

AOGS MAIN RESEARCH ARTICLE

Obstetric near-miss cases among women admitted to intensive care units in Italy

SERENA DONATI¹, SABRINA SENATORE^{1,2}, ALESSANDRA RONCONI¹ & the Regional Maternal Mortality Working Group*¹National Centre for Epidemiology, Surveillance, and Health Promotion, Istituto Superiore di Sanità-Italian National Institute of Health, Rome, Italy, and ²University – Tor Vergata, Rome, Italy**Key words**

Intensive care units, maternal mortality, near-miss, pregnancy, severe maternal morbidity.

Correspondence

Serena Donati, National Centre for Epidemiology, Surveillance, and Health Promotion, Istituto Superiore di Sanità-Italian National Institute of Health, via Giano della Bella 34, 00162 Rome, Italy. E-mail: serena.donati@iss.it

Conflict of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Please cite this article as: Donati S, Senatore S, Ronconi A & the Regional Maternal Mortality Working Group. Obstetric near-miss cases among women admitted to intensive care units in Italy. *Acta Obstet Gynecol Scand* 2012; 91: DOI: 10.1111/j.1600-0412.2012.01352.x.

Received: 13 May 2011

Accepted: 27 December 2011

DOI: 10.1111/j.1600-0412.2012.01352.x

Introduction

According to the World Health Organization ‘there is a story behind every maternal death or life-threatening complica-

*Vittorio Basevi, Veronica Casotto, Achille Cernigliaro, Gabriella Dardanoni, Martina De Nisi, Domenico Di Lallo, Valeria Dubini, Camilla Lupi, Luisa Mondo, Silvano Piffer, Renato Pizzuti, Arianna Polo, Raffaella Rusciani, Michele Santoro, Maurizio Saporito, Daniela Spettoli, Eleonora Verdini.

Abstract

Objective. Maternal near-miss defines a narrow category of morbidity encompassing potentially life-threatening episodes. The purpose of this study was to detect near-miss instances among women admitted to intensive care units or coronary units, analyze associated causes, and compute absolute and specific maternal morbidity rates in six Italian regions. **Design.** Observational retrospective study. **Setting.** Six Italian regions representing 49% of all resident Italian women aged 15–49 years. **Population.** The study population included all pregnant women aged 15–49 years admitted to intensive care units or coronary care units in the participating regions. Cases were defined as women aged 15–49 years resident in the participating regions, with one or more hospitalizations in intensive care for pregnancy or any pregnancy outcome between 2004 and 2005. **Methods.** Cases were identified through the Hospital Discharge Database. Enrolled cases were diagnosed according to the 9th International Classification of Diseases. **Main outcome measure.** Maternal near-miss rate (number of women experiencing an admission to intensive care units/all women with live or stillborn babies). **Results.** A total of 1259 near-miss cases were identified and the total maternal near-miss rate was 2.0/1000 deliveries. Seventy percent of the women were admitted to intensive care units or coronary units after a cesarean section. The leading associated risk factors were obstetric hemorrhage/disseminated intravascular coagulation (40%) and hypertensive disorders of pregnancy (29%). **Conclusions.** Monitoring of near-miss morbidity in conjunction with mortality surveillance could help to identify effective preventive measures for potentially life-threatening episodes.

Abbreviations: RR, relative risk; CI, confidence interval.

tion. Understanding the lessons to be learnt can help to avoid such outcomes’ (1). Near-miss and severe acute maternal morbidity are two interchangeable terms for a severe, life-threatening obstetric complication. In the area of maternal health, the concept of ‘maternal near-miss’ is of increasing interest as a useful means to monitor the quality of hospital-based obstetric care. There are different, but compatible, definitions of near-miss (2–4). All of them define a narrow category of morbidity encompassing ‘potentially life-threatening episodes’. There is no worldwide recognized gold standard available to define near-miss, and the surveillance of maternal morbidity and its relation to mortality must be refined.

A World Health Organization systematic review (5) summarized three distinct approaches to identifying severe acute maternal morbidity. The intervention-based criteria that we adopted, which is intensive care unit or coronary unit admissions, enabled the cases to be easily identified retrospectively.

As maternal deaths are becoming rare in high-income countries (6), near-miss has been suggested as a better indicator of maternity care than mortality (7–11). As noted by the Euro-Peristat report (12) we also strongly believe that pregnancy-related mortality, as well as severe morbidity ascertainment, remains unsatisfactory in Italy as well as in other developed countries. In Italy, the leading causes of direct deaths are hemorrhage and thromboembolism, followed by hypertensive diseases in pregnancy (13), suggesting the need for an improvement in the quality of care. We performed this study to improve efforts to prevent avoidable maternal deaths and near-miss cases and also suggest the use of confidential enquiries and clinical audit procedures in detected maternal near-misses. In fact, given the level of medical skill and technology available today, there is room for improvement in the handling of emergencies and life-threatening maternal complications. The primary aim of this study was to compute the absolute number of near-miss cases and the rate of near-miss cases associated with delivery and induced abortion in a population-based regional study. We also estimated the maternal near-miss mortality ratio defined as the ratio of maternal near-miss cases to maternal deaths, and computed relative risks by age, educational level, immigrant status and mode of delivery.

Material and methods

This study is part of a large study of maternal mortality in Italy (13). It involves six regions located in northern (Piedmont and Emilia-Romagna), central (Tuscany and Lazio) and southern (Campania and Sicily) Italy. The women of reproductive age resident in these regions represent 49% of all resident women aged 15–49 years. The study period was the years 2004 and 2005. The study population included all pregnant women aged 15–49 years admitted to intensive care units or coronary care units in the participating regions. The source population included all women aged 15–49 years resident in the participating regions. The hospitals' discharge databases were used to identify cases and also the number of women who gave birth. Maternal transport logs were used to identify women who were transferred to intensive care units or coronary units at another hospital or within the same hospital.

According to the International Statistical Classification of Diseases and Related Health Problems 10th Revision, we adopted the following definition of near-miss: 'a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination

of pregnancy' (14). In our study, a near-miss case was defined as a women with one or more hospitalizations in an intensive care unit or a coronary care unit during pregnancy, childbirth or within 42 days of termination of pregnancy. Women admitted to an obstetric tertiary health care center were not included in the study. Cases of maternal mortality were excluded from the study population.

The maternal near-miss rate within 42 days of delivery was calculated as follows: the number of women admitted to intensive care units or coronary care units after delivery, divided by all women with live or stillborn babies after 26 weeks of gestation. Hospital discharge databases giving the number of women delivering one or more live or stillbirths in the participating regions were used for maternal near-miss rate denominators.

The induced abortion near-miss rate was calculated as follows: the number of women admitted to intensive care unit or coronary care unit after a voluntary abortion, divided by the number of induced abortions. In Italy, voluntary abortion has been legal since 1978. The law permits abortions in the first 90 days of gestation for a broad range of health, social and psychological reasons. After the 90th day of gestation, abortion is allowed only for medical reasons. Abortions can be performed only in public or authorized private facilities. National data are available through a national surveillance system, which has been active since 1982 (15). The maternal near-miss rate within 42 days of delivery was also calculated by woman's age, mode of delivery, nationality and, for the Lazio and Piedmont Regions, level of education because other regions did not collect such data.

We also estimated the maternal near-miss mortality ratio, which is the ratio of maternal near-miss cases to maternal deaths (16). This indicator was computed only for Emilia-Romagna, Tuscany, Lazio and Sicily because mortality data for the study period were not available for Piedmont or Campania.

Women's nationality was classified as Italian or foreign. The specific country of origin of foreign women was not considered. Mother's educational level was defined as low for education of ≤ 8 years and high if ≥ 9 years, but this was available only for Lazio and Piedmont. The source of information of women's age, educational level, nationality and mode of delivery (vaginal or cesarean section) was the hospital discharge database.

We described the associated causes of near-miss cases using the International Statistical Classification of Diseases and Related Health Problems, 9th Revision. The attribution of the underlying cause of near-miss was decided by a group of experts at the Italian National Institute of Health (Istituto Superiore di Sanità). Additional procedures were also used, such as checking multiple diagnoses, in the case of more than one hospitalization of a woman.

Relative risks (RR) with 95% confidence interval (95%CI) were estimated for the maternal near-miss rates stratified for woman's age, educational level, mode of delivery and nationality. The data were analyzed using the Statistical Package, SPSS version 17.0. The project was approved by the national ethics committee of the Istituto Superiore di Sanità.

Results

During the study period, there were 539 382 deliveries in the participating regions. Among these, 4% were multiple deliveries. A total of 1259 near-miss cases that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy were identified using the intensive care unit or coronary unit admissions. The mean age at the time of near miss diagnosis was 32 years. There were 1102 near-miss cases associated with delivery, 18 with induced abortion and the remaining 139 occurred during pregnancy or within 42 days of termination of pregnancy.

The total maternal near-miss rate was 2.0/1000 deliveries (0.9 in Campania; 4.5 in Piedmont). The abortion near-miss rate was 0.13/1000 voluntary abortions (18/139 045).

The maternal near-miss rate was 2.8/1000 among women aged ≥35 years of age, and 1.8/1000 in women aged <35 years (RR = 1.6; 95%CI 1.4–1.8). The maternal near-miss rate was higher among women who delivered by cesarean section (3.7/1000) than among women who had a vaginal delivery (0.7/1000), RR 5.3 (95%CI 4.6–6.1).

The maternal near-miss rate among immigrant women was higher (3.0) than that of Italian women (1.9) (RR 1.6; 95%CI 1.3–1.9). Mother's educational level for Lazio and Piedmont showed a near-miss rate for a low level of 2.6 compared with 2.0/1000 for women with a high educational level (RR 1.3; 95%CI 0.9–1.7).

Figure 1 shows the obstetric condition associated with severe maternal morbidity: the majority of the women (70%) were admitted to intensive care unit or coronary unit after a cesarean section.

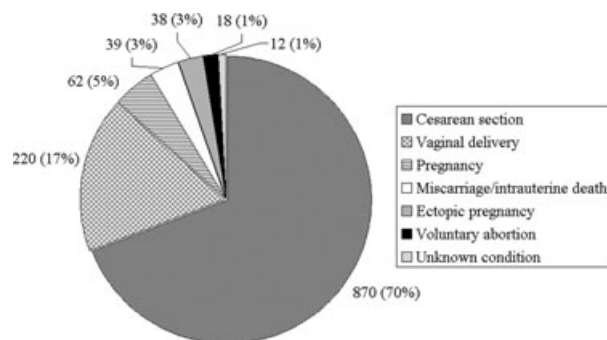


Figure 1. Obstetric conditions associated with near-miss cases in six Italian regions, years 2004–2005.

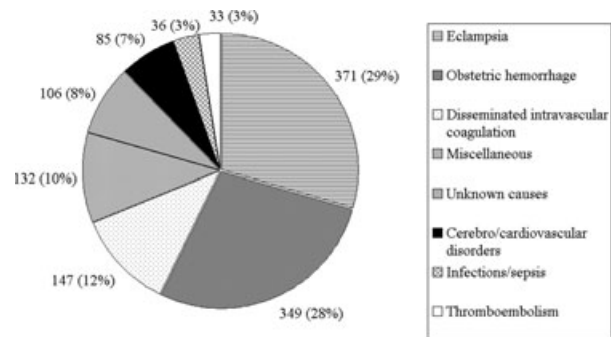


Figure 2. Factors associated with near-miss cases in six Italian regions, years 2004–2005.

The factors associated with near-miss cases are shown in Figure 2. The leading causes were obstetric hemorrhage/disseminated intravascular coagulation (40%) and hypertensive disorder of pregnancy (29%). There were 147 near-miss cases due to obstetric hemorrhage (30%), 70 cases of disseminated intravascular coagulation (14%), 54 cases of placental abruption (11%), 35 cases of placenta previa (7%), 24 cases of ectopic pregnancy (5%), 21 cases of placental retention (4%), 21 cases of uterine rupture (4%), 21 cases of miscellaneous (4%) and 124 cases of unknown cause (25%). The risk factors associated with hypertensive disorder of pregnancy were preeclampsia (59%, 219 cases), eclampsia (28%, 105 cases) and pregnancy hypertension (13%, 47 cases). Among the 1259 women admitted to an intensive care unit or coronary unit with a major obstetric morbidity, 1253 (99%) underwent one or more blood transfusions, 241 (19%) a hysterectomy and 82 (7%) a laparotomy or laparoscopy. Figure 3 shows the distribution of factors associated with near-miss among women who underwent a first ($n=728$) or repeated ($n=149$) cesarean sections. The proportion of the selected complications was always higher in cases of repeated surgical delivery compared with first cesarean section.

Table 1 shows the maternal near-miss mortality ratio in four regions. Differences by region were evident, with higher values of the maternal near-miss mortality ratio in Emilia-Romagna and Tuscany, which are located in northern Italy

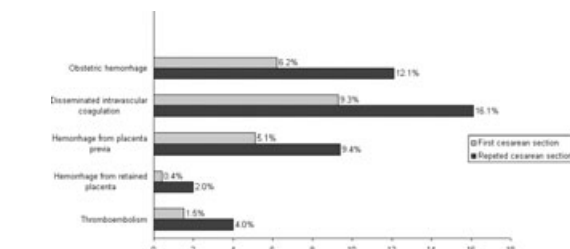


Figure 3. Factors associated with near-miss cases by first or repeated cesarean section in six Italian regions, years 2004–2005.

Table 1. Maternal near-miss mortality ratio by region, years 2004–2005.

Region	Maternal deaths	Maternal near-miss	Maternal near- miss mortality ratio*
Emilia-Romagna	18	205	11.4
Tuscany	10	133	13.3
Lazio	30	210	7.0
Sicily	32	217	6.8
Total	90	765	8.5

*Maternal near-miss/maternal deaths.

compared with Lazio and Sicily, located in central and southern Italy.

Discussion

Accurate classification of near-miss morbidity is the first step in analyzing factors that may differentiate survival from death on the continuum from morbidity to mortality. Our study detected a maternal near-miss rate of 2.0 per 1000 deliveries in the participating regions. The main immediate causes were obstetric hemorrhage/disseminated intravascular coagulation and hypertensive disorder of pregnancy.

The limitations of this study are the retrospective design and the enrolment of only the near-misses admitted to intensive care units and coronary units. We are aware that the accuracy of using intensive care unit and coronary unit admissions as a surrogate for near-miss cases depends on the availability and accessibility of intensive care units and coronary unit beds, and that this approach underestimates the real prevalence of the phenomena. In the participating regions, all provinces had intensive care units and coronary units with 0.5–0.7 beds per 1000 women aged 15–49 years. Other authors have not found differences between women who were and were not admitted to intensive care units (17). Moreover, compared with the approach based on the diagnosis of clinical conditions, the inclusion of procedures such as intensive care unit admission seems to be more reliable in avoiding under-ascertainment of some maternal conditions (18). Although ideally the definition of maternal near-miss should be based on organ dysfunction (5), the WHO 2005 global survey on maternal and perinatal health (19) supports the use of selected conditions such as intensive care units admissions to explore the concept of near-miss. Two studies (8,17) concluded that only about one-third of women with severe acute maternal morbidity are transferred to intensive care, possibly because many obstetric facilities can and do provide high level of care. Therefore, the maternal near-miss rate found in this study underestimates the real figure. Because the hospital discharge database is an administrative source with frequent misclassification in reported diagnosis, in our study the proportion of near-miss cases with an unknown cause was high. Nevertheless, the strengths of this study in terms of external

validity are the population-based design, the location of the participating regions in the North, Center and South of the country, and the fact that the enrolled resident women of reproductive age represent 49% of all resident Italian women aged 15–49 years.

A World Health Organization systematic review found that, internationally, the prevalence of severe acute maternal morbidity ranged from 0.80 to 8.23% in studies that use disease-specific criteria and from 0.01 to 2.99% in studies using management-based criteria (5). The maternal near-miss rate of 2.0/1000 deliveries detected in our study was in accordance with the reported prevalence data, as well as with the range of incidences of near-miss in women admitted to intensive care units in high-income countries (12,17,20).

The mean age of 32 years detected in this study for women with severe morbidity was similar to the mean age reported recently by Zwart (17). As more women delay childbearing in Italy, where the proportion of delivering women ≥ 35 years rose from 9% in 1981 to 29% in 2007 (21), the increased risks associated with pregnancy among older women has become a problem for the health system. Moreover, the increase in the proportion of immigrant women of reproductive age and in newborns from immigrant parents, which nowadays exceed 12% of total births in Italy (22), also represents a new challenge for the health system (23). In fact, in our analyses both the women's older age and their being immigrants were associated with a significantly higher risk of obstetric severe morbidity.

In our study, women who underwent a cesarean section had a fivefold RR of 5.3 of becoming a near-miss compared with those who delivered vaginally, in accordance with recent studies from the Netherlands and Finland (24,25). Unfortunately, although the data made it possible to distinguish spontaneous vaginal births and cesarean sections, the reasons for cesarean section could not be identified, although the association is certainly confounded, as cesarean delivery could be the consequence of the underlying potentially life-threatening disease for which the mother was admitted, rather than the risk factor. Nevertheless, cesarean section is an independent risk factor for maternal morbidity and mortality as compared with vaginal delivery, even when performed before labor (26). Moreover, data presented in Figure 3 highlight the higher risk of severe obstetric complications among women who undergo repeated cesarean section compared with first cesarean section. Italy has the highest European rate of cesarean sections, 38% for the year 2008, with enormous variability among geographical areas and regions (27). The proportion of cesarean section ranged from 24 to 32% in Tuscany, Emilia-Romagna and Piedmont and rose to 43% in Lazio, 53% in Sicily, and 60% in Campania (27). Clearly, a considerable proportion of cesarean section deliveries in Italy are for non-clinical reasons and the proportion of women who deliver vaginally after one or more cesarean

sections is still very low: 12% at the national level (27). It is therefore important that health professionals are aware of the increased risk of serious morbidity for women who deliver by cesarean section for non-clinical reasons (28). Women must be informed that repeated cesarean sections are associated with a higher risk of abnormal placentation and subsequent morbidity.

In this study, maternal obstetric hemorrhage and hypertensive disorders of pregnancy were the leading causes for near-miss cases, as reported in other recent studies (17,19). All of these associated factors should be preventable, to a large extent, and may indicate the need for an improvement in the quality of care. Previous studies have even proposed hemorrhage among all causes of maternal deaths as an indicator of the appropriateness of emergency obstetric care (29).

The higher maternal near-miss mortality ratios reported among the regions located in northern Italy compared with those located in central and southern Italy implies a problem of inappropriateness of care related to women's geographical residence. In fact, the North of the country had lower percentages of cesarean sections (27), lower maternal mortality ratio (13), and lower perinatal mortality rate compared with the South (21).

Conclusion

Incorporation of near-misses into confidential enquiry systems may yield important data on maternal care. The identification of incident cases would enhance data quality and allow comparisons between institutions, regions and countries. We therefore believe that the monitoring of near-miss morbidity, in conjunction with mortality, may help to identify possible risks for death, and may be an important mechanism for identifying effective preventive measures to improve maternal health practice.

Funding

Italian Ministry of Health.

References

1. Making pregnancy safer. WHO Regional Office for Europe website: <http://www.euro.who.int/pregnancy> (accessed May 2011).
2. Filippi V, Alihonou E, Mukantaganda S, Graham WJ, Ronsmans C. Near misses: maternal morbidity and mortality. *Lancet*. 1998;351:145–6.
3. Prual A, Hugué D, Garbin O, Rabé G. Severe obstetric morbidity of the third trimester, delivery and early puerperium in Niamey (Niger). *Afr J Reprod Health*. 1998;2:10–9.
4. Mantel GD, Buchmann E, Rees H, Pattinson RC. Severe acute maternal morbidity: a pilot study of a definition for a near-miss. *Br J Obstet Gynaecol*. 1998;105:985–90.
5. Say L, Pattinson RC, Gulmezoglu AM. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). *Reprod Health*. 2004;1:3.
6. World Health Organization, UNICEF, UNFPA, the World Bank. *Maternal mortality: 1990 to 2008*. Geneva: WHO, 2010.
7. Pattinson RC, Say L, Makin JD, Bastos MH. Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database Syst Rev*. 2005;CD002961.
8. Brace V, Penney G, Hall M: Quantifying severe maternal morbidity: a Scottish population study. *Br J Obstet Gynaecol*. 2004;111:481–4.
9. Waterstone M, Bewley S, Wolfe C. Incidence and predictors of severe obstetric morbidity: case-control study. *Br Med J*. 2001;322:1089–93.
10. Wen SW, Huang L, Liston R, Heaman M, Baskett T, Rusen ID, et al. Severe maternal morbidity in Canada, 1991–2001. *Can Med Assoc J*. 2005;173:759–64.
11. Geller SE, Cox SM, Callaghan WM, Berg CJ. Morbidity and mortality in pregnancy: laying the groundwork for safe motherhood. *Womens Health Issues*. 2006;16:176–88.
12. EURO-PERISTAT. European Perinatal Health Report by the EURO-PERISTAT project in collaboration with SCPE, EUROCAT & EURONEOSTAT, 2008. Available online at: www.europeristat.com (accessed May 2011).
13. Donati S, Senatore S, Ronconi A and the Regional Maternal Mortality group. Maternal mortality in Italy: a record-linkage study. *Br J Obstet Gynaecol*. 2011; 118: 872–9.
14. World Health Organization. *International statistical classification of diseases and related health problems*, 10th revision. 2nd edn. Geneva: WHO, 2004.
15. Ministero della Salute. *Relazione del Ministro della Salute sull'attuazione della legge contenente norme per la tutela della maternità e per l'interruzione volontaria di gravidanza (legge 194/78)*. Dati preliminari 2010, dati definitivi 2009. Agosto 2011. [Report of the Minister of Health on the implementation of the law containing provisions for the protection of motherhood and the voluntary termination of pregnancy (law 194/78). 2010 preliminary data, final data 2009] (In Italian). Available online at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_1585_allegato.pdf (accessed September 2011).
16. Say L, Souza JP, Pattinson RC. WHO working group on Maternal Mortality and Morbidity classifications. Maternal near miss – towards a standard tool for monitoring quality of maternal health care. *Best Pract Res Clin Obstet Gynaecol*. 2009;23:287–96.
17. Zwart JJ, Dupuis JR, Richters A, Ory F, van Roosmalen J. Obstetric intensive care unit admission: a 2-year nationwide population-based cohort study. *Intensive Care Med*. 2010; 36:256–63.

18. Yasmeeen S, Romano PS, Schembri ME, Keyzer JM, Gilbert WM. Accuracy of obstetric diagnoses and procedures in hospital discharge data. *Am J Obstet Gynecol*. 2006; 194:992–1001.
19. Souza JP, Cecatti JG, Faundes A, Morais SS, Villar J, Carroli G, et al. World Health Organization 2005 Global Survey on Maternal and Perinatal Health Research Group. Maternal near miss and maternal death in the World Health Organization's 2005 global survey on maternal and perinatal health. *Bull World Health Organ*. 2010;88:113–9.
20. Leung NYW, Lau A CW, Chan KKC, Yan WW. Clinical characteristics and outcomes of obstetric patients admitted to the Intensive Care Unit: a 10 year retrospective review. *Hong Kong Med J*. 2010;16:18–25.
21. ISTAT. Database Demografia in cifre – 2009 [Demography in figures database – 2009] Available online at: <http://demo.istat.it> (accessed May 2011).
22. Caritas/Migrantes (ed). Dossier Statistico Immigrazione 2010 – XX Rapporto Caritas/Migrantes sull'immigrazione [Statistical Report on immigration 2010 – XX Caritas/Migrantes Report on immigration] (in Italian). Rome: Idos, Edizioni Nuova Anterem, 2010.
23. Fedeli U, Alba N, Lisiero M, Zambon F, Avossa F, Spolaore P. Obstetric hospitalizations among Italian women, regular and irregular immigrants in North-Eastern Italy. *Acta Obstet Gynecol Scand*. 2010;89:1432–7.
24. van Dillen J, Zwart JJ, Schutte J, Bloemenkamp KW, van Roosmalen J. Severe acute maternal morbidity and mode of delivery in the Netherlands. *Acta Obstet Gynecol Scand*. 2010;89:1460–5.
25. Pallasmaa N, Ekblad U, Aitokallio-Tallberg A, Uotila J, Raudaskoski T, Ulander VM, et al. Cesarean delivery in Finland: maternal complications and obstetric risk factors. *Acta Obstet Gynecol Scand*. 2010;89:896–902.
26. Deneux-Tharaux C, Carmona E, Bouvuer-Colle M-H, Breart G. Post partum maternal mortality and cesarean delivery. *Obstet Gynecol*. 2006; 108:541–8.
27. Ministero del Lavoro, della Salute e delle Politiche Sociali – Settore Salute. Certificato di assistenza al parto (CeDAP). Analisi dell'evento nascita – Anno 2008 [Birth Certificates Register. Births data analysis – year 2008] (in Italian). Available online at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_1551_allegato.pdf (accessed September 2011).
28. Farchi S, Polo A, Franco F, Di Lallo D, Guasticchi G. Severe postpartum morbidity and mode of delivery: a retrospective cohort study. *Acta Obstet Gynecol Scand*. 2010; 89: 1600–3.
29. Wildman K, Bouvier-Colle MH and the MOMS Group. Maternal mortality as an indicator of obstetric care in Europe. *Br J Obstet Gynaecol*. 2004; 111: 164–9.