View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Università del Salento: ESE - Salento University Publishing

EJASA:DSS – Electronic Journal of Applied Statistical Analysis: Decision Support Systems and Services Evaluation

http://siba-ese.unisalento.it/index.php/ejasa_dss/index

e-ISSN: 2037-3627

DOI: 10.1285/i2037-3627v4n1p1

An evaluation of the variability of episiotomy rates across hospitals: the case of Sardinia

By Massimo Cannas, Emiliano Sironi

Published: 28 December 2013

This work is copyrighted by Università del Salento, and is licensed under a Creative Commons Attribuzione - Non commerciale - Non opere derivate 3.0 Italia License.

For more information see:

http://creativecommons.org/licenses/by-nc-nd/3.0/it/

Electronic Journal of Applied Statistical Analysis: Decision Support Systems and Services Evaluation
Vol. 04, Issue 01, 2013, 1-8
DOI: 10.1285/i2037-3627v4n1p1

An evaluation of the variability of episiotomy rates across hospitals: the case of Sardinia

Massimo Cannas[a] and Emiliano Sironi*[b]

[a] *University of Cagliari, Department of Business and Economics, Via Sant'Ignazio 74, Cagliari (CA)*
[b] *Catholic University, Department of Statistical Sciences, Largo Gemelli 1, Milan (MI)*

Published: 28 December 2013

The aim of this paper is to assess the extent of variation in the use of episiotomy across hospitals and to evaluate how much of this variation can be explained by case-mix factors. Using official hospital abstracts on deliveries occurred in the hospitals of the Italian region of Sardinia during 2009, we implement a multilevel logistic model in order to predict the likelihood of an episiotomy from a set of covariates which includes both socio-demographic and clinical indices. Results suggest that, with the exception of education, socio-demographic variables were not significant in determining episiotomy while several clinical predictors were significant. Our main finding is that almost half of the variation in episiotomy rates remains unexplained after conditioning on clinical indicators and socio-demographic factors.

keywords: Episiotomy, Variation in intervention rates across hospitals, Multilevel models.

1 Introduction

Episiotomy is defined as the incision of the perineum in vaginal childbirth. Obstetrics practice usually recommends an episiotomy when there is a risk of severe perineal tears or concerns for damage to the foetal head. Although over the past few decades episiotomy has been widely practiced in Western hospitals, more recently, in parallel with the rise in

*Corresponding author: emiliano.sironi@unicatt.it

©Università del Salento
ISSN: 2037-3627
http://siba-ese.unisalento.it/index.php/ejasadss/index

research-based evaluations of medical procedures, its routine use in vaginal deliveries has been seriously questioned (Wolley, 1995). Individualisation is now generally advocated instead of the routine use of episiotomy. Indeed, several studies have raised doubts about its ability to yield better maternal and neonatal outcomes and have also highlighted the possible negative effects associated with its liberal use (Wolley, 1995; Viswanathan et al., 2005; Wagner, 1999). It is likely that these studies have contributed to the slow but constant reduction in episiotomy usage reported in official statistics (Rockner and Flanu, 1999; Weber and Meyn, 2002).

Despite these criticisms and the general trend of a decrease of incidence rates, episiotomy remains a widespread procedure occurring in 24.5% of all vaginal deliveries in the U.S. in 2004 (Franckman et al., 2009) and in more than 70% in Italy, according to a sample study conducted in 2002 (Grandolfo et al., 2002). It should be emphasized that, since the use of episiotomy can be heavily driven by local professional norms, experience in training, and the individual clinician's preference (Wolley, 1995), the total rate can be misleading as indicator of incidence and great variation may exist across hospitals and practitioners within a region.

Variation in rates of obstetric interventions has already been observed in the obstetric literature. For example, Humphrey and Tucker (2009) reported consistent variation in the rates of induction of labour across hospitals, and found that about one third of inductions remained unexplained after controlling for medical indications. Webb and Culhane (2006) focused explicitly on the relationship between episiotomy and its claimed benefits and, using data from 18 maternal hospitals in a large suburban area, they showed that the large differences in episiotomy rates were difficult to be justified since they did not positively correlate with lower rates of severe tears. Clearly, it is possible that episiotomy rates are more strongly correlated with pre-treatment variables than with rates of post-treatment outcomes. Robinson et al. (2000) investigated the determinants of episiotomy in a single hospital facility and showed that the strongest predictor of episiotomy was the type of obstetric provider, i.e., a pre-treatment variable operating at an "intermediate" level between the hospital and the mother.

In this study, using data from hospital facilities located in the Italian region of Sardinia, we attempt to clarify whether differences in hospital rates can be justified considering differences in case-mix factors. Using a two-level logistic regression model, we show that case mix factors accounting for both medical indications and socio-demographic characteristics can explain only 50% of the total variation in episiotomy use across hospitals.

2 Methods

We considered a data set containing information on deliveries which occurred in the 22 hospitals of the Italian region of Sardinia in the year 2009. The data set merges the individual information contained in the following official sources: the hospital discharge abstract and a complementary abstract called CeDAP. The first source uses the ICDM-9 coding system to record all information on medical interventions performed during the stay in hospital while the latter is an abstract designed by an Italian regulation in 2002 for capturing additional information on social and demographic characteristics of the family. The two sources were linked using the mother's taxpayer code as the matching key, leading to a merged data set containing 11,324 records.

We restricted our analysis to the subset of 5,305 records which included all singleton, vaginal and term (36 weeks or after) deliveries. Operative deliveries (using forceps or vacuum, 317 records) were excluded from the analysis because the use of episiotomy in these cases was universal. Another variable that could bias intervention rates is multiparity (which usually decreases the likelihood of an episiotomy) but in our study the expected proportion of multiparas women was considered to be the same across all hospitals, and so we included both nulliparous and multiparas women in the analyzed sample, and introduced a multiparity dummy variable among the covariates of the model. The overall mean rate of episiotomy in the final data set was 0.492, ranging from 0.162 to 0.937 across the 22 hospitals in the region.

Following the relevant literature explaining the potential factors behind the use of episiotomy, we considered a set of case mix factors that can be classified as medical or social. In the first class, factors included clinical indications for the use of episiotomy: nulliparity, newborn's weight, gestational age, epidural analgesia, induction of labour and premature rupture of membranes (Webb and Culhane, 2006; Robinson et al., 2000). It is well known that episiotomy may also have non-clinical determinants (Wolley, 1995; Robinson et al., 2000) and in the second class we considered the following socio-demographic characteristics of the expectant mother: marital status, age, education and employment condition. The results of chi-squared and t-tests to assess the association between case mix-factors and the use of episiotomy are shown in Table 1. It is evident that both clinical and socio-demographic variables varied significantly between treated and untreated women. In order to assess the importance of these variables, we modeled the likelihood of an episiotomy using a two level logistic regression model, with the mother's characteristics at the lowest level of the hierarchy and a random intercept at the hospital level.

It is possible that not all factors that contributed to the decision of executing an episiotomy were observed. In particular, we were concerned with unobserved variables that did not vary at the hospital level, such as obstetrician practice, preferences of the providers working in the same hospital and hospital guidelines promoting or restricting the liberal use of episiotomy. Hence, we take into account all unobserved predictors at the hospital level introducing the term ς_j. Therefore, we estimate the unexplained variation across hospitals of the response variable by means of the variance of ς_j. Using the latent response formulation, the model can be written as:

$$y^*_{ij} = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \cdots + \beta_k x_{kij} + \varsigma_j + \epsilon_{ij} \tag{1}$$

where y^*_{ij} is the propensity of observing $y_{ij} = 1$; this happens if an episiotomy has been performed in patient i at hospital j; $x_{1ij}, \cdots, x_{kij}$ are the clinical and socio-demographic predictors for individual i, whereas ς_j is the random intercept at the hospital level. In this framework, it should be noted that the random intercept is zero mean normally distributed. This specification allows us to consider clinical indications to predict episiotomy within each hospital as well as to consider the underlying systematic differences across hospitals in case of high variance of the ς_j distribution.

3 Results

The model can be estimated by simulated maximum likelihood. We used STATA 11 to perform all calculations (Rabe-Hesketh and Skrondal, 2008). The estimates of the parameters are shown in Table 2. Generally, it can easily be seen that clinical predictors for episiotomy were significant, while social variables were not important determinants of an episiotomy with the exception of education: patients with a lower education were less likely to undergo an episiotomy.

Odds ratios for medical indications confirmed nulliparity as a strong predictor of episiotomy followed by the use of epidural analgesia and premature rupture of membranes. Similarly, heavier infants increased the likelihood of an episiotomy, in line with previous findings (Robinson et al., 2000; Hueston, 1996) where macrosomia - i.e., weight > 4000 g - was used as a predictor instead of the exact weight (using macrosomia as predictor we obtained an odds ratio of 1.37 close to the values obtained in the cited studies). Conversely, induction of labour does not seem to be an important predictor of episiotomy, a result found also by Robinson et al. (2000). Finally, gestational age is positively correlated with the probability of an episiotomy.

However, as previously mentioned, in this study we were not particularly interested in the impact of individual-level variables themselves but rather on estimating the variance of the random intercepts, i.e., in estimating the quota of the total variance that could not be explained by the observed characteristics. Following the latent-response approach (Rabe-Hesketh and Skrondal, 2008), the estimate of the intra-class correlation coefficient $\rho = corr(y^*_{ij}, y^*_{i'j} \,|\, \mathbf{x}_{ij}, \mathbf{x}_{i'j})$ expresses the within-hospital correlation in predicting episiotomy due to unobservable factors. In this case, $\hat{\rho}$ was equal to 0.502 meaning that approximately half of the total variation in episiotomy rates is explained at the hospital level, i.e. it is due to the hospital habits.

4 Discussion

After controlling for both clinical and social confounders, we found that the rate of unexplained variation in episiotomy use across hospitals is substantial, suggesting that it cannot be explained by observable predictors at the individual level. In particular, about half of the variation in episiotomy rates across hospitals remains unexplained by clinical indications and socio-demographic characteristics of the mother. A similar result was found for obstetric interventions rates in the work of Humphrey and Tucker (2009), which emphasizes the high variability in the rates of induction of labor after conditioning for well-established clinical indications.

The present work shows that - as suggested in Webb and Culhane (2006) - episiotomy belongs to the procedures for which unexplained usage variation across hospitals exists. It should be underlined that information contained in official abstracts is not enough to totally explain variation rates. In order to shed light on the determinants of this variation, and also of other obstetric interventions, official abstracts should contain additional information, capable of separating the role of hospital-level variables, such as intervention policies for deliveries, the role of obstetric providers, and the physician's beliefs in determining interventions patterns.

Acknowledgements

The authors would like to thank the Autonomous Region of Sardinia for providing us access to the data. The publication of the manuscript has been authorized by the Health General Administrative Office of Sardinia Region for scientific purposes.

References

Franckman, E., Wang, L., Bunker, C., and Lowder, J. (2009). Episiotomy in the united states: has anything changed? *Am J Obstet Gynecol*, 200(5):573.e1–7.

Grandolfo, M., Donati, S., and Giusti, A. (2002). Indagine conoscitiva sul percorso nascita. Aspetti metodologici e risultati nazionali. *Centro Nazionale di Epidemiologia, Sorveglianza e Promozione della Salute. Istituto Superiore di Sanità.*

Hueston, W. (1996). Factors associated with the use of episiotomy during vaginal delivery. *Obstet Gynecol*, 87:1001–5.

Humphrey, T. and Tucker, J. (2009). Rising rates of obstetric interventions: exploring the determinants of induction of labour. *J Public Health (Oxf)*, 31(1):88–94.

Rabe-Hesketh, S. and Skrondal, A. (2008). *Multilevel and Longitudinal Modeling Using Stata, 2nd ed.* Stata Press.

Robinson, J., Norwitz, E., Cohen, A., and Lieberman, E. (2000). Predictors of episiotomy use at first spontaneous vaginal delivery. *Obstet Gynecol*, 96(2):214–8.

Rockner, G. and Flanu, J. (1999). Changed pattern in the use of episiotomy in sweden. *J Obstet Gynaecol*, 106(2):95–101.

Viswanathan, M., Hartmann, K., Palmieri, R., Lux Swinson, T., and Lohr, K. (2005). The use of episiotomy in obstetrical care: a systematic review. *Journal of the American Medical Association*, 293(17):2141–8.

Wagner, M. (1999). Episiotomy: a form of genital mutilation. *Lancet*, 353(17):1977–98.

Webb, D. and Culhane, J. (2006). Hospital variation in episiotomy use and the risk of perineal trauma during childbirth. *Birth*, 29(2):132–6.

Weber, A. and Meyn, L. (2002). Episiotomy use in the united states 1979-1997. *Obstet Gynecol*, 100(6):1177–82.

Wolley, R. (1995). Benefits and risks of episiotomy: A review of the english-language literature since 1980. part 2. *Obstet Gynecol Surv*, 50:821–35.

Table 1: Episiotomy use by clinical and socio-demographic characteristics of the expectant mother (categorical variables: relative frequency and significance of χ^2 test of independence; continuous variables: mean and significance of t-test.)

Variable	Episiotomy=1	Episiotomy=0	Significance[†]
Age			***
< 20	0.510	0.490	
20-24	0.530	0.470	
25-29	0.525	0.475	
30-34	0.498	0.502	
35-39	0.458	0.542	
≥ 40	0.429	0.571	
Marital Status			***
Single	0.493	0.507	
Married	0.498	0.502	
Other	0.320	0.680	
Education			***
University	0.566	0.434	
Upper secondary	0.507	0.493	
Lower secondary	0.458	0.542	
Primary or less	0.311	0.689	
Employment status			***
Employed	0.515	0.485	
Unemployed	0.495	0.505	
Student	0.643	0.357	
Housewife	0.452	0.548	
Nulliparity	0.603	0.397	***
Newborn's weight (grams)	3263	3255	***
Gestational age (weeks)	39.41	39.27	***
Epidural analgesia	0.652	0.348	***
Induction of labour [oxytocine]	0.538	0.462	**
Premature rupture of membranes	0.540	0.460	***

[†] $*** : pvalue < 0.01$; $** : 0.01 \leq pvalue < 0.05$; $* : 0.05 \leq pvalue < 0.10$.

Table 2: Estimated odds ratios of multilevel logistic regression coefficients.

Variable	Odds Ratio	Standard Error	Significance†
Age (reference: ≥ 40)			
< 20	0.709	0.192	
20-24	1.143	0.210	
25-29	1.219	0.191	
30-34	1.098	0.159	
35-39	1.005	0.147	
Marital Status (reference: other)			
Single	1.184	0.261	
Married	1.339	0.277	
Education (reference: university)			
Upper secondary	0.896	0.090	
Lower secondary	0.818	0.089	*
Primary or less	0.436	0.105	***
Employment status (reference: employed)			
Unemployed	0.990	0.130	
Student	1.380	0.331	
Housewife	0.926	0.073	
Nulliparity	3.343	0.270	***
Newborn's weight (g)	1.003	0.000	***
Gestational age (weeks)	1.059	0.027	**
Epidural analgesia	1.767	0.375	***
Induction of labour (oxytocine)	1.014	0.111	
Premature rupture of membranes	1.408	0.189	**
$\hat{\rho}$	0.502	0.082	***

† $***: pvalue < 0.01$; $**: 0.01 \leq pvalue < 0.05$; $*: 0.05 \leq pvalue < 0.10$.