \rho_{im} \delta_{jm}\right) \quad (6)$$

where  $\alpha_i$  and  $\beta_j$  are the effects of I and J respectively,  $\theta_m$  is a measure of strength of the association between I and J and  $\rho_{im}$  and  $\delta_{jm}$  are respectively the m-th component of i-th row score and j-th column score. With respect to the scores the following constraints are employed:  $\sum_{i=1}^I \rho_{im} p_{i+} = \sum_{j=1}^J \delta_{jm} p_{+j} = 0$ ;  $\sum_{i=1}^I \rho_{im}^2 p_{i+} = \sum_{j=1}^J \delta_{jm}^2 p_{+j} = 1$ ;  $\sum_{i=1}^I \rho_{im} \rho_{i'm} p_{i+} = \sum_{j=1}^J \delta_{jm} \delta_{j'm} p_{+j} = 0$ , where  $p_{i+} = \sum_{j=1}^J p_{ij}$  and  $p_{+j} = \sum_{i=1}^I p_{ij}$ .

Eshima and Tabata (1997) showed that the RC(M) association model is a discretized version of canonical correlation analysis in the multivariate normal distribution.

For graphical display of the RC(M) association model (De Rooij and Anderson 2007) we have to compute a vector for rows of elements  $\theta_m \frac{1}{2} \rho_{im}$  and one for columns of elements  $\theta_m \frac{1}{2} \delta_{jm}$  and consider the inner product.

The ORs related to RC(M) association model can be computed using the inner product rule and are:

$$OR_{ii'jj'} = \exp\left(\sum_{m=1}^M \theta_m (\rho_{im} - \rho_{i'm})(\delta_{jm} - \delta_{j'm})\right) \quad (7)$$

The graphical representation of RC(M) association model can be given also using a distance rule (De Rooij and Heiser 2005). Define  $r_i = \sum_m \theta_m \rho_{im}$  the i-th principal coordinate of variable I and  $c_j = \sum_m \theta_m \delta_{jm}$  the j-th principal coordinate of variable J. When using the Euclidean distance ( $d^2$ ), the ORs can be computed as:

$$OR_{ii'jj'} = \exp\left[\frac{1}{2}\left(d^2(r_{i'}, c_j) + d^2(r_i, c_{j'}) - d^2(r_i, c_j) - d^2(r_{i'}, c_{j'})\right)\right] \quad (8)$$

### A Summary Measure

Gilula, Krieger, Ritov, and Haberman in 1988 showed that association in a RC(M) model might be studied, in each component, by considering  $\theta_m$  and the Pearson product-moment correlation coefficients of row and column scores:

$$P_m = \sum_{i=1}^I \sum_{j=1}^J \rho_{im} \delta_{jm} p_{ij} \quad (9)$$

In this section, it is proposed a summary measure of association in the RC(M) association model by considering the log odds-ratios related and computed using the inner product rule:

$$\log OR_{ii'jj'} = \sum_{m=1}^M \theta_m (\rho_{im} - \rho_{i'm})(\delta_{jm} - \delta_{j'm}). \quad (10)$$

If the baseline line  $\rho_{i'm}$  and  $\delta_{j'm}$  of row and column score vectors are replaced by the averages with respect to I and J, i.e. the zero vectors ( $\rho_{i'm} = 0$  and  $\delta_{j'm} = 0$  for  $m=1, \dots, M$ ). The equation (10) becomes:

$$\log OR_{i_0j_0} = \sum_{m=1}^M \theta_m \rho_{im} \delta_{jm} \quad (11)$$

The equation 11 can be rewritten as:

$$\log OR_{i_0j_0} = \rho_i P \delta_j,$$

where P is  $M \times M$  diagonal matrix.

To compute a summary measure, it is possible to consider the OR mean:

$$E[\rho_i P \delta_j] = \frac{1}{2} \left[ \sum_{i=1}^I \sum_{i'=1}^I \sum_{j=1}^J \sum_{j'=1}^J \sum_{m=1}^M (\rho_{im} - 0)^2 p_{ij'} + (0 - \delta_{jm})^2 p_{i'j} - (\rho_{im} - \delta_{jm})^2 p_{ij} \right] \quad (12)$$

Using the equation 9, the previous expression can be written as

$$E[\rho_i P \delta_j] = \sum_{m=1}^M \theta_m \sum_{i=1}^I \sum_{j=1}^J \rho_{im} \delta_{jm} p_{ij} = \sum_{m=1}^M \theta_m P_m. \quad (13)$$

To get a summary index to analyse the between the two variables just to divide equation 13 by the sum of singular values of matrix containing the complete set of log odds-ratios.

$$\Lambda(I, J) = \frac{\sum_{m=1}^M \theta_m P_m}{\sum_{m=1}^M \theta_m}$$

Eshina, Tabata and Tsujitani in 2001 showed in Theorem 5 that equation 5 is equivalent to Kullback-Leibler Information  $K_I(I, J)$ :

$$K_I(I, J) = \sum_{i=1}^I \sum_{j=1}^J p_{ij} \log \frac{p_{ij}}{p_{i+} p_{+j}} + \sum_{i=1}^I \sum_{j=1}^J p_{i+} p_{+j} \log \frac{p_{i+} p_{+j}}{p_{ij}} = \sum_{i=1}^I \sum_{j=1}^J p_{ij} \log p_{ij} - \sum_{i=1}^I \sum_{j=1}^J p_{i+} p_{+j} \log p_{ij}$$

This equivalence implies that higher the values of  $\Lambda(I, J)$  the more the association between the variables of a contingency table is.

### Case Study

In this section the RC(M) model association is used to verify if the legislative decree 81/2008 has managed to reduce the unacceptable level of work accidents. The data, shown in table 2, have been provided by the annually report of National Institute for Insurance of Accidents at Work (INAIL) and represent the trend of accidents in Italy between 2008 and 2018 in areas of Italy (North, Center, South and Isles). Before this table was drawn up, the trends in employment in Italy in the same years (table 1) (the data have been provided by the ISTAT) has been analyzed.

**Table 1:** Occupation in Italy

	2008	2009	2010	2011	2012	2013
<b>NORTH</b>	12354817	12171118	12097756	12162878	11900580	11775568
<b>CENTER</b>	4762710	4740066	4730957	4723021	4817814	4745953
<b>SOUTH</b>	4351837	4201487	4135797	4151705	4190853	4025987
<b>ISLES</b>	2080120	2048236	2026735	2027374	1989482	1872749
	2014	2015	2016	2017	2018	
<b>NORTH</b>	11611970	11664409	11830872	12459254	12568489	
<b>CENTER</b>	4810778	4851000	4875864	4931259	4969370	
<b>SOUTH</b>	3986333	4033000	4137596	4192790	4227667	
<b>ISLES</b>	1869837	1918000	1913506	1928928	1944761	

The association between the row and columns variables, of table 1, is not statistically significant (Phi coefficient equal to 0.149 on 33 degrees of freedom), i.e. there is no significant change in the number of employees during years. This implies that employment values do not influence the accident variable and therefore there is independence between the two variables.

**Table 2:** Work accidents in Italy

	2008	2009	2010	2011	2012	2013
<b>NORTH</b>	550777	517741	519107	489133	451101	419433
<b>CENTER</b>	191270	175936	173741	163360	146923	137316
<b>SOUTH</b>	133094	123317	120278	109959	98530	92424
<b>ISLES</b>	61383	58446	58174	55086	48982	45830
	2014	2015	2016	2017	2018	
<b>NORTH</b>	400799	385167	387116	392234	395691	
<b>CENTER</b>	130873	126409	125522	125520	123196	
<b>SOUTH</b>	88151	84136	85811	85170	84932	
<b>ISLES</b>	43748	41413	42896	41955	41880	

To verify the full effect of legislative decree 81/2008, the data of table 2 have been analysed using the RC(M) association model. Although the sample size is large, the RC(3) association model fits the data well. According to analysis, the intrinsic association coefficients related to log odds ratio of the model are:

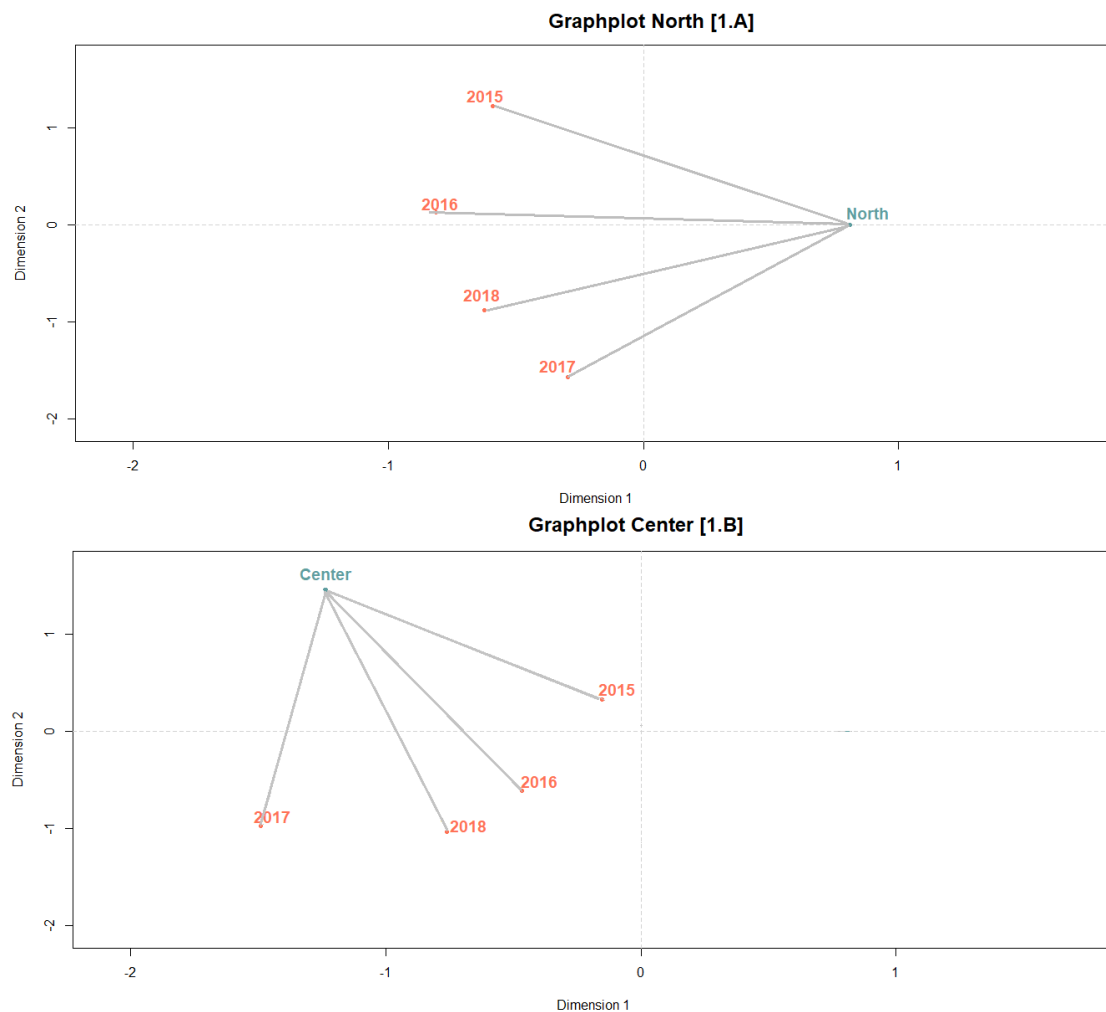
$$\theta_1 = 0.01680, \quad \theta_2 = 0.00351, \quad \theta_3 = 0.00298$$

It is evident that are positive and close to zero, highlighting there is no correlation between the considered variables. In order to compute a summary measure between the variables zones and years ,as proposed in section 4, the Kullback-Leibler Information is used ( $E[\log OR_{ii'jj'}] = -0.00828$  and  $K_I(I, J) = 0.00015$ ).  $K_I$  value is very close to zero implying there is no correlations between variables. In this application the results are compared with the findings obtained from the Altham's index (De Rooij and Anderson 2007), a basic measure which summarizes the ORs:

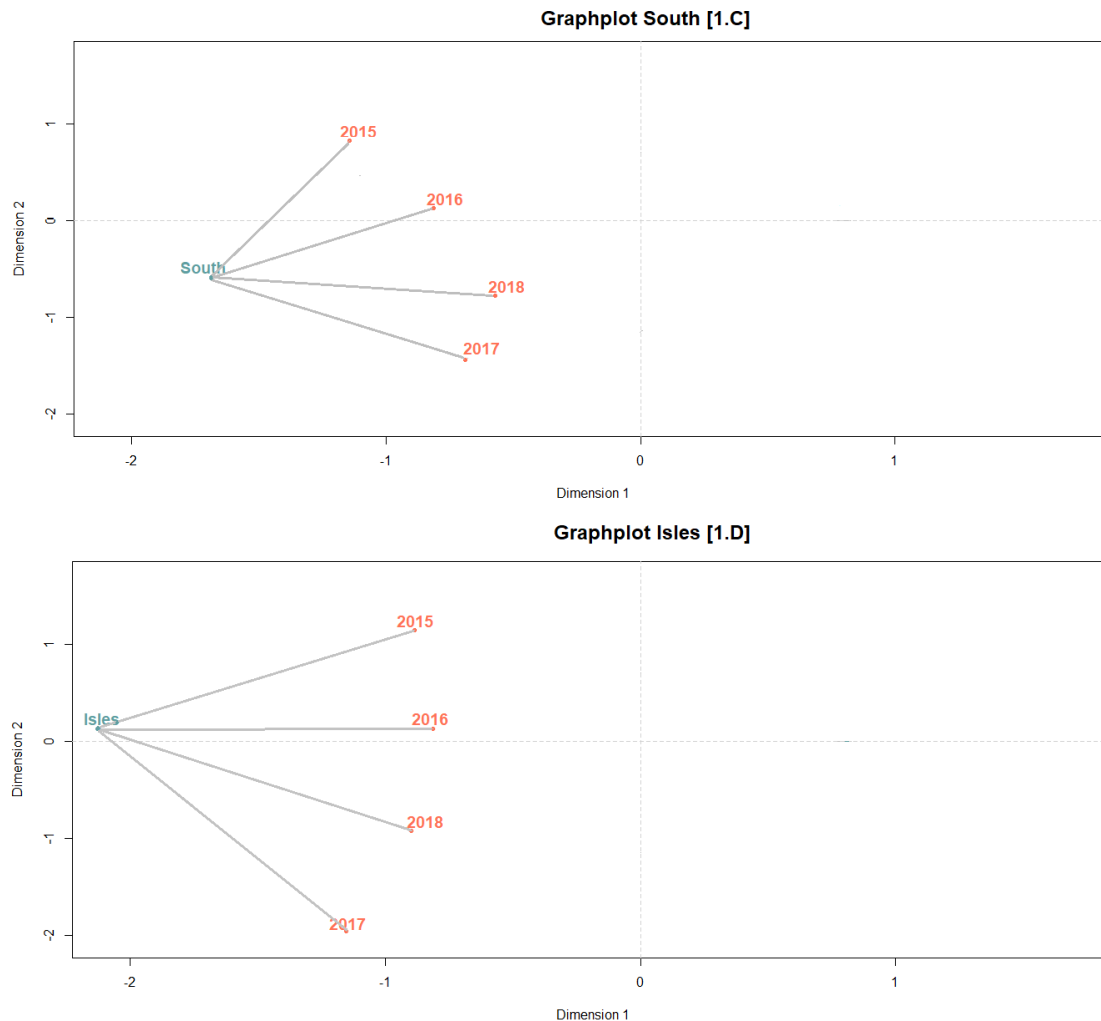
$$A = \left[ \frac{\sum_i \sum_j (\log OR_{ii'jj'})^2}{I^*J^*} \right]^{\frac{1}{2}} = 0.0002576054$$

This index also implies that there is no correlation between the two variables and therefore over the years there has not been a real decrease in accidents as expected.

In figure 1 is portrayed the graphical representation of table 2 using the RC(M) association model in which the ORs are represented using solid and dashed lines. In the graph plot the column scores are represented by red points and the row scores by blue points. The distances between row and column categories can be analyzed. Each of four figures represents the trend of accidents in a given geographical area. The plots highlight there is no significant reduction of the number of accidents over the years (as distances between row and column categories are substantially equal).







**Figure 1. The interactive biplot from the RC(M) analysis with solid and dashed lines**

## Conclusions

Research and regulation in the field of safety and health at work are relatively recent phenomena. In 2015, the European Agency for Safety and Health at Work has issued a report on the European situation for accidents at work, highlighting the critical state of Italy.

Currently, in Italy, the law of reference is the legislative decree 81/2008 ((known as the Testo Unico Sicurezza Lavoro), which revised and integrated most of the decrees from the '50s onwards, by incorporating the EU Directives coordinated in a single piece of legislation that includes specific sanctions against defaulters. The main provisions are related to the organization of thorough procedures to improve health and safety. In this work, it was investigated whether preventive policies, mandatory in Italy with the legislative decree 81/2008, have highlighted a real decrease in accidents at work. The data were extracted from National Institute for Insurance of Accidents at Work (INAIL) and represent the trend of accidents in Italy between 2008 and 2018 in areas of Italy (North, Center, South and Isles). The analysis has been conducted using RC(M) model association, in particular has been proposed the use of a summary measure and a graphical representation to verify if correlation between the variables zones and years exists. Both the graphical results and the summary index pointed out that there is very little association between the number of accidents and the time period analyzed. This implies that there has not been a significant decrease in accidents at work and therefore the Legislative Decree 81/2008 didn't meet all expectations.

These results imply that the mere legislation is not enough and in addition are necessary more specific interventions: an awareness-raising campaign on the importance of occupational safety and procedures to be followed, the creation of a task force to carry out more extensive checks on the national territory and the enactment of specific regional laws also by virtue of the different problems in which the Italian regions pour.

## References

- Agresti, A. (2002) *Categorical Data Analysis*. New York: Wiley
- Altham, P. M. E. (1970). The Measurement of Association of Rows and Columns for an  $r \times s$  Contingency Table. *Journal of the Royal Statistical Society: Series B (Methodological)*, 32(1):63-73.
- Bisio, C. (2009) Psicologia per la sicurezza sul lavoro. Rischio, benessere e ricerca del significato. *Giunti Organizzazioni Speciali, Florence*.
- Broy, M., and Dener, E. (2002) Software engineering --- from auxiliary to key technologies. *Software Pioneers*, Springer, Heidelberg: pp. 10-13.
- Campbell, I. (2007) Chi-squared and Fisher-Irwin tests of two tables with small sample recommendations. *Statistic in Medicine*, 26, 3661-3675.
- Darwish, S., Ahmed, U., & Pahi, M. H. (2020). Innovative Work Behavior During COVID-19 for Medical Representative in the Pharmaceutical Industry: Test of a Moderation Model in Bahrain. *International Journal of Pharmaceutical Research*. 12(4), 1927-1934. doi.org/10.31838/ijpr/2020.12.04.277
- De Rooij, M., and Anderson, C. J. (2007). Visualizing, summarizing, and comparing odds ratio structures. *Methodology*, 3:139-148.
- De Rooij, M., and Heiser, W. J. (2005) Graphical representations and odds ratios in a distance-association model for the analysis of cross-classified data. *Psychometrika*, 70(1):99-122.
- Dod, J. (1999) Effective substances. *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry.
- Eshima, N., & Tabata, M. (1997) The RC (M) association model and canonical correlation analysis. *Journal of the Japan Statistical Society*, 27(1): 109-120.
- Eshima, N., Tabata, M., & Tsujitani, M. (2001) Property of the RC(M) association model and a summary measure of association in the contingency table. *Journal of the Japan Statistical Society*. 31(1): 15-26.
- Everitt, B. S. (1992) *The Analysis of Contingency Tables*. London: Chapman & Hall.
- Geddes, K. O., Czapor, S. R., Labahn, G. (1992) *Algorithms for Computer Algebra*. Kluwer academic publishers.
- Gilula, Z., Krieger, A. M., & Ritov, Y. (1988) Property of th RC(M) association model and a summary measure of associations in the contingency table. *Journal of the Japan Statistical Society*, 31: 15-26.
- Gilula, Z., & Haberman, S. J. (1988) The Analysis of Multivariate Contingency Tables by Restricted Canonical and Restricted Association Models. *Journal of the American Statistical Association*, 83: 760-761.
- Greenacre M. (2009). Correspondence Analysis in Practice. *Journal of the International Biometric Society*, 65(3): 997-998.
- Goodman, L. A. (1979) Simple Models for the Analysis of Association in Cross-Classifications Having Ordered Categories. *Journal of the American Statistical Association*, 74:537-552.

- Goodman, L. A. (1981) Association models and canonical correlation in the analysis of cross-classifications having ordered categories. *Journal of the American Statistical Association*, 76(374): 320-334.
- Hamburger, C. (1995) Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Annali di Matematica Pura ed Applicata* 169:321-354.
- Kim, J., Lee, J., Chang, S. (2016) A Study on the Accident Analysis of Architectural Work. *Journal of the Korean Society of Safety*, 31(3): 96-101.
- Lynch, D., and Vogel, D. (2001) The Regulation of GMOs in Europe and the United States: A Case-Study of Contemporary European Regulatory Politics. *Council on Foreign Relations Relations*.
- Milanowicz, M., and Budziszewski, P. (2013) Digital Human Modeling and Applications in Health, Safety, Ergonomics, and Risk Management. Healthcare and Safety of the Environment and Transport. In: *4th International Conference, DHM 2013, Held as Part of HCI International 2013*, Las Vegas, NV, USA, July 21-26, 2013, Proceedings, Part I VL - 8025
- Schilling. (2013) Occupational health practice. *Butterworth-Heinemann*. R. S. F. Schilling editions.
- Slifka, M. K., Whitton, J. L. (2000) Clinical implications of dysregulated cytokine production. *J. Mol. Med.* Testo unico sulla salute e sicurezza sul lavoro. D.lgs. 9 aprile 2008, n. 81.
- Tiraboschi, M. (2016) *Le nuove regole del lavoro dopo il Jobs Act. Commento sistematico dei decreti legislativi nn. 22, 23, 80, 81, 148, 149, 150 e 151 del 2015 e delle norme di rilievo lavoristico della legge 28 dicembre 2015, n. 208 (Legge di stabilità per il 2016)*, Giuffrè, Milano, Le nuove leggi civili, pp. 3-624.
- Tiraboschi, M., and Fantini, L. (2009) *Il Testo Unico della salute e sicurezza sul lavoro dopo il correttivo (d.lgs. n. 106/2009). Commentario al decreto legislativo n. 81/2008 come modificato e integrato dal decreto legislativo n. 106/2009*, Giuffrè, Milano, Le nuove leggi civili, pp. 1-1209.
- Waring, J., Allen, D., Braithwaite, J., Sandall, J. (2015) Healthcare Quality and Safety: A Review of Policy, Practice and Research. *Sociology of health & illness* 38(2):198-215.