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REVIEW ARTICLE

The worldwide incidence of neonaticide: a systematic review

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Abstract Neonaticide is the killing of a neonate on the day of its birth by his/her own mother. Neonaticidal women were reported to be predominantly young, unmarried, and primiparous. The motive for murdering the newborn relates to the shame, the fear of rejection, and abandonment by significant others, and the social stigmas associated with an illegitimate birth. The goal of the present study was to conduct a systematic review of the scientific literature and identify population-based studies reporting the incidence of neonaticide in different countries. A total of 485 abstracts were screened. After applying the inclusion/exclusion criteria, 10 studies were selected. Additional searches identified two more articles. Most of these studies were from Europe, where incidence varied from 0.07 (Finland, 1980–2000 period) to 8.5 neonaticides per 100000 births (Austria, 1975–2001 period). More recent studies have indicated that a growing proportion of neonaticidal women are married, multiparous, and suffers from mental disorders. Preventive measures, such as anonymous free delivery, were shown to reduce the incidence of neonaticide, although this effect may be short-lived. Despite social and institutional changes, neonaticide persists even in the most socially advanced, liberal, and prosperous societies in the world.

Keywords Neonaticide · Newborn murder · Infanticide · Epidemiology · Shame · Social stigma

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Introduction

Neonaticide is the killing of a neonate on the day of its birth by his/her own mother (Resnick 1970). Women who murdered their newborns were reported to be predominantly young—usually in their late teens or early twenties—, unmarried, and primiparous (d'Orban 1979; Mendlowicz et al. 1998). They often kept the pregnancies concealed and, with few exceptions (Haridas et al. 2014; Mendlowicz et al. 2000; Mishra et al. 2014), gave birth to their babies without any assistance outside a hospital. The secret delivery was followed almost immediately by the murder of the newborn. Next, neonaticidal women strove, not always successfully, to hide the body of the victim, and resume normal activities (Mendlowicz et al. 1999). The accused often reported amnesia for the facts surrounding the killing of the child, which has been variously interpreted either as an evidence of potential malingering (Mendlowicz et al. 2002) or as part of a dissociative experience (Spinelli 2001). Psychiatric assessment, however, usually did not reveal any past or present major mental disorder (Friedman et al. 2005; Mendlowicz et al. 1999). This characteristic socio-demographic and

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behavioral pattern led Resnick (1970) to conclude that most neonaticides were carried out because the illegitimate child was not wanted. The motive for murdering the newborn might relate to the shame, the fear of rejection, and abandonment by significant others, and the social stigmas associated with an illegitimate birth (Ottesen 2012). A recent study has attempted to categorize filicidal offenders from a register-based, combined Austrian-Finnish nationwide criminal database covering the 1995–2005 period into subgroups using latent class analysis. A five-class solution was selected as the best fitting model. The empirically derived latent classes were (1) homicidal–suicidal fathers; (2) violent impulsive parents; (3) single sober parents; (4) prosocial, psychotic parents; and (5) infanticidal mothers. The latter group corresponded closely to the classical description of neonaticidal women. All the offenders in this class were women and, as a group, they were the youngest ones. Seventy-nine percent of the victims were newborns. The members of this class had had almost no previous dealings with the authorities. The most common motive for the filicide was to get rid of an unwanted child; there were no cases of psychotic or extended suicide motivation (Putkonen et al. 2016).

News about the senseless killing of a newborn by a hapless young mother inevitably cause widespread bewilderment and consternation and fuel the debate on how to avoid similar tragedies. Three main approaches for preventing neonaticide have been adopted worldwide. Safe Haven laws, allowing anonymous legal abandonment of unharmed very young children at designated sites, such as hospitals, police stations, and fire houses, have been passed by at least 45 of the 50 American states (Friedman and Resnick 2009). Anonymous free delivery of unwanted babies was first legalized in France in 1793, during the French Revolution, but only became effectively available in 1941 (Bonnet 1993; Lefaucheur 2004) and was later established in other European nations. *Baby hatches* are protected boxes, usually attached to a hospital, where a woman can anonymously abandon her newborn before an alert is automatically triggered to warn the staff inside that a baby has been deposited. Anonymous birth or baby hatches are now available in several countries, including Austria, Belgium, Czech Republic, Germany, Hungary, India, Italy, Japan, Pakistan, Philippines, South Africa, and Switzerland (Friedman and Resnick 2009).

To devise effective prevention strategies for neonaticide and monitor their effectiveness, precise figures on the magnitude of the problem are needed. At this point, however, critical information regarding the epidemiology of neonaticide is still lacking. The goal of the present study was therefore to conduct a systematic review of the scientific literature to identify and compare population-based studies reporting the incidence of neonaticide in different countries.

Methods

Search strategy and study selection

A computerized systematic literature search for studies reporting the incidence of neonaticide was performed in the ISI Web of Science, PubMed, and SCOPUS databases. The fields used were TS (topic), all fields, and TITLE-ABS-KEY, respectively. The query (neonaticid*) was employed across the three databases without any restriction (e.g., time, language, age). The search was conducted in February 8th 2016.

Two of the authors (CT and AMV) independently screened the titles and abstracts of all references. If a source was deemed suitable for inclusion, the full article was obtained and read. Studies were selected based on the inclusion and exclusion criteria (see below). Corresponding authors were contacted when the full text version of potentially relevant articles could not be accessed. Further manual checking of relevant journals and reference lists was also conducted, in addition to a *soft search* in the Google Scholar database for the term *neonaticide*. The two authors discussed any disagreement about the inclusion of a study, and a third author (WB) was consulted when a consensus decision could not be reached. Experts on the field were contacted and asked about additional existing studies that might not have been identified by these methods.

Only original, population-based studies reporting the incidence of neonaticide were selected. Studies were excluded if they were (1) population-based studies that did not report the incidence of neonaticide; (2) empirical articles on neonaticide on issues other than epidemiology; (3) articles on aspects of child murder, abandonment, or abuse or denial of pregnancy but not specifically on neonaticide; (4) comments, editorials, literature reviews, theoretical, or historical articles; (5) cases series and case reports; (6) empirical data reported for a second time; and (7) published in a language other than English, French, Portuguese or Spanish.

Results

A total of 485 abstracts were screened. After applying the inclusion/exclusion criteria, 10 articles were selected. Two additional studies were found through a free search in the Google Scholar database (Câmara et al. 2015; Stasiūnienė et al. 2015) (Fig. 1).

The characteristics and the main findings of the 12 studies were summarized in Table 1.

Seven articles (Amon et al. 2012; Câmara et al. 2015; Herman-Giddens et al. 2003; Krüger 2015; Putkonen et al. 2007; Stasiūnienė et al. 2015; Tursz and Cook 2011) also reported socio-demographic, obstetrical, psychiatric,

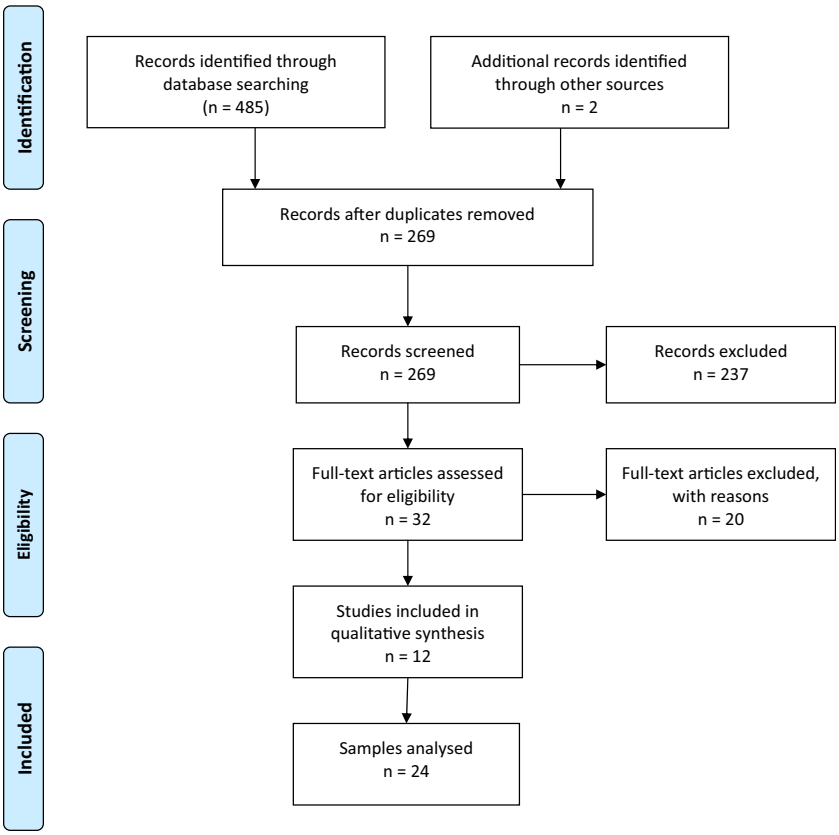

Fig. 1 PRISMA flow chart: data collection and selection of studies on the worldwide incidence of neonaticide

behavioral, and/or other relevant features of the sample of neonaticidal mothers, which are depicted in Table 2.

The 12 studies identified in our search reported 24 nationwide, regional, or local estimates of neonaticide incidence in 13 countries in different periods, extending from 1975 to 2012. Most of these countries were European, the only exceptions being one study in the USA (Herman-Giddens et al. 2003) and another in Tanzania (Outwater et al. 2010). Two studies have conducted cross-country comparisons (Amon et al. 2012; Klier et al. 2013) and two carried out cross-temporal comparisons (Grylli et al. 2015; Klier et al. 2013). The lowest national figures were found in Finland, ranging from 0.07 neonaticides per 100000 births in the 1980–2000 period (Putkonen et al. 2007) to 1.6 neonaticides per 100000 births in the 1991–2001 period (Klier et al. 2013). The highest national figures were reported in Austria, ranging from 2.59 neonaticides per 100000 births in the 1995–2005 period (Amon et al. 2012) to 8.5 neonaticides per 100000 births in the 1975–2001 period (Grylli et al. 2015). Relatively high incidences (above 5 neonaticides per 100000 births) were also found in Lithuania and Estonia in the 2008–2012 period (Stasiūnienė et al. 2015).

At subnational levels, the highest incidence was reported in the city of Dar es Salaam, Tanzania in the year of 2005 (Outwater et al. 2010). This figure —27.7 neonaticides per 100000 births—was one order of magnitude higher than those of other studies. The lowest figure was reported by Makhlouf and Rambaud (2014) in three prefectures around Paris: 0.12 neonaticides per 100000 births (1991–2008 period), but Tursz and Cook's (2011) study covered a large area of central–northwestern France which also included that of Makhlouf and Rambaud's (2014) investigation and found an incidence of 2.1 neonaticides per 100000 births in the period 1996–2000. The only study conducted in North America reported an estimate of 2.1 neonaticides per 100000 births in North Carolina in the period 1985–2000 (Herman-Giddens et al. 2003).

Amon et al. (2012) compared the incidence of neonaticide in Austria and Finland in the period 1995–2005, but despite the large difference in the figures, no statistical testing was carried out. To assess rates of neonaticide after the implementation of a preventative anonymous delivery law in mid-2001 in Austria, Klier et al. (2013) compared neonaticide rates before (1991–2001) and after (2002–2009) the introduction of the new legislation in Austria, Sweden, and Finland. They found a statistically significant decrease in the number of neonaticides in Austria after the enactment of new statute, as compared to Sweden and Finland, where the rates tended to remain stable. Grylli et al. (2015), however, showed that this effect tended to be relatively short-lived and gradually faded away along the following decade, probably reflecting the fact that the anonymous birth rates themselves dropped by nearly 50% during this period.

Table 1 Incidence of neonaticide in 13 countries

Study	Country (region)	Period	Source	*n*	Incidence[a]
Amon et al. (2012)	Austria	1995–2005	Coroners' reports and death certificates	23	2.59
Klier et al. (2013)	Austria	1991–2001	Police-reported cases of neonaticide	70	7.20
Klier et al. (2013)	Austria	2002–2009	Police-reported cases of neonaticide	19	3.10
Grylli et al. (2015)	Austria	1975–2001	Police criminal statistics	202	8.50
Grylli et al. (2015)	Austria	2002–2012	Police criminal statistics	29	3.10
Marcikić et al. (2006)	Eastern Croatia	1980–2004	Judicial records	16	5.30
Stasiūnienė et al. (2015)	Estonia	2008–2012	Statistical Bureau	4	5.20
Putkonen et al. (2007)	Finland	1980–2000	Court decisions	18	0.07[b]
Putkonen et al. (2007)	Finland	1980–2000	Police investigation records	50	0.18[c]
Amon et al. (2012)	Finland	1995–2005	Coroners' reports and death certificates	5	0.78
Klier et al. (2013)	Finland	1991–2001	Police-reported cases of neonaticide	11	1.60
Klier et al. (2013)	Finland	2002–2009	Police-reported cases of neonaticide	6	1.30
Tursz and Cook (2011)	France (Brittany, Île de France & Nord-Pas-de-Calais)	1996–2000	Judicial files and mortality statistics	27	2.10
Makhlouf and Rambaud (2014)	France (Parisian region)	1991–2008	Department of Pathology and Legal Medicine	16	0.12
Stasiūnienė et al. (2015)	Latvia	2008–2012	Central Statistical Bureau	3	2.90
Stasiūnienė et al. (2015)	Lithuania	2008–2012	Ministry of the interior	8	5.80
Stasiūnienė et al. (2015)	Poland	2008–2012	National Police	48	2.40
Câmara et al. (2015)	Portugal (Great Lisbon area)	2001–2010	Institute of Legal Medicine and Forensic Sciences	5	2.96
Klier et al. (2013)	Sweden	1991–2001	Police-reported cases of neonaticide	22	1.80
Klier et al. (2013)	Sweden	2002–2009	Police-reported cases of neonaticide	23	2.80
Krüger (2015)	Switzerland (all cantons)	1980–2004	Files from prosecution services and courts and Swiss Homicide Database	30	1.50
Krüger (2015)	Switzerland (15 German-speaking cantons)	1980–2004	Files from prosecution services and courts	16	1.59
Outwater et al. (2010)	Tanzania (Dar es Salaam)	2005	National Hospital Mortuary	19	27.7
Herman-Giddens et al. (2003)	USA (North Carolina)	1985–2000	Medical Examiner database	34	2.10

[a] Incidence in cases of neonaticides per 100000 births

[b] Legal criminality estimates

[c] Apparent criminality estimates

Discussion

Determining the actual incidence of neonaticide is an important yet challenging task. Several factors may influence directly or indirectly not only the practice of neonaticide itself but also its recording. As a rule, neonaticidal women conceal their pregnancies, deliver without medical assistance, kill the victim, and hide the body soon afterwards. All this process is likely to go unnoticed, particularly in isolated rural areas. It has been suggested that the very low figures reported in Finland may reflect at least partially the fact that this country has a lower proportion of its population living in urban areas as compared to other Western countries (Kauppi et al. 2010). In Poland, however, a significantly higher proportion of neonaticide cases were recorded in rural areas [63.8%] (Stasiūnienė et al. 2015), casting doubts on the role played by this factor.

Even when the corpse of an unknown newborn is eventually retrieved, depending on the time elapsed since death and on the weather conditions it can be so decayed that no conclusion on whether the child was born alive and killed after birth can be drawn. Any suspected case of newborn murder where live birth, and criminal death cannot be proved for certain or when the corpse is simply not found will lead to an underestimation of the incidence of neonaticide. This difference between the real and the recorded (apparent) criminality is known as the *dark number* (*or figure*) *of a crime* (Brookman and Nolan 2006). So far, there are no reliable estimates of the dark number of neonaticide (Malmquist 2013).

The official acknowledgement by the criminal justice system that a newborn was murdered does not guarantee accurate recording of neonaticide cases. The legal definition of newborn murder varies from country to country in significant ways. Finnish law, for instance, defines neonaticide as "the homicide of a newborn by its mother in a *state of physical or mental exhaustion following* delivery" (Tursz and Cook 2011) (p. F262, our emphasis). In consequence, unless the offending mother was positively identified and an abnormal postpartum mental state diagnosed, the prosecution cannot result in a neonaticide conviction that will be featured as such in the final official court statistics.

Table 2 Socio-demographic, obstetrical, psychiatric, behavioral, and other relevant features of neonaticidal mothers

Study	Mean age (range) in years	First delivery	Living status during pregnancy	Educational level	Occupation	Local of delivery	Concealment or denial of pregnancy	Prenatal care attendance	Psychiatric diagnosis
Amon et al. (2012)	28 (16.4–42.5)	52.2%	Married or living with a partner: 57.1%	Compulsory school: 47.8%; secondary school: 43.5%	25% unemployed:	100% at the offender's home	82.1%	Once by one (3.6%) woman	Mood disorder: 27.8%, PD[a]: 33.4%, brief psychotic disorde-r:11.1%, no diagnosis: 27.8%
Câmara et al. (2015)	25 (14–35)	40%	Married or living with a partner: 80%	Mean: 9 (SD = 5.32) years of education	80% professionally active; 20% unemployed	100% delivered without medical assistance	100%	None	No major mental disorder at the time of the offense
Herman-Giddens et al. (2003)	19.1 (14–35)	65%	Single: 50% married: 20.6%	NA[b]	NA	100% delivered without medical assistance	23.5% denied being pregnant	23.5% have received some prenatal care	NA
Krüger (2015)	31.3 (14.8–61.1)	62%	Unmarried: 63.6%	Finished compulsory school: 60%; Incomplete education: 40%	Working: 10%; housewives, students, disability pension, unemployed: 90%	100% delivered without medical assistance	Partial secret: 50%; full secret: 50%	One woman (12.5%) kept regular appoint-ments	No mental disorder at the time of the offense: 72.7; Unspecified mental disorder: 27.3%
Marcikić et al. (2006)	24 (16–33)	60%	Single: 60%; widow: 20%; married: 13.33%; divorced: 6.67%	Primary education: 53%; secondary education: 33%; college student: 7.14%	Unskilled workers: 26.7%; housewives: 26.7%; school-girls: 0%; cooks: 6.7%; clerks: 6.7%; technicians: 6.7%; student: 6.7%	Except for one case, delivery took place outside health institu-tions	Pregnancy was concealed in 73% of cases	NA	NA
Putkonen et al. (2007)	26 (16–41)	66%	Single: 66%; married or in common-law marriage: 31%; divorced: 3%	NA	Working at the time of the offense: 53%; unemployed: 13%; students: 25%; on maternity leave: 6%; on pension: 3%	26 women (81%) delivered in their own home, without any assistance	Twenty-nine women (91%) had concealed their current pregnancy	Two women (6%) attended prenatal care	14 women underwent forensic psychiatric examination: 4 (29%) were diagnosed psychotic and 10 (71%) personality disordered
Stasiūnienė et al. (2015)	27.4 (17–44)	NA	NA	Basic 19.4%; secondary 47.2%; vocational 13.9%; college 8.3%	Housewives: 27.8%; employee or student: 27.8%; not working or studying at the time of the offense: 23%; on the dole: 11.1%	100% delivered without medical assistance	NA	NA	NA
Tursz and Cook (2011)	26.5 (17–45)	35%	Married and living together 23.5%; cohabiting 35.3%; separated 11.7%; single 29.4%	NA	White collar 17.6%; skilled and unskilled workers 47.1%; unemployed 35.3%	No deliveries took place in medical facilities	All pregnancies were concealed	No cases registered with health system or medically monitored	2 cases of psychotic functioning and 7 women with history of previous depression

[a] Personality disorder

[b] Not available

The adoption of the legal criminality (i.e., a case on which judgment was pronounced) as the criteria for recording cases of neonaticide leads to an underestimation of the incidence of this type of offence and may also account for the ultralow figures—0.07 neonaticides per 100000 births—reported by Putkonen et al. (2007) in Finland for the 1980–2000 period. In contrast, this kind of problem is unlikely to affect French data since there is no longer specific legislation concerning neonaticides in this country (Tursz and Cook 2011).

It must be noted that most studies analyzed here have reported only apparent criminality figures, the exceptions being Putkonen et al. (2007), Tursz and Cook (2011), and Krüger (2015). Putkonen et al. (2007), however, reported both apparent and legal criminality figures and acknowledged that the latter probably represent a vast underestimation. Tursz and Cook (2011) have pointed out that sometimes even official mortality statistics based on apparent criminality can be misleading. They found 5.4 times as many homicides of newborns in the judicial data as in the official mortality statistics during the same period and in the same regions.

Despite these conceptual and methodological difficulties, some significant conclusions can be drawn from the present findings. First, notwithstanding the variability in the methodology of the studies and in the demographic and cultural characteristics of the populations studied, there is a degree of consistency in the incidence of neonaticide across the 12 westernized countries investigated. For all of them, studies reporting apparent criminality indicate that the figures are of the same order of magnitude, ranging from 1.3 to 8.5 neonaticides per 100000 births [particularly if outliers such as Makhlouf and Rambaud (2014) and Putkonen et al. (2007), whose low estimates could not be replicated in other studies in their own countries, are not considered]. So far, the absence of identifiable cases of neonaticide has been reported only in Norway in the 1990–2009 period (Ottesen 2012). One might expect that these findings would be generalizable to other, yet unstudied westernized countries. In contrast, the only study available from an African country reported a figure of a different order of magnitude—27.7 neonaticides per 100000 births (Outwater et al. 2010). However, the latter study covered only a one-year period, making it particularly sensitive to random variations in the incidence of neonaticide. It remains, therefore, to be determined whether its findings can be replicated in other countries with similar social, economic, and demographic profile.

Indeed, it would not be thoroughly inconceivable to assume that, in contrast to the less developed countries, neonaticide would be a phenomenon doomed to extinction in the modern Western world. The main forces supposedly driving young unmarried women toward killing their newborns have been in steep decline in the westernized countries during the last century or more. The radical changes in the sexual morality and lifestyles and the waning influence of religion nearly consigned to oblivion the ancient social stigmas attached to premarital sex and pregnancy and to out-of-wedlock maternity. These social changes, however, probably occur at an uneven pace. For instance, the relatively elevated incidence of neonaticide in Austria has been ascribed to the unconscious guilt resulting from a stronger Catholic religious influence in this country, in contrast to the more secular mindset of other western European countries (Amon et al. 2012). Sex education, effective birth control and, in the Scandinavian countries, the availability of legal abortion after the 12th week of gestation for women who deny pregnancy and find out about their pregnancy too late for the lower gestational limit usually adopted for abortion in other countries (Klier et al. 2013), have enabled the prevention of many unwanted pregnancies. Women's growing empowerment and financial independence help keep at bay the twin specters of poverty and social exclusion. Welfare payments support, to a certain degree, single mothers raising children by themselves. More recently, measures like anonymous free delivery of unwanted children, baby hatches, and Safe Haven laws have supposedly provided a last resort safety net against the practice of neonaticide. Nevertheless, as the present study has shown, a steady, albeit low grade, persistence of this phenomenon is found in several of the most socially advanced, liberal, and prosperous societies in the world (Krüger 2015).

We suggest that this persistence of neonaticide may be associated, at least in part, with recently described changes in the socio-demographic characteristics of newborn murderers (Beyer et al. 2008; Friedman et al. 2005; Vellut et al. 2013). Some of the studies reviewed here have reported a profile of neonaticidal women that differs from the "young, unmarried and nulliparous mother without any major mental disorder" one described by Resnick (1970). Tursz and Cook (2011) found that 58.8% of their sample were married or living with a partner, and only 35% were primiparous at the time of the offense. Comparable figures for Amon et al.'s (2012) combined Austrian-Finnish sample were 57.1 and 52.2%, respectively. Mean age of the Lithuanian neonaticidal mothers was 27.4 years in Stasiūnienė et al.'s (2015) study, and 28 years in the Amon et al.'s (2012) Austrian-Finnish one. Putkonen et al. (2007) had already suggested that neonaticidal mothers were a more heterogeneous group than previously thought, and that there might exist specific subgroups with different characteristics and backgrounds. Tursz and Cook (2011) proposed that among married or cohabiting mothers of several children aged 30 years or older neonaticide might appear as a solution when an unwanted pregnancy risked creating a family scandal, or lead to the loss of one's partner or of a satisfying lifestyle. One can hypothesize that the social and institutional changes discussed above—loosening of the moral stigmas around premarital sex and out-of-wedlock pregnancy, increased access to contraceptives methods, welfare program for single mothers, baby hatches, Safe Haven laws, etc.—may have been more effective in reducing the practice

of neonaticide among younger, unmarried nulliparous female (which one could christen type 1 neonaticide). As a result, the proportion of a second subgroup of neonaticidal mothers—older, married, non-nulliparous women with a history of depression or personality disorder (a hypothetical type 2 neonaticide)—has increased and now figures prominently in the statistics of the most socially developed countries. The relative refractoriness of the older subgroup to these social and institutional changes would then account at least partially for the puzzling persistence of neonaticide in westernized countries.

Finally, it must be noted that, despite the identification of numerous factors that theoretically influence the incidence of neonaticide, only two studies have empirically tested one of them. Klier et al. (2013) assessed rates of neonaticide before and after the implementation of a preventive anonymous delivery law in mid-2001 in Austria, allowing women to access antenatal care and give birth in a hospital anonymously, without showing any ID and free of charge. The figures were compared with those of Finland and Sweden and showed a statistically significant decrease in the number of police-reported neonaticides in Austria after the implementation of anonymous delivery. Grylli et al. (2015) found, however, that after an initial drop following the implementation of the new law, a significant increase in neonaticide rates coupled with a decreasing number of anonymous births occurred. They suggested that this trend might indicate the emergence of a fading effect of the awareness raising campaign, an element of fundamental importance to the success of preventive measures. Considering the methodological (Orthofer and Orthofer 2013) and ethical (Swientek 2001) objections raised against the effectiveness of the currently available preventive measures for neonaticide, additional studies are needed to assess the impact of different interventions on newborn murder rates.

Hanna Putkonen et al. (2007) have emphasized the importance of "international joint projects for enlarged material to enable grouping, … to prevent neonaticide, … and improve the treatment of the offenders" (p. 15). The present study represents a pioneering attempt at synthesizing the findings of regional, national, and cross-national studies reporting the epidemiology of neonaticide in representative populations. The achievement of this goal was hindered to a certain degree by factors such as the relatively small sample sizes, the limited description of the offenders and of their offenses in most reports, the dearth of non-European studies, the lack of older articles to be compared with the more recent ones we found (which covered only the period extending from 1975 to 2012), and the conceptual and methodological differences between studies. The existence of neonaticide laws, separate from the statutes for homicide, and the availability of register-based, comprehensive, nationwide criminal databases are sine qua non prerequisites for reliably estimating the actual numbers of neonaticide cases. These measures should be adopted by all countries to help reduce neonaticide.

Despite these limitations, the present systematic review provided the first-ever assessment of the magnitude of the newborn murder problem in several countries and thus represents a necessary stepping stone toward enhancing the understanding of this phenomenon and creating a more solid foundation for its prevention.

Compliance with ethical standards

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References

Amon S et al (2012) Potential predictors in neonaticide: the impact of the circumstances of pregnancy. Arch Womens Ment Health 15(3):167–174. doi:10.1007/s00737-012-0268-0

Beyer K, Mack SM, Shelton JL (2008) Investigative analysis of neonaticide an exploratory study. Crim Justice Behav 35(4):522–535. doi:10.1177/0093854807313410

Bonnet C (1993) Adoption at birth: prevention against abandonment or neonaticide. Child Abuse Negl 17(4):501–513

Brookman F, Nolan J (2006) The dark figure of infanticide in England and Wales complexities of diagnosis. J Interpers Violence 21(7):869–889

Câmara C, Graça O, Costa T, Santos J (2015) Uma década de neonaticídios na grande Lisboa: contributos da Psicologia e Psiquiatria. Psiquiatr Psicol Justiça 8:4–51

d'Orban PT (1979) Women who kill their children. Br J Psychiatry 134(6):560–571. doi:10.1192/bjp.134.6.560

Friedman SH, Resnick PJ (2009) Neonaticide: phenomenology and considerations for prevention. Int J Law Psychiatry 32(1):43–47

Friedman SH, Horwitz SM, Resnick PJ (2005) Child murder by mothers: a critical analysis of the current state of knowledge and a research agenda. Am J Psychiatry 162(9):1578–1587. doi:10.1176/appi.ajp.162.9.1578

Grylli C, Brockington I, Fiala C, Huscsava M, Waldhoer T, Klier CM (2015) Anonymous birth law saves babies—optimization, sustainability and public awareness. Arch Womens Ment Health 19(2):291–297. doi:10.1007/s00737-015-0567-3

Haridas S, Patekar M, Ninal N, Zine K (2014) Newborn infanticide within hospital premise an unusual case report. J Indian Acad Forensic Med 36(2):220–222

Herman-Giddens ME, Smith JB, Mittal M, Carlson M, Butts JD (2003) Newborns killed or left to die by a parent: a population-based study. JAMA 289(11):1425–1429

Kauppi A, Kumpulainen K, Karkola K, Vanamo T, Merikanto J (2010) Maternal and paternal filicides: a retrospective review of filicides in Finland. J Am Acad Psychiatry Online 38(2):229–238

Klier C, Grylli C, Amon S, Fiala C, Weizmann-Henelius G, Putkonen H (2013) Is the introduction of anonymous delivery associated with a reduction of high neonaticide rates in Austria? BJOG 120(8):1028–1029

Krüger P (2015) Prevalence and phenomenology of neonaticide in Switzerland 1980–2010: a retrospective study. Violence Vict 30(2):194–207

Lefaucheur N (2004) The French 'Tradition' of anonymous birth: the lines of argument. Int J Law Policy Fam 18(3):319–342

Makhlouf F, Rambaud C (2014) Child homicide and neglect in France: 1991–2008. Child Abuse Negl 38(1):37–41

Malmquist CP (2013) Infanticide/neonaticide: the outlier situation in the United States. Aggress Violent Behav 18(3):399–408. doi:10.1016/j.avb.2013.04.001

Marcikić M, Dumencić B, Matuzalem E, Marjanović K, Pozgain I, Ugljarević M (2006) Infanticide in Eastern Croatia. Coll Antropol 30(2):437–442

Mendlowicz MV, Rapaport MH, Mecler K, Golshan S, Moraes TM (1998) A case–control study on the socio-demographic characteristics of 53 neonaticidal mothers. Int J Law Psychiatry 21(2):209–219. doi:10.1016/s0160-2527(98)00003-x

Mendlowicz MV, Jean-Louis G, Gekker M, Rapaport MH (1999) Neonaticide in the city of Rio de Janeiro: forensic and psycholegal perspectives. J Forensic Sci 44(4):741–745

Mendlowicz MV, Da Silva JF, Gekker M, De Moraes TM, Rapaport MH, Jean-Louis F (2000) Mothers murdering their newborns in the hospital. Gen Hosp Psychiatry 22(1):53–55. doi:10.1016/s0163-8343(99)00044-4

Mendlowicz MV, Rapaport MH, Fontenelle L, Jean-Louis G, De Moraes TM (2002) Amnesia and neonaticide. Am J Psychiatry 159(3):498. doi:10.1176/appi.ajp.159.3.498-b

Mishra K et al (2014) Neonaticide in India and the stigma of female gender: report of two cases. Paediatr Int Child Health 34(3):224–226

Orthofer M, Orthofer R (2013) Is the introduction of anonymous delivery associated with a reduction of high neonaticide rates in Austria? A retrospective study. BJOG 120(8):1028

Ottesen V (2012) A current absence of neonaticide in Norway. Scand J Forensic Sci 18(2):155–163

Outwater A, Mgaya E, Campbell JC, Becker S, Kinabo L, Menick DM (2010) Homicide of children in Dar es Salaam, Tanzania, 2005. East Afr J Public Health 7(4):345

Putkonen H, Weizmann-Henelius G, Collander J, Santtila P, Eronen M (2007) Neonaticides may be more preventable and heterogeneous than previously thought–neonaticides in Finland 1980–2000. Arch Womens Ment Health 10(1):15–23

Putkonen H et al (2016) Classifying filicide. Int J Forensic Mental Health 15(2):1–13. doi:10.1080/14999013.2016.1152616

Resnick PJ (1970) Murder of newborn - a psychiatric review of neonaticide. Am J Psychiatry 126(10):1414–1420

Spinelli MG (2001) A systematic investigation of 16 cases of neonaticide. Am J Psychiatry 158(5):811–813. doi:10.1176/appi.ajp.158.5.811

Stasiūnienė J, Justickis V, Jasiulaitis A (2015) Newborn murder and its legal prevention. Health Policy Manag 1(8):91–119. doi:10.13165/SPV-15-1-8-05

Swientek C (2001) Die Wiederentdeckung der Schande: Babyklappen und anonyme Geburt. Lambertus

Tursz A, Cook JM (2011) A population-based survey of neonaticides using judicial data. Arch Dis Child Fetal Neonatal Ed 96:F259–F263. doi: 10.1136/adc.2010.192278

Vellut N, Simmat-Durand L, Tursz A (2013) Le portrait des meres néonaticides dans les expertises judiciaires. L'Encéphale 39(5):352–359