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Term perinatal mortality audit in the Netherlands 2010–2012: a population-based cohort study

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ABSTRACT

Objective: To assess the implementation and first results of a term perinatal internal audit by a standardised method.

Design: Population-based cohort study.

Setting: All 90 Dutch hospitals with obstetric/paediatric departments linked to community practices of midwives, general practitioners in their attachment areas, organised in perinatal cooperation groups (PCG).

Population: The population consisted of 943 registered term perinatal deaths occurring in 2010–2012 with detailed information, including 707 cases with completed audit results.

Main outcome measures: Participation in the audit, perinatal death classification, identification of substandard factors (SSF), SSF in relation to death, conclusive recommendations for quality improvement in perinatal care and antepartum risk selection at the start of labour.

Results: After the introduction of the perinatal audit in 2010, all PCGs participated. They organised 645 audit sessions, with an average of 31 healthcare professionals per session. Of all 1102 term perinatal deaths (2.3/1000) data were registered for 86% (943) and standardised anonymised audit results for 64% (707). In 53% of the cases at least one SSF was identified. Non-compliance to guidelines (35%) and deviation from usual professional care (41%) were the most frequent SSF. There was a (very) probable relation between the SSF and perinatal death for 8% of all cases. This declined over the years: from 10% (n=23) in 2010 to 5% (n=10) in 2012 (p=0.060). Simultaneously term perinatal mortality decreased from 2.3 to 2.0/1000 births (p<0.00001). Possibilities for improvement were identified in the organisation of care (35%), guidelines or usual care (19%) and in documentation (15%). More pregnancies were antepartum selected as high risk, 70% in 2010 and 84% in 2012 (p=0.0001).

Conclusions: The perinatal audit is implemented nationwide in all obstetrical units in the Netherlands in a short time period. It is possible that the audit contributed to the decrease in term perinatal mortality.

Strengths and limitations of this study

- The Netherlands is the first country in which all collaborating perinatal healthcare professionals nationwide participate in an internal perinatal audit systematically performed at the local level.
- Within 2 years all hospitals in the country providing obstetric/paediatric care with their surrounding midwifery practices participated in the perinatal audit.
- The perinatal audit resulted in description of substandard factors (SSF), relation to death and the formulation of many recommendations mostly ready for implementation.
- Not all term perinatal deaths are audited. Characteristics of the audited cases are comparable to all term perinatal deaths in the national registration.
- Of all audited cases information was insufficient in 11% for SSF assessment. This is a major point of attention for the years ahead.

INTRODUCTION

Perinatal mortality is an important indicator of the quality of perinatal care.[1] In 2000 the Netherlands had the highest perinatal mortality rate when compared with a large group of European countries.[2 3] Although perinatal mortality in the Netherlands has decreased in recent years, in 2010 the ranking relative to other European countries showed only a modest improvement.[4 5]

These outcomes of the international benchmarks were an important incentive for Dutch politicians and professionals in the field of perinatal care to investigate the determinants of perinatal mortality including assessment of the quality of care. One of the possible interventions in this regard was the introduction of the perinatal audit, a critical and systematic analysis of the quality of perinatal care.[6] Earlier, the introduction of a perinatal audit in Norway was an important

factor in improving the quality of perinatal care and preceded a decline of perinatal mortality in Norway.[7–9]

In the Netherlands, perinatal audit studies were undertaken in the eighties of the past century. These audits were local or regional one-time studies.[10–12] Recently, the professional organisations involved jointly prepared a nationwide perinatal mortality audit programme that would become a standard part of perinatal care.[13–17] The Foundation Perinatal Audit in the Netherlands (PAN) was set up by the professional organisations of midwives, general practitioners, obstetricians, paediatricians and pathologists (http://www.perinataleaudit.nl). The first nationwide Dutch perinatal mortality audit started in the period 2010–2012 with a focus on audit of term perinatal deaths.

PAN receives annual funding from the Ministry of Health of about €900 000. A third of the budget is used for support of perinatal cooperation groups (PCG) by regional teams. About 30% is intended for use and management of the registration systems and for reporting and communication (both including personnel costs). Another third is needed for the PAN office, board and advisory committees.

The objective of this study is to describe the implementation process of this perinatal audit programme and to present the results after the first 3 years of the term perinatal audit: perinatal death classification, antepartum high-risk selection, identification of substandard (care) factors (SSF), SSF in relation to death and conclusive recommendations for quality improvement in perinatal care.

METHODS

Organisation and training

A regional infrastructure with audit support teams has been set up. The teams consist of healthcare professionals in the 10 tertiary centres for perinatology with a neonatal intensive care unit (NICU) and obstetric 'high care' department facilities. These regional teams were trained by PAN for coordination and support of the audit performance at local (hospital) levels. Subsequently these regional teams trained the audit teams of the local hospitals and the surrounding practices of independent community midwives and general practitioners within their region. PAN cooperated with the IMPACT project that pioneered the introduction of perinatal audit in the Northern region of the Netherlands.[18] PAN offered regular training sessions in organisation of the audit, in making narratives, in chairing of the audit meeting and in classification of perinatal mortality.

In January 2010, the nationwide Dutch perinatal mortality audit officially started with the audit of term perinatal deaths as the first topic. This topic was chosen because of the involvement of all professional groups in the obstetric/paediatric/neonatal field in term pregnancies and deliveries. Within the Netherlands community midwives and, on a small scale, general practitioners provide obstetric care (including home births) to women with antepartum-judged low-risk profiles. If complications (threaten to) occur the responsibility for obstetric care is transferred to a medical specialist in a general hospital (secondary care) or tertiary centre. Risk selection during pregnancy and labour in primary or secondary or tertiary care is therefore the essence of Dutch perinatal care organisation.[19–21]

The Netherlands is divided into 10 perinatal healthcare regions, catchment areas for perinatal high care centres that have NICU facilities. In 2012 there were 90 hospitals with obstetric/paediatric care facilities (97 in 2010 and 93 in 2011). Each hospital and the surrounding community practices of independent midwives and general practitioners are organised in a PCG. Each PCG is responsible for auditing and registration of the mortality cases in their catchment area.

Representatives of the professionals of the PCG analyse the cases in a systematic way, identify SSF in delivered care and/or organisation of care, identify the types of professionals involved and classify mortality according to three different systems, that is, the Wigglesworth/Hey, Modified ReCoDe and Tulip classifications.[22–26] During the audit, the professionals relate the degree (none/unlikely, possible, (very) probable, unknown) to which SSF was the cause of death. Specific recommendations for improving the quality of care are then formulated. An independent chairperson presides over the audit and provides a safe environment. The individual is a perinatal healthcare professional not practising in the hospital/PCG where the audit takes place and is often a member of the regional audit team.

An audit with (involved) professionals is a delicate matter and needs to follow careful procedure. The PAN has developed basic rules to enable a safe environment.

- Everything discussed during the audit is confidential. Every participant signs for this.
- Each participant is an expert in her or his own professional field, participants can question professionals in other fields but do not judge them.
- The provided care and cure are assessed by comparison to formal guidelines or usual care, not by personal judgement.
- Narratives of the discussed cases that were drawn up before the meeting by members of the PCG are destroyed after the audit.

Definitions

Term perinatal mortality is defined as stillbirth and neonatal mortality during the first 4 weeks of life in births with gestational age from 37 weeks onwards, including the post-term period.[27] Cases with unknown gestational age are excluded.

A SSF is present if care deviated from the safe limits of practice as laid down in national guidelines, local protocols (translation of national guidelines for local use) or normal professional practice.[28] The formal agreed guidelines are accessible at the websites of the

professional organisations of the midwives (25 topics), obstetricians (63), paediatricians (29) and general practitioners (3). The agreed referral list for primary and secondary care (VIL, Obstetric Indication List) comprises 125 items[14] (translated in English).[21] Most guidelines and the referral list items are covering term pregnancies as well. All agreed national guidelines in perinatology and the Obstetric Indication list are also available on the PAN website, arranged by professional organisation and by topic (http://www.perinataleaudit.nl/bibliotheek/richtlijnen/aandoeningen).

Antepartum low-risk assessment is defined as antepartum-judged low-risk profile for care during labour and delivery by primary care professionals (community midwife or general practitioner), including delivery at home.[19–21]

Registries

Because the audit focuses on recent cases that require more detailed and up-to-date information than is present in the national Dutch perinatal registry (PRN, Perinatal Registry of The Netherlands), two specific real-time databases were created to support the audit. The first is for the registration of perinatal death cases to be audited (PRN-Audit, Perinatal Audit Registry of The Netherlands) and the second for the confidential registration of the audit process and its outcomes (PARS, Perinatal Audit Registry System).

PRN-Audit database

Term perinatal mortality deaths are registered in PRN-Audit by healthcare professionals. Data are gathered from the medical records and registered with specific details needed to construct the narrative that will be used during the audit. In PRN-Audit supplemental information is included such as professionals involved in the care process, diagnostics, policy decisions, actions (treatments, referrals) and antepartum risk selection with their time frames. The audit narrative, the basic document for the audit meeting, is automatically generated from the PRN-Audit database as an anonymous document.

PARS database

The audit meetings (participants, number of cases discussed) and the outcomes of the audits are registered by the local audit groups in a separate database PARS. Because of privacy restrictions and to create a safe and secure environment for audit participants the PARS database is anonymous; only characteristics such as gestational age (categories) at birth, time (fetal-neonatal) of death and the perinatal death classifications are registered in PARS.

PRN registry as reference

The standard national PRN registry contains population-based information on all pregnancies, deliveries from 22 weeks onwards and (re)admissions occurring until 28 days after delivery. The data are collected by different professionals and are linked when year data sets are available which is 1.5 years afterwards. The PRN data is made available to healthcare providers, researchers and policymakers. The completeness of PRN is currently around 96–98% of all births (http://www.perinatreg.nl). The national PRN database is the reference source for the audit cases in our study.

Statistical methods

Frequencies and descriptive statistics were expressed as n (%). For testing group differences, we used χ^2 for categorical variables.

RESULTS

A total of 943/1102 (86%) of term perinatal deaths in the period 2010–2012 are registered in the PRN-Audit database and 707 (64%) cases were audited and recorded in the PARS database. Compared with the number of cases in the national perinatal registry PRN, the number of cases that were registered in the PRN-Audit database increased over the years (from 85% in 2010 to 89% in 2012, p=0.04) and the registration of cases in PARS showed an increase of 59% in 2010 to 66% in 2012, p=0.015 (table 1).

Number of audit meetings and participants

Throughout the Netherlands, 645 audit meetings took place in 2010–2012 with a total of 20 091 participating healthcare professionals as community (independent) midwives, general practitioners, obstetricians, clinical midwives, nurses, paediatricians, pathologists, registrars, medical students and students in midwifery (with an average of 31 healthcare professionals per session). The number of participants nearly doubled in 2012 as compared with 2010. Half of the participants were once present, 15% twice and 35% three or more times. Audit participation of all the PCGs reached full coverage in the second year (2011; table 1).

Substandard factors

In 53% (376) of the 707 audited cases one or more SSFs were identified (table 2).

A total of 717 SSFs emerged. In 35% of the cases these were related to non-compliance with guidelines or missing appropriate local protocols and in 41% they implied deviation from usual professional care (table 3).

Examples of deviations from guidelines are: no or delayed consultation of the obstetrician in case of suspected fetal growth restriction, no fetal monitoring in case of induction of labour, expectant management in case of non-reassuring cardiotocography and non-optimal application of the guideline for resuscitation of the new born. Examples of deviation from usual professional care are: no fetal monitoring in case of vaginal blood loss, no consultation or action undertaken in case of decreased fetal movements, no further diagnosis

Table 1 Term perinatal deaths and audit implementation parameters 2010–2012

	2010		2011		2012		2010–2012		
	n	Per cent	n	Per cent	n	Per cent	n	Per cent	p Value*
Term born children (PRN)	163 276		163 248		160 714		487 238		
Term death cases and rate (PRN)									
Perinatal	379	0.23	398	0.24	325	0.20	1102	0.23	<0.00001
Fetal	249	0.15	252	0.15	217	0.14	718	0.15	<0.00001
Neonatal	130	0.08	146	0.09	108	0.07	384	0.08	<0.00001
Term death cases in PRN-Audit	324	85	329	83	290	89	943	86	0.04
Term death cases in PARS	222	59	272	68	213	66	707	64	0.015
Number PCG	97		93		90		–		
Audit participation of PCG	94	97	93	100	90	100	–		
Meetings	149		244		252		645		
Participants	4,291		7,557		8,243		20 091		

*χ^2 Test.
PARS, Perinatal Audit Registry System; PCG, perinatal cooperation groups (number decreased by closure of hospitals); PRN, Perinatal Registry of The Netherlands; PRN-Audit, Perinatal Audit Registry of The Netherlands.

and/or action in case of presumed growth restriction and insufficient documentation in the medical records (medication, diagnostic considerations and policy).

Cause of death

Autopsy was performed in 38% and pathological examination of the placenta in 77% of the term cases registered for audit. Table 4 gives the results of the death classifications.

In the Tulip classification, in 36% of cases the underlying cause of death is classified as 'placental' and subclassified as placental pathology (development, parenchyma, localisation, 31%), followed by umbilical cord complications (28%) and placental bed pathology (28%). Congenital malformation was classified in 19% as the underlying cause of death. In 32% of cases the cause of death is unknown. Using the ReCoDe classifications placental pathology was the most important clinical condition (24%) with placental insufficiency (n=108) and placental abruption for 26 cases as main groups. The Wigglesworth/Hey classification shows 62% fetal death and 15% of the pregnancies had a gestational age of ≥41 weeks (table 4).

Table 2 Number of substandard factors (SSF) assessed per case of term perinatal death 2010–2012

SSF per case	n	Per cent
No SSF	252	36
≥1 SSF	376	53
1	213	30
2	73	10
3	43	6
4	27	4
≥5	20	3
Insufficient information	79	11
Total cases	707	100

SSF, relation to death and professional involvement

In 8% (57) of the 707 audited cases the relation of SSF to death was assessed as probable or very probable and in 13% (92) as possible. The percentage of cases with one or more SSF remained stable during the years. Of these the cases with none/unlikely relation of SSFs to death increased from 20% in 2010 to 30% in 2012 (p=0.028). The rate of cases with SSF possibly related to death remained the same during the years, the cases with SSF (very) probably related to death decreased from 10% to 5% (p=0.060; table 5).

In total, 1269 healthcare professionals played a role in SSFs in 376 cases: mean 3.4 professionals per case. Of them, 26% were obstetricians, 20% independent community midwives and 12% clinical midwives. Nurses were involved in 10% of the cases, paediatricians in 7% and registrars in 10% of the cases.

Antepartum low risk assessment

For 19% (183) of all registered cases there was antepartum low-risk selection for primary care delivery. Antepartum high-risk assessment showed a significant increase from 70% to 84% (p=0.0001; table 6).

Table 3 Categories of all 717 substandard factors (SSF) in 376 term perinatal deaths of infants born in 2010–2012

Category SSF	n	Per cent
Non-compliance of guidelines or local protocols missing	250	35
Deviation from usual professional care	294	41
Other	173	24
Total SSF	717*	100

*Per case more SSFs can be present.

Table 4 Tulip classification, modified ReCoDe classification and Wigglesworth/Hey classification of term perinatal deaths (2010–2012)

Tulip classification of perinatal mortality (underlying cause of death, main groups and placental subgroups)[25]

	n	Per cent			n	Per cent
Congenital anomaly	135	19				
Placenta	253	36	→	Placenta		
Infection	32	5		Umbilical cord	70	28
Other	52	7		Placental bed	71	28
Unknown	224	32		Development	42	17
No information	11	2		Parenchyma	31	12
Total	707	100		Localisation	6	2
				NOS	33	13
				Total	253	100

Modified ReCoDe classification, most relevant condition at death (main groups and placental subgroups)[23 24]

	n	Per cent			n	Per cent
Fetus group	85	13				
Neonate	129	20				
Umbilical cord	60	9				
Placenta	155	24	→	Placenta		
Amniotic fluid	4	1		Placental abruption	26	17
Uterus	6	1		Placenta praevia	2	1
Mother	26	4		Vasa praevia	9	6
Intrapartum	28	4		Placental insufficiency	108	70
Trauma	2	0		Other	10	6
Unclassified	130	20		Total	155	100
Unknown	31	5				
Total	656	100				
Not eligible	**51***					

Wigglesworth/Hey classification[22]

	Fetal		Neonatal		Unknown period		Total
Delivery at	**n**	**Per cent**	**n**	**Per cent**	**n**	**Per cent**	**n**
37–40.6 weeks	373	62	217	36	8	1	598
≥41 weeks	67	61	42	39	–	–	109
Total	440	62	259	37	8	1	707

*During the first year missing data because of registration limitation for ReCoDe most relevant condition.
NOS, not otherwise specified.

Table 5 Substandard factors (SSF) and relation to death in term perinatal deaths in 2010–2012

	2010		2011		2012		2010–2012		
Relation to death	**n**	**Per cent**	**n**	**Per cent**	**n**	**Per cent**	**n**	**Per cent**	**p Value***
Cases with SSF	116	52	147	54	113	53	376	53	0.92
None/unlikely	45	20	75	28	63	30	183	26	**0.028**
Possible	28	13	32	12	32	15	92	13	0.47
(very) probable	23	10	24	9	10	5	57	8	0.060
Unknown	20	9	16	6	8	4	44	6	0.053
Cases without SSF	75	34	97	36	80	38	252	36	0.71
Cases with insufficient information	31	14	28	10	20	9	79	11	0.26
Total cases	222	100	272	100	213	100	707	100	

*χ^2 test.
Bold typeface indicates significance.

Table 6 Level of care at start of labour, period of death and year of birth in term perinatal

	Deaths					
	Perinatal death		Fetal death		Neonatal death	
Level of care at start of labour	**n**	**Per cent**	**n**	**Per cent**	**N**	**Per cent**
Primary care	183	19	101	11	82	9
Secondary/tertiary care	730	77	508	54	222	24
Unknown	30	3	4	0	26	3
Total	943	100	613	65	330	35

	Primary care		Secondary/tertiary care		Unknown		Total
Year	**n**	**Per cent**	**n**	**Per cent**	**n**	**Per cent**	**n**
2010	68	21	227	70	29	9	324
2011	69	21	259	79	1	0	329
2012	46	16	244	84	0	0	290
2010–2012	183	19	730	77	30	3	943
p Value*		0.19		**0.0001**			

*χ^2 test.
Bold typeface indicates significance.

Recommendations from the audit

A total of 512 SSFs were identified in the 376 cases with one or more SSFs: in 57% (213) of the cases one SSF, in 19% (73) two SSFs and in 24% (90) three or more SSFs. This leads to 603 recommendations: in 71% of all indicated SSFs (512/717) one recommendation is described, and in 6% (41) two and sometimes three recommendations.

Recommendations were, in 35%, about the organisation of care as well as for the quality of cooperation inside and outside the hospital between the different professional groups. In 19% the recommendations were for better use of guidelines and following usual care. The recommendations for guidelines focused on the development or adjustment of local protocols. In addition recommendations are given for producing local protocols for usual care. A specific frequently pronounced recommendation was the development of a national guideline for reduced fetal movements. In 15% the recommendations are to do with better documentation of the care process. The advice for better communication (11%) refers to improvement of communication between professionals in community and hospital care. For training and education (17%) recommendations were formulated, for instance training in neonatal resuscitation and in cardiotocography interpretation courses.[26]

On the PAN website all recommendations are sorted in groups and extensively elaborated http://www.perinataleaudit.nl/onderwerpen/204/uitwerking-van-aanbevelingen.

Representativeness of the documented and audited cases

Distribution of gestational age, congenital malformation and fetal-neonatal death are comparable in PARS and PRN registry (table 7).

The characteristics of the cases from 2010 to 2012 in the PRN-Audit database and in the national PRN database are comparable with regard to maternal characteristics such as parity, maternal age and gestational age except for a lower percentage of women of non-Caucasian ethnicity (p=0.04) and for less infants with birth weight <2000 g (p=0.01; table 7).

DISCUSSION

The Netherlands is the first country with a nationwide perinatal audit that is now systematically performed by all collaborating perinatal healthcare professionals at the local level. Within 2 years of its inception, all hospitals that provide perinatal care with the surrounding and adherent midwifery practices in the country participated in the perinatal audit. It proved feasible to audit and register the results of 64% (707) of all term perinatal deaths, which was a well representative sample of all term perinatal deaths in the Netherlands. The perinatal audit resulted in the description of SSFs and many recommendations ready for implementation within the PCG.

During the 3-year audit period term perinatal mortality decreased from 2.3 to 2/1000 births (p=<0.00001; table 1). The percentage of cases with one or more SSFs did not change during these years, but the percentage of cases without or with an unlikely relation of SSFs to death increased (p=0.028). Antepartum high risk selection increased from 70% to 84% during the years (p=0.0001).

Strengths and limitations

Audits by a multidisciplinary team of healthcare professionals themselves (internal audit), is a feasible way to increase implementation of the audit results/recommendations in local practice. In the chosen approach in the Netherlands an independent chairperson has proven instrumental to optimise audit performance.[18]

This study concerns term perinatal deaths of recent date, the last cases of 2012 were audited in June 2013. Most audits are performed within 3–6 months after death, which minimises the potential loss of knowledge/memory and details of the cases and circumstances that contributed to them.

Not all term cases of perinatal death are audited. Characteristics of the audited cases, however, are comparable with all term perinatal deaths in the national registration of the PRN; the registered cases were also comparable except for fewer cases with non-Caucasian ethnicity and fewer cases with birth weight <2000 g. This suggests that cases have not been avoided systematically or were lost for discussion in the audit.

Of all audited cases information was insufficient in 11% for SSF assessment. This percentage remained similar during the years and is a point of concern for the years ahead.

It is unknown whether all audit meetings take place in the most optimal and consistent way.

However, in our study the percentage of cases with assessed SSFs remained about the same during the years. In our view this fits with a stable audit method.

Knowledge of the outcome can influence the judgement of the care and the relation between the SSFs and the outcome, especially when the outcome is perinatal death.[29 30] Although participants may have assessed more or less harshly, the overall nationwide collected output of cases with SSF was quite consistent.

The cause of death according to the Tulip classification was classified as unknown in 32% of the cases in our study. This high percentage suggests that improvement may be feasible by further training of the audit teams in using the Tulip classification in addition to the desirability of more autopsies and placenta biopsies.[25 31]

Comparison with other studies

There are no other studies with national internal perinatal audit programmes, so we can only compare with earlier regional (external) audit studies.

SSF

In 36% of the audited cases in our study the audit group did not identify or assess any SSF. This is lower

Table 7 Characteristics of term perinatal deaths in PARS and PRN-Audit versus PRN 2010–2012

	PARS		PRN		
Characteristics	**n**	**Per cent**	**n**	**Per cent**	**p Value***
Gestational age (weeks)					0.91
37.0–40.6	598	85	930	84	
≥41.0	109	15	172	16	
Congenital malformations	135	19	238	22	0.20
Moment of death					0.40
Fetal	440	62	718	65	
Neonatal	259	37	384	35	
Unknown period	8	1			
Total	707	100	1102	100	

	PRN-Audit		PRN		
Characteristics	**n**	**Per cent**	**n**	**Per cent**	**p Value***
Parity 0	450	48	536	49	0.68
Age mother (years)					
<20	6	1	11	1	0.37
≥35	243	26	292	26	0.71
Non-Caucasian ethnicity	185	20	257	23	**0.04**
Congenital malformation	194	21	238	22	0.57
Period of death					0.94
Fetal	613	65	718	65	
Neonatal	330	35	384	35	
Birth weight (grams)					
<2000	30	3	60	5	**0.01**
2000–2499	85	9	98	9	0.92
≥4500	22	2	22	2	0.60
Gestational age (weeks)					
37.0–39.6	579	61	707	64	0.20
40.0–41.6	341	36	371	34	0.12
≥42.0	23	2	24	2	0.69
Total	943		1102		

*χ^2 test.
PARS, Perinatal Audit Registry system; PRN, Perinatal Registry of The Netherlands; PRN-Audit, Perinatal Audit Registry of The Netherlands.
Bold typeface indicates significance.

than in earlier regional studies in the Netherlands in 1996–1997 and 2003–2004 with 40–45%.[12 15] A possible explanation is that professionals are more critical about their own delivered care than external audit panels are. Otherwise these studies were performed 10 or even more years ago and in the meantime many guidelines have been developed and could be used as references for SSF.

In 11% of all cases insufficient information was present for SSF assessment. In earlier audit studies in the Netherlands this percentage was 2-4.[12 15] However, these audits (and narratives) were prepared by one or two dedicated researchers while in the nationwide audit each PCG has to gather all information for the narrative during their daily work.

SSF and relation to death

The audit groups found a probable or very probable relation of SSFs to death in 8% (n=57) of all discussed term perinatal deaths. In the LPAS study, a regional external audit in 2003–2004 in the Netherlands, this was 9%.[15] In earlier studies (external audits), only the combined outcome of possible and probable relation of SSF and death is given. In 25-30% a combined possible or probable relation is found in the Netherlands and even 46% in 10 European regions in 1993–1998 (Euronatal study).[1 11 12 30] These combined percentages were higher than in our recent study (21%) and in the earlier LPAS study (19%).[15] It is possible that these differences can be (partly) explained by quality of care improvement during the past 20 years. Otherwise it would be desirable to examine whether, compared with external review, our method of internal review with an external chair was more or less likely to identify SSFs with possible/probable relation to death.

Classification of perinatal death

At 36%, a placental cause of death in the Tulip classification was the most frequent. This is similar to the results of the LPAS study.[15] Comparison of the prevalence of perinatal death causes with other studies is difficult since those reports do not show the term period with enough separation for proper comparison. In a university clinic with preterm births included, 27% placental cause of death was found.[25]

Implications of the study and further research

A systematic method of perinatal audit has been implemented by all PCGs in The Netherlands. Audits generated many recommendations for quality of care improvements, which are in progress towards implementation. The infrastructure of the perinatal audit in the Netherlands had been secured and more topics can be chosen in the future for audit in perinatal care. For the years 2013–2015 the focus is on term intrapartum and neonatal death and admission to an NICU for neonatal asphyxia.

Further evaluation of time trends on term perinatal mortality will be an important focus for the years 2013–2015. The evaluation so far is based on only 3 years, which is rather short to draw conclusions about trends in an outcome as rare as perinatal mortality.

It is assumed that the chance of uptake of actions formulated by local professionals themselves is greater than the uptake of top down imposed advice. In general, the implementation of changes in care proves to be difficult.[32] At a national level the professional organisations involved now cooperate in college perinatal care (CPZ), instituted by the Ministry of Health (http://www.collegepz.nl/organisatie). CPZ is coordinating desirable changes in perinatal care.

During the 3 years studied, term perinatal mortality decreased. The percentage of cases with SSF without a relation to death increased while the percentage of cases with SSF and a probable relation to death decreased. Although a direct relationship cannot be proven, the parallel is striking with the synchrony of audit implementation and subsequently declining perinatal mortality in Norway.[9]

Antepartum high-risk selection increased during the years 2010–2012. This can suggest that risk selection became more accurate but this needs further investigation.[33] Some recommendations from the audits have already been implemented, such as the need for developing a new national guideline for ‘reduced fetal movements’.[34]

Conclusion

Within a short time period a systematic method of internal perinatal audit has been implemented by all PCGs in the Netherlands. Audits performed by healthcare professionals themselves generated many recommendations for quality of care improvements, which are in progress towards implementation. It is possible that the audit contributed to the decrease in term perinatal mortality. With ongoing audits quality of perinatal care can be continuously monitored and instruments for quality of care improvement developed.

These findings can be a stimulus for introduction of nationwide internal perinatal audit in other countries and in other medical disciplines.

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