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SUDDEN INFANT DEATH SYNDROME: KNOWLEDGE OF ITS RISK FACTORS AMONG ITALIAN HEALTHCARE PROFESSIONALS

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***Abstract**: This paper focuses on healthcare professionals' knowledge about risk and protective factors of Sudden Infant Death Syndrome.*
We adapted a Rasch model to obtain an index of unpreparedness which we then analysed with a random logistic regression model.
Healthcare professionals from different regions present significant differences in their knowledge. All healthcare professionals, especially physicians, show a significantly lower knowledge than paediatricians. Similar conclusions can be drawn with respect to those not working in birth centres or in family planning clinics.

***Keywords**: Healthcare professionals, infant mortality, knowledge assessment, Rasch model, random logistic regression model.*

1. Introduction

In developed countries the major causes of death for healthy born infants in the post-neonatal age (from 1 to 12 months) is Sudden Infant Death Syndrome (SIDS, also known as 'crib death'). It is defined as 'the sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history' [6]. In the United States, 8.4% of infant deaths were attributed to SIDS in 2007 [14]. More generally, its impact on the population of healthy born infants can be estimated at between 0.4 and 1.0 deaths per 1000 infants [11,9].

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The cause of SIDS has not yet been determined, so it is impossible to prevent it for sure. However, it is possible to try to prevent it through some interventions which reduce its risk [7-5]: placing the newborn to sleep in a supine position, avoiding smoking during pregnancy (for the mother) and after the newborn's birth (for both parents), keeping the temperature of the room where the newborn sleeps around 20°C, and using a mattress on which the newborn sleeps of the exact size of the cot and not too soft. Furthermore, some other interventions which are still under debate are: the newborn's feet should touch the bottom of the cot or crib, introducing, as a screening procedure, an electrocardiography (ECG) examination for all newborns [10], breastfeeding [5, 12], the newborn should sleep in the same room as her/his parents but should not share the same bed [1], and, finally, parents should consider offering a pacifier at nap time and bedtime throughout the first year of life (but no longer) [4].
Healthcare professionals' role is of paramount importance, as they are the subjects in charge of transmitting and explaining to parents how to implement these interventions in order to reduce the risk of SIDS for their newborns. Therefore, their knowledge of this topic must be as thorough and updated as possible.
The main objective of this study is to analyse the preparation of healthcare professionals on the basis of their personal and contextual characteristics in order to identify those in need of additional training. Moreover, since in Italy most of the healthcare policy decisions are made at a regional level, we also want to assess whether the regional effect is significant or not.

2. Data

Data were gathered in the occasion of the National Campaign 'GenitoriPiù', set up in 2007 by the Italian Ministry of Health to increase the prevention of eight major childhood risks. The survey, performed between September 2008 and June 2009, consisted in a questionnaire to be completed by the healthcare professionals in paper form.
9 Italian Regions and 2 Milan Local Health Units (known in Italian as ASLs) participated in the survey. Within the participating regions, 59 ASLs out of 111 took part in the survey and 5,911 questionnaires were filled in. The survey cannot be considered representative of all Italian healthcare professionals since it is based only on data collected from those belonging to the participating ASLs. On the other hand, this is the first national survey on this topic, so the findings are particularly important.
Our analysis focused on 7 items which the healthcare professionals were asked to classify as protective factors against SIDS or not (the correct answer is in brackets):
1. Put the newborn to sleep in a supine position [protects]
2. Avoid smoking in the room where the newborn sleeps [protects]
3. Use a soft mattress for the crib of the newborn [does not protect]
4. Breastfeeding [protects]
5. Keep high the temperature of the room where the newborn sleeps [does not protect]
6. Ensure that the newborn touches the bottom of the cot with her/his feet [protects]
7. Perform an ECG of the newborn [does not protect]

For all items the response categories were: 'Protects', 'Does not protect' and 'I do not know'.
The characteristics available for the respondents were: region and ASL to which they belonged, gender, age (in classes), years of professional experience, professional role, and workplace.

3. Methods

We began our analysis by constructing an index which quantified healthcare professionals' unpreparedness. Then we studied this index on the basis of the respondents' characteristics.
Data distribution showed that the response category 'I do not know' was chosen frequently: in the case of 'use of a soft mattress', for example, it accounted for 19.6% of the answers, 25.2% in the case of 'touching with the feet the bottom of the cot' and 25.4% in the case of 'ECG'. Starting from this evidence, we assumed that the response variable was of ordinal nature (with correct being the best response in terms of knowledge, 'I do not know' being the second-worst response, and wrong being the worst response). The underlying hypothesis to do this is that the response 'I do not know' should be interpreted as a less serious admission of ignorance than a wrong answer. Giving parents a wrong advice, in fact, will have much worse consequences than admitting not knowing the correct answer and telling them to come back or to seek further advice.
Since the number of possible response categories was constant for all items, we obtained the index by applying a Rating Scale Model [13,8], which is commonly used when there is the need to evaluate respondents' knowledge over a series of items:

$$\Pr(X_{in} = w \mid \theta_n) = \frac{\exp\{\lambda_i \sum_{l=0}^{w} (\theta_n - \delta_{il})\}}{\sum_{w=0}^{W} \exp\{\lambda_i \sum_{l=0}^{w} (\theta_n - \delta_{il})\}} \qquad (1)$$

Where: X_{in} = 0,1, …,W is the answer given by the n-th respondent to the i-th item; W is the number of the possible response categories (W=3); θ_n is the unpreparedness of the n-th respondent; δ_{il} is the difficulty parameter associated with the transition from the category (l-1) to the category l for the i-th item; λ_i is the discrimination parameter for the i-th item.
We assessed the one-dimensionality of the model *a priori*: given the nature of the response variable, we proceeded with a correspondence analysis. The proportion of inertia explained by its first dimension was very high (77.2%) and the first axis clearly separated the three response options. We also validated the discrimination parameters of the Rating Scale Model with the opinion of some experts by comparing the average weight given to each item by 5 experts with the values of the λ_i. The concordance of the results was assessed through the use of the Spearman's rank correlation coefficient (equal to 0.8929, p = 0.007).
Once the index was ready, we considered it as a dependent variable.
The approach we used is the random intercept logistic model [2,3]. We are mainly interested in the regional effect, because the region is responsible for the most important healthcare policies. Thus we considered the Region as a fixed effect. Anyway, because regional directions are applied at the ASL level, the ASL was considered as a random effect, in order to assess if the additional administrative partition in ASLs led to different behaviours within the same region. The effect of the ASL, then, was estimated using the intraclass correlation coefficient (ICC).
The choice of a logistic model is justified by the strong non-normality of the response variable, which led us to the decision to dichotomise the index's scores. The threshold for the

dichotomisation was carefully determined after discussing with the policymakers involved in the campaign and after performing a sensitivity analysis to ensure the results' consistency.
The model considers the interaction between gender and professional role; this choice is basically *a priori*, due to the different distribution of professional roles between males and females—females are significantly more likely than males to be obstetricians, and among nurses more females specialise in newborn care.

4. Results

At first, we evaluated the opportunity of including the discrimination parameter λ_i in the Rating Scale Model. We estimated six discrimination parameters, one for each item, with 'Sleeping supine' chosen as reference (λ=1) because it is the most important protective factor against SIDS and, consequently, it should be among those with the highest discrimination power. The λ_i for the items 'Avoid smoking' and 'Breastfeeding' were not significantly different from 'Sleeping supine' (p=0.089 and 0.168 respectively). This means that answering incorrectly to any one of these three items implies a higher probability of answering incorrectly also the other questions. The other items have a significant lower discrimination power (p<0.001); the lowest power is associated with 'Performing an ECG' (λ=0.18). This means that giving the wrong answer to this item does not imply that the respondent gave the wrong answer to all the other questions too.
After obtaining the appropriate index of unpreparedness, we proceeded with the random intercept logistic regression. The ICC was equal to 0.04, which is very low, almost negligible. Only 8 ASLs (out of 59) showed a baseline value that was significantly different from the mean. Hence, the results below refer to a one-level logistic model in which the effect of ASL is omitted.
The generalized R^2 is 9.2%, a remarkable value with only five variables. Professional seniority was not included as it is highly correlated to age. Age, instead, was left in the model despite its lack of significance because it could represent a useful hint for targeted training sessions.
The effect of the professional role is very important (Table 1). Once the paediatrician is taken as a reference, all the other professional roles show significantly higher levels of unpreparedness, with the only exceptions being the 'Male obstetrician' (too few cases and high standard error). The obstetrician is the professional role with the better knowledge after the paediatrician. The level of preparation of physicians is much worse than that of paediatricians. However, it is worthy to remember that they are mostly gynaecologists, and that their major role next to newborns' parents ends at the time of childbirth. Nonetheless, this result underlines how they may be at risk of an excessive specialisation in terms of their knowledge on this topic.
Among females the difference of knowledge between paediatricians and the other professional roles is not as high as it is among males.
The workplace also has an effect on healthcare professionals' knowledge: taking the birth centre as a reference, all other workplaces show an unpreparedness which is significantly higher, with the only exception of the family planning clinics.
Finally, it is possible to spot many regions that behave differently from Veneto: Friuli-Venezia Giulia, with a significantly higher degree of knowledge, and Lazio, Lombardia, Apulia, Sardinia and Aosta Valley with a significantly worse performance. The result on the Friuli-Venezia Giulia

is of particular interest, as in this region the local policymakers implemented training courses on this topic which have been running for some years before this survey.

Table 1. Logistic regression of the unpreparedness' index: estimates of ORs and of their confidence intervals.

Covariate	Odds Ratio [OR]	95% Wald Confidence Interval	
Age: ref. 55 years and older			
18-34 years	1.282	0.957	1.719
35-44 years	1.147	0.905	1.452
45-54 years	1.061	0.860	1.309
Professional role among males: ref. Paediatrician			
Healthcare assistant	**4.444**	1.607	12.291
Nurse	**4.070**	1.978	8.375
Obstetrician	4.524	0.860	23.812
Physician	**3.881**	2.424	6.212
Other	**3.571**	2.002	6.366
Professional role among females: ref. Paediatrician			
Healthcare assistant	**1.996**	1.393	2.860
Nurse	**1.790**	1.310	2.445
Obstetrician	**1.469**	1.031	2.094
Physician	**2.352**	1.591	3.477
Other	**2.380**	1.661	3.409
Workplace: ref. Birth centre			
Dep. of public health	**1.571**	1.180	2.092
District	**1.865**	1.460	2.383
Family planning clinic	1.114	0.858	1.447
Hospital	**1.694**	1.290	2.225
Medical clinic	**1.739**	1.269	2.383
Vaccinations centre	**2.121**	1.533	2.935
Other	**1.819**	1.235	2.679
Region: ref. Veneto			
Abruzzo	0.490	0.135	1.772
Aosta Valley	**2.300**	1.351	3.916
Apulia	**2.072**	1.602	2.680
Emilia-Romagna	0.983	0.745	1.297
Friuli Venezia-Giulia	**0.529**	0.386	0.725
Lazio	**2.034**	1.592	2.599
Lombardia (2 Milan ASLs)	**1.394**	1.002	1.940
Molise	1.131	0.482	2.656
Sardinia	**1.653**	1.278	2.139
Umbria	1.224	0.920	1.628

5. Conclusions

This paper shows how the level of knowledge about SIDS risk factors varies across different healthcare professionals. The most important determinants of these differences are the professional role and the workplace: paediatricians, and then obstetricians, are the most qualified professionals, while all the other healthcare professionals, including other physicians, have a significantly lower knowledge. Professionals working in birth centres and in family planning clinics show a significantly higher knowledge than the professionals working in other workplaces. This aspect is very important, because family planning clinics are not meant to be primary care providers for families, and because after birth newborns' parents seek care for their child in other places rather than in birth centres. Usually, in fact, they seek care for their child at vaccination centres, hospitals, and medical clinics. As a consequence, particular attention should be given to increase training about SIDS risk factors at these care locations.
Spatial variables also turned out to be significant: moreover, the increased competence of the professionals working in Friuli-Venezia Giulia can plausibly be attributed to a previous training Campaign, hence proving the effectiveness of these campaigns.
This study also presents some limitations: above all, the fact that the involvement of the ASLs in the project was voluntary, so there is the risk of a systematic bias caused by systematically different levels of knowledge among the non-participating ASLs. Therefore, it is necessary to implement a survey that would make use of a probability sample in future studies.

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