Birth Centre Care in the Netherlands: added value?!

Klapwijk-Hermus, M.A.A.

Chapter 04

Development of the Optimality Index-NL 2015, an instrument to measure outcomes of maternity care

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Abstract

Introduction An optimality index is a composite tool to measure maximum outcome with minimal intervention. It focuses on optimality instead of on normality and is useful in comparing differences in processes and perinatal outcomes for women at low risk of complications. The latest Dutch version dates from 2 decades ago, and international versions of the optimality index are not directly applicable to the Dutch maternity system. Most data for perinatal research in the Netherlands are derived from a national perinatal database: the Netherlands Perinatal Registry. The aim of this study was to develop a new Dutch version of the optimality index (OI-NL2015) that could be calculated from data derived from this national perinatal database and to assess the reliability of these data for use in the index.

Methods Potential items were collected by a thorough comparison of earlier (inter) national optimality indexes and the current data collection of the national database. All items were reviewed by 2 experts in maternity care and assessed for importance, relevance for the Dutch maternity care system, and feasibility to retrieve information on these items. For each item a criterion for optimality was formulated based on evidence-based or consensus-based effectiveness of care in pregnancy and childbirth. All selected items were scored on potential problems, with reliability by 20 randomly selected community midwives. The level of agreement was calculated comparing these 2 data sets, which included data of the same women.

Results The final OI-NL2015 consists of 31 items in 3 different components: 22 intrapartum, 7 neonatal, and 2 postpartum. Of the 7 items that were examined because of expected potential problems with reliability, in 6 items a level of 90% agreement was found.

Discussion An optimality index is not a standard measurement instrument but must be validated and adapted to local circumstances and available data.

Introduction

One of the hallmarks of midwifery philosophy is the 'advocacy of nonintervention in the absence of complications'.[1] In line with this philosophy, labor and birth in women at low risk of perinatal complications are seen as physiological events that do not require technological or obstetric interventions unless indicated by a change in risk status.[2] To evaluate maternity care in these women it is therefore preferable not to focus on perinatal complications and adverse outcomes as these are rare condition in this population. Nonetheless, such variables are often the main outcome measures used when comparing obstetric outcomes among subgroups, such as women with different planned places of birth in the Netherlands.[3–7] In addition, adverse outcomes may vary from mild to severe and they rarely occur alone.

In 1980 Prechtl introduced another approach. He defined a list of criteria of the most favorable and optimal conditions for a representative and comprehensive description of the pre and perinatal condition of the mother, the fetus and the placenta.[8] This list was based on common clinical experience and on perinatal mortality data. Applying this optimality concept, a list of maternal and newborn optimality criteria was designed. Wiegers updated and adapted this instrument in the early 1990's [9]; later it was revised and validated for use in the United States (the Optimality Index-US [1,10]) and in the United Kingdom (Optimality Index-UK).[11]

The Optimality Index (OI) is a composite outcome tool based on the concept of optimality.[13] Optimality differs from normality because it avoids the problem of choosing a cut-off point on an often continuous scale of what is normal and which is not. In health care 'normal' is often defined as 'without abnormalities' or 'with the highest occurrence'. This does not automatically mean that a 'normal' process or outcome is the most optimal one. For instance, when the majority of women receive labor induction, that may be 'normal', but based on our knowledge of the physiology of labor and birth, it is not an 'optimal' outcome. The OI combines commonly used perinatal outcomes as instrumental birth, birth weight and perinatal death with evidence based processes such as amniotomy, episiotomy and the use of oxytocin for augmentation of labor within one instrument. All items are scored optimal (1) or nonoptimal (0). Individual items within the OI are not weighted, because the instrument as a whole is self-weighting: it reflects the potential cascade of interventions by including items that are closely related. Although an individual sum score is calculated for each woman, the OI is more specifically designed to compare between groups. It can highlight differences in the total of processes and outcomes of care by showing the mean sum scores of optimally scored items within essentially healthy groups of pregnant women in whom adverse outcomes are rare.[1] The OI has been shown to be valuable over a decade of

meaningful use in distinguishing processes of maternity care across and within various groups.[14]

Although there is much overlap in the different versions of the OI, all versions include items that are only applicable to a specific health care system or available from a specific perinatal database. In the Netherlands most data for perinatal research are obtained from a national perinatal database: the Netherlands Perinatal Registry.[15] The latest Dutch version of the OI, also partly based on this registry, dates from 2 decades ago.[9] In 2013 a national study started to evaluate the effects of planned birth centre birth in the Netherlands compared to alternative places to give birth (the Dutch Birth Centre Study).[16] To be able to use the OI in the current Netherlands practice climate and to use the OI as the primary outcome of the Dutch Birth Centre study, an updated version was needed.

The aim of this study was to develop a new version of the optimality index (OI-NL2015) based exclusively on the items in the Netherlands Perinatal Registry, as an outcome measurement tool for women with term pregnancies and at low risk for perinatal complications who were under care of a midwife at the onset of labor. We also investigated the reliability of the items of the OI-NL2015 within the Netherlands Perinatal Registry. The resulting OI-NL2015 will be used in the Dutch Birth Centre Study.[16]

Methods

Setting

The Dutch maternity care system is based on the notion that pregnancy, birth and the puerperium are primarily physiological processes. Most pregnant women are initially considered as 'low risk' and in 2015 87% of them initially received antenatal care from an independently practicing community midwife. A woman is referred to secondary care if risk factors arise during pregnancy, during labor or in the postpartum period. Secondary care is provided under the responsibility of an obstetrician and clinical midwives or trainee obstetricians can be involved. This risk selection and role division between the professions is based on the *List of Obstetric Indications*, a document that designates the appropriate level of care for more than a hundred obstetrical conditions. This list recommends that only women without known risk factors for complications in pregnancy and childbirth are under care of a community midwife.[17,18] Other conditions for this type of care are prepregnancy body mass index below 40 and spontaneous start of labor. Women with (previous) obstetric complications (for example, cesarean at prior birth or preterm contractions) or whose labor is induced are at the onset of

labor under care of the obstetrician. Interventions such as augmentation of labor, pharmacological pain relief, continuous fetal monitoring or instrumental birth only take place in secondary or tertiary care. In 2015, 51.4% of all women who gave birth in the Netherlands were in primary community midwife led care at the onset of labor.[19]

Construction of the index

An optimality index is not a static measurement tool. It requires close evaluation of its internal validity before it can be applied to specific situations in practice. The tool needs to be critically assessed and redesigned on a regular basis to accommodate different or changed insights into maternity care and to be appropriate for the available data and the purpose of the study.[9]

To develop the new Dutch version of the index, several steps were taken, all by 2 researchers (TW and MH). First, we collected and sorted all possible items already used in the existing optimality indexes: the Perinatal Background Index and Perinatal Outcome Index (PBI and POI, both elements of the previous Dutch OI, 36 items), the Optimality Index-US (OI-US, 94 items) and the Optimality Index-UK (OI-UK, 54 items).[9,11,12]

Second, the current list of items as registered in the Netherlands Perinatal Registry was studied to find potential extra items for the OI-NL2015. The Netherlands Perinatal Registry is an electronically collected national database that contains individual demographics and risk factors, as well as prenatal, intrapartum, postpartum, and neonatal interventions and outcomes during the first 7 days after birth. It is a routine registry in which standard response categories are defined for each item. There are no open-ended questions. The respondent has to score multiple discrete choices per item. However completing each item is not required for all items.[20] All 4 professional obstetric disciplines (midwives, general practitioners, obstetricians, paediatricians) have their own professional registry. These separate registries are afterwards linked to each other into one combined file per woman with data obtained from all involved professionals. Not all items from the 4 registries are scored for all women as not all 4 professionals are involved in caring for each woman.[21] Reliability of individual items of this database has been studied before but information about the inter-rater agreement of more than 1 item of the database is rare.[22,23]

Third, all potential items retrieved from the first two steps were reviewed by the same 2 researchers and evaluated for their relevancy to the Dutch maternity care system and the availability of information on this item within the Netherlands Perinatal Registry.

Fourth, items were excluded if they did not identify women at low risk of complications at the onset of labor under care of a midwife according to criteria written in the *List of Obstetric Indications*.[17]

Fifth, the optimal evidence based value for an item was decided. This was based

on the evidence lists about the optimal value of the items of the 3 earlier versions of the optimality indexes as well as the recently updated guideline from the English National Institute for Health and Care Excellence (NICE) on the subject of intrapartum care. [9,11,12,24] If no evidence was found in one of these before mentioned documents, a search was conducted in the Pubmed database. 'Clinical consensus' was defined as evidence if no scientific research with evidence for optimality was found, but national guidelines contained uniform endorsement of the desirability of an outcome. The term 'clinical consensus' was also used when the criteria for optimality were adapted from the existing categorical options in the Netherlands Perinatal Registry. For instance, in the Netherlands Perinatal Registry the item 'duration of first stage of labor' is categorically scored, with values <6, 6-12, >12 hours. An individual item was recorded in the OI-NL2015 if its criterion for optimality was agreed on by both experts (TW and MH).

These methods (a thorough comparison of earlier versions of the Optimality Index, deriving consensus about the inclusion of all items, and coming to agreement on the criteria for an optimal score) provided data to support the content validity of the index. This is consistent with the current recommendations for the construction of assessment instruments.[25]

Reliability

To study the reliability of the data extracted from the Netherlands Perinatal Registry we asked 20 community midwives to assess all potential items of the OI-NL2015 as to their perceptions of the level of accuracy of these items in the registry. The midwives were randomly chosen from a group of 52 midwives all working in one area located around a hospital in the southern part of the Netherlands. They represented 12 different midwifery practices, all had worked over 5 years as a primary community midwife and had over 5 years of experience in filling out data in the registry. The midwives were asked to give their opinion on the reliability of the registry per item on a rating scale of 4 points: 1 (very unsure about the reliability) to 4 (very sure about the reliability). For example, would 'artificial rupture of membranes' be reliably recorded in the Netherlands Perinatal Registry? An item was assessed as unsure if more than 30% of the respondents answered unsure or very unsure.

In order to assess the reliability of these data, all unsure items were added to a case report form that was used to collect data for the Dutch Birth Centre study. This cohort consisted of 3455 low risk women who started labor under care of a community midwife. [26] The methodology for the Dutch Birth Centre study has been reported elsewhere.[16] It was assumed that the remaining items were reliabley registered within the registry. The same person filled out both datasets directly after birth, sometimes completed by a colleague if there was additional information on outcomes or interventions at a later stage.

All women in the Dutch Birth Centre Study were linked to their data in Netherlands Perinatal Registry. This resulted in a combined database in which all unsure items were recorded twice per woman: once in the Dutch Birth Centre Study and once in the national perinatal registry. Missing data were recoded when possible with extrapolated data; for example, if data about referral were missing but the woman had a cesarean birth, referral was assumed to have taken place and was therefore recoded from missing to referred.

For all items, and corresponding to other optimality indexes, each optimal item received a score of 1 and each nonoptimal item received a score of 0. To determine the reliability of the unsure items, we compared the percentage of women with an optimal score on an item between our study data and the data derived from national perinatal registry. Agreement was defined as the frequency in which 2 evaluators assigned the exact same rating.[27] Ninety percent absolute agreement was used as acceptable level of agreement.[28]

The Netherlands Perinatal Registry gave approval for anonymous use of requested data for the analyses of this study. Design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that this study agrees with Dutch legal regulations for the methods used for this study. For this reason official ethical approval of this study was not required.[29]

Results

In total, 94 possible OI items were described in the 3 earlier versions of the OI and 6 possible new items were derived from the Netherlands Perinatal Registry (Figure 1). From these 100 items, 46 items were not in the Netherlands Perinatal Registry and therefore excluded. Another 11 items were present in the registry but only for a subgroup of women, namely those under care of an obstetrician after referral during labor. Including these items would have led to missing values for nonreferred women, so exclusion was the only option. Nine items were not distinctive for women at low risk of complications starting labor under care of a community midwife, according to the *List of Obstetric Indications*.[17] These items included women with problems like hypertension, diabetes, previous problems during childbirth (such as a previous cesarean) or an indication for induction of labor. If any of these events occur a woman is no longer considered as low risk and will be referred to secondary care before onset of labor. A list of the excluded items is in Appendix 1.

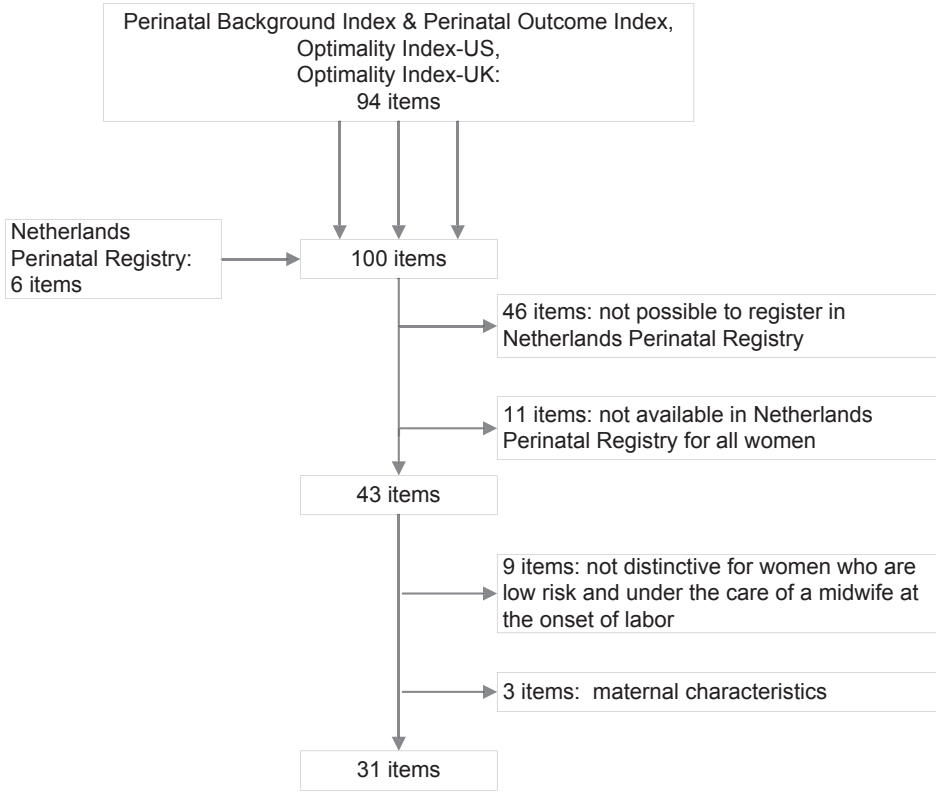

Figure 1 • Flowchart on selection of items for Optimality Index NL-2015

Table 1 shows the final selection of 31 items for the OI-NL2015 with the criteria for optimality and the maternal characteristics to adjust the sum score of the OINL-2015 for. As shown in this table, 4 items did not appear in earlier versions of the OI. These items are 'serious maternal complications postpartum', 'manual placenta removal', 'urgent referral' and 'cephalic position at birth'.

Four maternal characteristics were used to adjust the sum score of the OI-NL2015 for potential selection bias. Three of them were used in earlier versions of the OI (maternal age, maternal ethnic background and social deprivation). The fourth item 'social deprivation' was indirectly measurable by linking the postal code as registered in the Netherlands Perinatal Registry to the database of The Netherlands Institute for Social Research.[30] The postal code also made it possible to extend the number of maternal characteristics to 4 by linking it to the database of Statistics Netherlands to gain information on the level of urbanization.[31] Both procedures are often used in research with data obtained from the Netherlands Perinatal Registry.

Evidence for a criterion of optimality was found in earlier versions of optimality indexes in 25 items of the 31 potential items left. This was consistent with the evidence obtained in the recently updated NICE intrapartum guideline.[24] Evidence for the 4 new items (see Table 1) was found in this guideline as well, except for the criterion 'no urgent referral'. Criteria for this item were adapted as suggested in the referral categories by Amelink et al.[32] For the criterion for the item 'time between rupture of membranes and birth' the *List of Obstetric Indications* was used as evidence.[17] For the item 'duration of first stage' it was only possible to record 0-6 hours, 6-12 hours or 12+ hours in perinatal registry.[15] Therefore a maximum of 12 hours was chosen to be the criterion for optimality. The criteria for 'congenital anomalies' were adapted from the European Registration of Congenital Anomalies (and Twins) that was used in earlier Dutch research on congenital anomalies.[33,34]

The final Optimality Index NL2015 consists of a list of 31 items in 3 different components: 22 intrapartum, 7 neonatal and 2 postpartum.

All 31 items were presented to 20 randomly chosen community midwives and scored on expected reliability in Netherlands Perinatal Registry. Seven items scored were considered unsure or very unsure. These items were added to the case report form of the Dutch Birth Centre Study in order to study the inter-rater agreement on the optimality score between both registrations.

Table 1 • Optimality Index NL 2015 with the criteria for optimality

Optimality Index-NL-2015 [a,b]	Criterion for optimality
intrapartum component	
time between rupture of membranes and birth	≤ 24 hrs
duration first stage	≤ 12 hrs
duration second stage	≤ 120 min
color of amniotic fluid	clear
use of oxytocin for augmentation of labor	no
amniotomy	no
oral or injectable medication for pain relief during first or second stage of labor	no
epidural analgesia for labor and/or birth	no
birth occurred in the place originally intended at the onset of labor	planned place of birth is final place of birth
fetal presentation at birth	cephalic

Table 1 • Continued Optimality Index NL 2015 with the criteria for optimality

Optimality Index-NL-2015 [a,b]	Criterion for optimality
cephalic position at birth [c]	occipital
instrumental (vaginal) birth	no
cesarean section	no
episiotomy	no
1st or 2nd degree laceration of perineum or perineal tissue requiring sutures (including sulcus and cervical lacerations)	no
3rd or 4th degree extension of either an episiotomy or a 1st or 2nd degree laceration	no
loss of blood during birth	< 1000mL
blood transfusion	no
other serious intrapartum complications (eclampsia, preeclampsia or HELLP syndrome present during intrapartum period, placental abruption, vasa previa, placenta previa discovered during intrapartum period, infected uterus before birth, other major serious obstetric complications)	no
referral during labor or within 2 hours postpartum	no
urgent referral [c]	no
manual placenta removal (after vaginal birth) [c]	no
neonatal component	
duration of gestation	37-42 weeks
birth weight	P10-P90
Apgar score at 5 minutes	>= 9
transfer to high risk neonatal care setting within 24 hours postpartum	no
congenital anomalies	no
birth trauma within 24 hours postpartum (Erb's palsy, clavicular fracture, cephalo-hematoma, other serious birth trauma)	no
perinatal death within 24 hours postpartum	no
postpartum component	
maternal mortality within 24 hours after birth	no
serious maternal postpartum complications (eclampsia, deep venous thrombosis, preeclampsia or HELLP syndrome present during postpartum period, pulmonary embolism postpartum) [c]	no

[a] The sum score of the OI-NL2015 should be adjusted for the maternal characteristics ethnicity, social depriviation, maternal age and level of urbanization
[b] All items are available within the Netherlands Perinatal Registry except for social depriviation, which is obtained from the linkage with the database of the Netherlands Institute for Social Research. [30]
[c] new item, not present in former versions of the Optimality Index

As shown in Table 2, 6 of the 7 OI-NL2015 unsure items scored more than 90% agreement within both databases. The agreement on the OI item "birth occurred in the place originally intended at the onset of labor" was the lowest; this was the case in 71.8%.

Table 2 • Inter-rater agreement on optimality between scores from the Dutch Birth Centre Study and the Netherlands Perinatal Registry (n=3655)

Optimality Index-NL2015 item with criterion for optimality	Optimal score in the Dutch Birth Centre Study (%)	Optimal score in Netherlands Perinatal Registry (%)	Absolute agreement between Dutch Birth Centre Study and the Netherlands Perinatal Registry (%)[a]
no use of oxytocin for augmentation of labor	75.4	74.4	94.5
no epidural analgesia for labor and/or birth	87.2	86.3	96.3
birth occurred in the place originally intended at the onset of labor	54.2	57.8	71.8
no blood transfusion	98.8	99.8	98.9
no referral during labor or within 2 hours postpartum	53.9	57.8	93.8
no urgent referral	96.1	97.5	97.7
no transfer to high risk neonatal care setting within 24 hours postpartum	99.7	99.9	99.7

[a] equal score in both (both optimal or both nonoptimal)

Discussion

The OI-NL2015 is designed to assess aggregated outcomes in comparison to an evidence based standard and has its value in distinguishing processes of maternity care across various groups as has been demonstrated in other publications.[1,14] To our knowledge this is the first outcome measurement tool that focuses on optimality and can be calculated with data from the Netherlands Perinatal Registry. As is true of other versions of the Optimality Index, it is intended as a research instrument, not a quality assessment tool.

The OI-NL2015 consists of 31 items in 3 different components: 22 intrapartum, 7 neonatal and 2 postpartum items. For 29 items of the OI-NL2015 scientific evidence was found for its criteria of optimality. For 2 items this criterion was based on consensus. Thirty out of all 31 items of the OI-NL2015 can reliably be used when calculating a sum score for the OI-NL2015 with data from Netherlands Perinatal Registry.

To use the OI-NL2015 all items need to be scored optimal (1) or nonoptimal (0) as is true of other forms of the optimality index. To use this index, inclusion criteria for the sample are women with a term pregnancy who are at low risk of complications who under care of a community midwife at the onset of labor. A mean sum optimality score should be calculated for each group being evaluated; this must be adjusted

for the baseline characteristics of maternal background, maternal age at the time of birth, socio-economic status and level of urbanization. Because of the large differences in frequencies of interventions and outcomes between nulliparous and multiparous women, groups should also be analyzed by parity.[35]

More items are known to have an effect on optimal outcome than the items now included in the OI-NL2015. For the development of the OI-NL2015 we only had the items registered in the Netherlands Perinatal Registry available. Therefore, other items such as body mass index, smoking behavior, continuous support during labor and skin-to-skin contact between mother and her baby directly after birth could not be included although they are known to have evidence based effects on optimal outcomes. To use the OI-NL2015 in future studies all 31 items should be re-evaluated when major changes in maternity care have occurred or when there are changes in items included in the Netherlands Perinatal Registry.

Data in perinatal registries are routinely collected and often used in scientific research although little is known about their reliability and validity. The degree of underreporting and the percentage of incorrect data have an unknown effect.[20] We therefore assessed the reliability of all items to be used in de OI-NL2015. All, except one, scored over 90% agreement between the data from Netherlands Perinatal Registry and from the Dutch Birth Centre Study. The item that did not meet the 90% criterion was 'birth occurred on the planned place of birth'. The relatively high percentage of women with unknown planned place of birth in registry and the lack of definition of what birth location is called a birth centre could have contributed to that.[16,36] When using the OI-NL2015 only with data derived from registry and not being able to assess the item 'birth occurred on the planned place of birth' in another way, one should be alert that the sum score of the OI-NL2015 will end up lower, implying a lower level of optimality.

Although the OI-NL2015 is a research instrument, it can be used in care to increase awareness of the effect of interventions that are used on a daily basis in some midwifery practices (for example, episiotomy): it can demonstrate differences in the process between comparable subgroups by showing that every (unnecessary) intervention interrupts the process of physiological childbirth and often starts a cascade of other interventions. Evaluation and adjustment of these processes can lead to more optimal outcomes. Awareness of differences between one subgroup and another can be the first step to change practice. Although the aggregated evaluation provides information on processes, the OI is not an alternative for the evaluation of care on case level. It is supplementary. Acquaintance with the OI-NL2015 can also lead to a more positive evidence based approach on childbirth by looking at sum scores of optimal items

instead of the percentage of rare adverse outcomes (for example, perinatal death).

For this study, the aim was to develop a new Dutch version of the Optimality Index that can be calculated with data from Netherlands Perinatal Registry and could be used as an outcome measurement tool for the Dutch Birth Centre Study.[16] The perinatal registry includes over 95% of all births in the Netherlands and data are supplied by 3 different disciplines all involved in maternity care. Data are generated per hospital department (obstetrics and/or neonatology) and per independent community midwifery practice. With their own identification code midwifery practices are able to look at their own data on obstetric processes and outcomes in relation to anonymized national data online. In the near future it would be helpful if the OI-NL2015 could be included as an automatically generated outcome score within this web-based program to make it easier to reflect on the given care.[37] Although it is clear that in clinical use an optimality list should never replace the separate recordings of complications and was never intended to do so, a new version of the Optimality Index ensures a more comprehensive evaluation of potential differences between sub-groups of low risk women at the onset of labor under care of a community midwife, divided by planned place of birth (i.e. home, hospital, birth centre).[8]

Conclusion

We redeveloped and updated an outcome measurement tool that focuses on optimal outcomes instead of the presence of perinatal complications. All but one met the 90% criterion of reliability to use when calculating a sum score with data from the Netherlands Perinatal Registry. The Optimality Index NL-2015 will be used to distinguish variation between groups of low risk women by planned place of birth as studied in the Dutch Birth Centre study. An optimality index is not a standard measurement instrument but must be validated and adapted to local circumstances and available data.

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Appendix 1 • Items of other Optimality Indexes and reason for exclusion

not possible to register in Netherlands Perinatal Registry (n=46)
marital status
took part of parenthood classes
use of any smoking since conception (during index pregnancy)
use of any alcohol since conception (during index pregnancy)
drugs or over the counter since conception
prepregnancy body mass index (weight [in kg] / height [in m^2]) (18.5 to 24.9)
access to services (woman speaks and understands Dutch)
previous preterm birth < 28 wks
previous preterm birth 28-36 wks
previous instrumental birth
previous low birth weight for gestation infant
previous infertility
uncertain date of last menstrual period
intrauterine fetal demise
history of domestic violence during the pregnancy
anemia (Hb < 6.8 mmol/L)
major psychiatric history (formal diagnosis or treated with drugs/inpatient therapy)
pyelonephritis
Rhesus sensitization
vaginal bleeding
prenatal care: initiation in first trimester (prior to 14 weeks) and minimum of 5 visits
amniocentesis
nonstress test/contraction stress test/biophysical profile
cardiotocography during pregnancy
drugs prescribed or taken during pregnancy
history of mental health issues
24 hours or less have elapsed between first digital examination following rupture of membranes and birth
fetal heart rate abnormalities
presence of a support person during labor (other than care provider)
pushing was nondirected
nonsupine position at birth
medication (other than oxytocin or local anesthetic for perineal repair) during the third stage of labor
skin-to-skin contact
placental retention (≥ 30 mins)
insufficient cervical dilatation
insufficient progress in second stage

fetal distress
any breastmilk taken by time of discharge (including partial)
problems in first 24 hour
problems in first week
fever while mother remains in the birth setting, or provider diagnosis of infectious process or major complication
hematoma
local infection of sutures
prescription medications for conditions newly identified in intrapartum or postpartum period (Exception: Analgesic medications at over the counter dosages (OTC), iron and vitamins, oral contraceptives, rubella vaccine)
other problems
active management of third stage of labor
not available for all cases in Netherlands Perinatal Registry (for example, only available for cases for which obstetricians supplied data) (n=11)
inter-pregnancy interval between index pregnancy and previous viable birth > 18 months and < 60 months
more than one previous abortion
previous intrauterine fetal death
previous pregnancy-induced hypertension
specialist advice required during pregnancy (not during parturition)
fetoscope, Doppler or intermittent electronic monitoring used during labor, rather than continuous electronic fetal monitoring
assisted birth (not instrumental)
cystitis
endometritis
mastitis
specialist advice required during labor or birth
not distinctive for low risk women at the start of labor under care of a community midwife (n=9)
evidence of any preexisting, major, chronic, disease (chronic renal disease, diabetes (nongestational), heart disease class II-IV, HIV antibody positive, hypertension, major psychiatric history (treated with drugs or inpatient therapy))
previous cesarean section
history of any other serious antepartum complications (diabetes, eclampsia, placenta previa, placenta abruption, preeclampsia (RR of 140/90 and proteinuria 1+ or use of this term by any provider, pyelonephritis, Rh sensitization))
placental abruption in pregnancy
diabetes diagnosed in pregnancy (including gestational diabetes)
multiple birth (twins or higher number of births anticipated)
placenta previa
preeclampsia
hypertension (RR > 90)

All items above were included in other optimality indexes [14,20,23]