

Optimising the International Classification of Diseases to identify the maternal condition in the case of perinatal death

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Abstract

Objective

The WHO Application of ICD-10 to perinatal deaths: ICD-PM captures essential characteristics of the mother-baby dyad that contribute to perinatal deaths. We compare capture of maternal conditions in the existing ICD-PM with the maternal codes from The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM, to explore the potential benefits in the quality of data received.

Design

Retrospective application of ICD-PM

Setting

South Africa, United Kingdom

Population

Perinatal death databases

Methods

The maternal conditions were classified using the ICD-PM groupings for maternal condition in perinatal death, and then mapped to the ICD-MM groupings of maternal conditions.

Main outcome measures

Main maternal conditions in perinatal deaths

Results

We reviewed 9661 perinatal deaths. The largest group (4766 cases, 49.3%) in both classifications is that capturing the deaths where there was no contributing maternal condition. Each of the other ICD-PM groups map to 3-6 ICD-MM groups. If the cases in each ICD-PM group are re-coded using ICD-MM, that one group becomes multiple, more specific groups. For example the 712 cases in group M4 in ICD-PM become 14 different and more specific main disease categories when the ICD-MM is instead applied.

Conclusions

As we move towards ICD-11, the use of more specific, applicable, and relevant codes outlined in ICD-MM for both maternal deaths and the maternal condition at the time of a perinatal death would be preferable and provide important additional information about perinatal deaths.

Key words

Stillbirth, perinatal death, maternal conditions, classification, global, ICD

Tweetable abstract: Improving the capture of maternal conditions in perinatal deaths provides important actionable information.

Introduction

The link between maternal and newborn health is increasingly emphasised, with the Every Newborn Action Plan clearly highlighting that we will get a triple return on our investment if we focus on high coverage of care during birth and in the immediate neonatal period, resulting in the saving of lives of both mothers and babies, alongside the prevention of stillbirths(1). The events that cause perinatal death can result in maternal morbidity and mortality, and in the strategies for Ending Preventable Maternal Mortality (EPMM), it is highlighted that any approach to this must sit alongside improving reproductive health and newborn survival(2).

Building on ongoing work related to classification systems for perinatal mortality(3-6), we have developed, through a consultative process, the WHO Application of ICD-10 to perinatal deaths: ICD-Perinatal Mortality (ICD-PM)(7, 8). ICD-PM captures information to allow us to target the combined needs of the mother baby dyad. The ICD-PM separates perinatal deaths by timing of death (antenatal, intrapartum, or neonatal), and ensures that both a perinatal cause of death and the maternal condition at the time of perinatal death are captured(7).

In the initial pilot testing of ICD-PM, two things became clear(9). Firstly, there is scope for the ICD-10 codes that are currently applied to maternal condition at the time of perinatal death to be more specific, and thus better guide programs that would result in a triple return in investment. For example, maternal hypertension at the time of perinatal death in the current ICD-PM (following ICD-10 coding rules) is not delineated into the underlying causes, e.g. pre-eclampsia compared to essential hypertension. Secondly, the ICD codes

used to capture maternal conditions in situations outside of a perinatal death (e.g. in a maternal death) are different to those used for the mother in the situation where the baby has died. We risk poor data by asking clinicians to use disparate codes for two situations that are in fact the same in their underlying pathology (e.g. eclampsia where the mother dies is coded differently to eclampsia where the mother survives but the baby dies).

The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM(10) was released in 2012 and outlines the ICD -10 codes as clinically logical groups to be used in the case of maternal mortality. As these codes are also applicable in maternal morbidity, a system where the approach to maternal deaths and maternal conditions in perinatal deaths is aligned optimizes data collection and analysis. We aimed to test the ICD-PM system described previously(7, 9) using the maternal codes from ICD-MM, in order to compare this to the maternal codes currently used in ICD-PM, and to explore the potential benefits in the quality of data received with this change. This is the fourth in a series of papers related to the development and application of the ICD-PM (Box 1).

Box 1 Outline of the ICD-PM mini-series

Development of ICD-PM and our pilot testing is described in this mini-series of four articles. Paper 1(7) details the development of the ICD-PM. Paper 2 demonstrates the application of ICD-PM, using two perinatal death databases from South Africa and the UK(9). In paper 3(11), we use pre-term neonatal deaths as an informative case study of a challenging condition where ICD-PM allows better utilisation of data around the causes and contributing factors. Paper 4(12) explores the contributing maternal conditions and benefits of changes to the

coding rules in the upcoming ICD-11, such that ICD-PM and ICD-MM would utilise the same maternal codes, which is currently not the case.

Methods

The development of the ICD-PM and the initial pilot testing of it has been described in detail in the first two papers of this mini-series(7, 9). In brief, the application of ICD-PM to a perinatal death, which is based on ICD-10 coding rules, is as follows. The reviewing clinical team identifies the cause of perinatal death and this is later assigned a 3 character ICD-10 code (a letter followed by 2 numbers e.g. P22 respiratory distress of the newborn) by a trained coder. The 3 character codes can be further broken down in to specific disease subgroups, e.g. P22.0 Respiratory distress syndrome of the newborn. The process of assigning the maternal condition in a perinatal death is the same; the condition is identified by the reviewing clinical team and then a trained coder assigns a relevant 3-character main disease category code in ICD-10 (e.g. P00 fetus and newborn affected by maternal condition which may be unrelated to the present pregnancy), followed by a more specific disease subgroup code grouped under this 3 character code, e.g.P00.0 fetus and newborn affected by maternal hypertension. The ICD main disease category code that can be used for maternal condition in perinatal death can only be one of the P00-P04 codes.

Following the above process, the cause of perinatal death is grouped into the ICD-PM groupings for cause of perinatal death, designated with a leading A, I or N for the timing of perinatal death (ante partum, in partum, neonatal). The maternal condition is grouped in to 1 of 5 main groups for the maternal condition in ICD-PM, designated with a leading M (maternal). The ICD-PM groupings can be seen in Table 1.

Table 1: The ICD-PM system: perinatal causes of death, separated by timing of death, and maternal

| Main perinatal cause of death ICD-PM groups | | | | | |
|---|--|---------------------------|--|----------------|--|
| ANTEPARTUM DEATH | | INTRAPARTUM DEATH | | NEONATAL DEATH | |
| A1 | Congenital malformations, deformations and chromosomal abnormalities | I1 | Congenital malformations, deformations and chromosomal abnormalities | N1 | Congenital malformations, deformations and chromosomal abnormalities |
| A2 | Infection | I2 | Birth trauma | N2 | Disorders related fetal growth |
| A3 | Antepartum hypoxia | I3 | Acute intrapartum event | N3 | Birth trauma |
| A4 | Other specified antepartum disorder | I4 | Infection | N4 | Complications of intrapartum events |
| A5 | Disorders related fetal growth | I5 | Other specified intrapartum disorder | N5 | Convulsions and disorders of cerebral status |
| A6 | Antepartum death of unspecified cause | I6 | Disorders related to fetal growth | N6 | Infection |
| | | I7 | Intrapartum death of unspecified cause | N7 | Respiratory and cardiovascular disorders |
| | | | | N8 | Other neonatal conditions |
| | | | | N9 | Low birth weight and prematurity |
| | | | | N10 | Miscellaneous |
| | | | | N11 | Neonatal death of unspecified cause |
| | | MATERNAL CONDITION | | | |
| | | M1 | Complications of placenta, cord and membranes | | |
| | | M2 | Maternal complications of pregnancy | | |
| | | M3 | Other complications of labour and delivery | | |
| | | M4 | Maternal medical and surgical conditions | | |
| | | M5 | No maternal condition | | |

The process of applying the codes from the ICD-MM to the maternal condition in an individual case is the same as described above, except that the main ICD-10 codes that are used in ICD-MM are the O00-O99 codes. The maternal condition is first classified with a 3 character main disease category code (e.g. O14 pre-eclampsia), and then, where appropriate, a more specific disease sub-group is applied, e.g. O14.1 severe pre-eclampsia. ICD-MM then separates the codes applicable to maternal mortality in to nine separate groups. These groups are also applicable to maternal conditions where there is a perinatal death. In addition to this, ICD-MM has an annex (annex B2)(10) of codes which would not cause maternal mortality, but which may cause maternal morbidity and be a contributory condition to the maternal death. These conditions however may result in perinatal death, and so become the 10th groups of codes from ICD-MM able to be used for maternal condition at the time of perinatal death (named maternal morbidity conditions). The nature of this group in the context of ICD-MM, as these are conditions of maternal morbidity, is very broad in terms of its included conditions. For the purposes of ICD-PM, we have divided this in to 5 sub-groups; complications following abortion and ectopic and molar pregnancy, complications of the antenatal period, complications related to amniotic fluid, preterm labour and delivery, and complications related to labour. It remains important to capture cases of perinatal death in which there is no maternal condition identified (a healthy mother) and so we have modified the maternal conditions in ICD-MM to include an additional group (group 11, no maternal condition identified).

Overall, using the main disease category codes (and their specific sub-groups), in each system, there are 53 possible ICD-10 codes for maternal condition in ICD-PM. This would

become 702 possible ICD-10 codes for maternal condition in perinatal death should the codes from ICD-MM be used instead. It should be noted in both ICD-PM and ICD-MM that more than one maternal condition can be recorded – the main condition, followed by multiple other contributing conditions.

The ICD-PM maps the perinatal cause of death with the maternal condition at the time of perinatal death. It currently follows ICD-10 coding rules. This analysis focuses on the maternal condition identified at the time of perinatal death and how the information captured about those conditions improves if ICD-MM codes are used for maternal condition in place of the current ICD-10 codes used in ICD-PM. The main maternal conditions captured by M1-M5 in ICD-PM and by Groups 1-11 in ICD-MM are outlined in Table S1.

South Africa

We extracted perinatal death data from the South Africa Perinatal Problems Identification Program (PPIP)(13) from one province for the period October 2013 to January 2014, for stillbirths weighing 1000gr or more or those born at 28 weeks or more, and for all early neonatal deaths. Following a perinatal death, site based clinical review is undertaken and, along with assigning the cause of death for the perinate, the maternal condition at the time of perinatal death is also captured for every case. For each case in the database, a 3 character and, if appropriate, a more specific sub-group code for the primary maternal condition at the time of death was assigned. This process was done using both the ICD-10 codes currently outlined in ICD-PM and the ICD-10 codes used in ICD-MM. The codes were then mapped to each of the ICD-PM and ICD-MM groups for maternal condition.

UK

The UK database captures all perinatal deaths in the West Midlands from 1997-2010. Fetal death data were collected from 20 weeks, but subsequently truncated from 24 weeks according to the UK definition of stillbirths. Postnatally, it included deaths up to age 28 days. Data were captured from perinatal death notification forms which listed the primary and secondary causes, from which ICD codes were applied by a regional coding team, with codes for the main condition in the fetus or infant and the main maternal condition affecting fetus or infant. ICD-PM was applied to this database. The database was already populated with ICD-10 codes. Although the existing ICD-10 coding rules are that the maternal condition in a perinatal death should be coded with the P00-P04 codes, the maternal condition in this database was most often coded using the O00-O99 codes. In order that both the codes from ICD-PM and ICD-MM could be used, mapping between the two systems was undertaken. For example, a case coded in the database as O14.1 (severe pre-eclampsia), which is an ICD-MM code, was coded in ICD-PM as P00.0 fetus and newborn affected by maternal hypertension. This mapping was also done in reverse in the cases where an ICD-PM code (P00-P04) had been used, such that we ended up with both an ICD-PM and an ICD-MM code for the maternal condition in each perinatal death. Ninety five cases (1%) were unable to be mapped to both an ICD-PM and ICD-MM code due to insufficient case information.

Results

We reviewed data on a total of 9661 perinatal deaths from South Africa (n=689) and the UK (n=8972). Table 2 maps the groups of maternal conditions in ICD-PM (M1-M5) to the 11 groups for maternal condition that would apply if we used the ICD-MM codes in place of the existing ICD-PM codes. The largest group (4766 cases, 49.3%) in both the ICD-PM and ICD-MM classification of maternal conditions is that capturing the deaths where there was no

Table 2: Mapping ICD-PM groups to the ICD-MM groups (n=9661)

| ICD-MM groups | Group 1 Pregnancies with abortive outcomes | Group 2 Hypertensive disorders | Group 3 Obstetric haemorrhage | Group 4 Pregnancy-related infection | Group 5 Other obstetric complications | Group 6 Unanticipated complications of management | Group 7 Non-obstetric complications | Group 8 Unknown / undetermined | Group 9 Coincidental causes | Group 10 Maternal morbidity conditions | | | | | Group 11 No maternal condition identified | Unknown | Total n(%) |
|--|---|-----------------------------------|----------------------------------|--|--|--|--|-----------------------------------|--------------------------------|--|---|---|---------------------------------|-------------------------------------|--|---------|--------------------|
| | | | | | | | | | | abortion and ectopic and molar pregnancy | 10b Complications of the antenatal period | 10c Complications related to amniotic fluid | 10d Preterm labour and delivery | 10e Complications related to labour | | | |
| ICD-PM groups | | | | | | | | | | | | | | | | | |
| M1: Complications of placenta, cord and membranes | 0 | 0 | 1242 | 163 | 1 | 0 | 0 | 0 | 0 | 0 | 389 | 280 | 1 | 235 | 0 | 0 | 2311 (23.9) |
| M2: Maternal complications of pregnancy | 531 | 0 | 4 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 42 | 373 | 0 | 0 | 0 | 0 | 964 (10) |
| M3: Other complications of labour and delivery | 0 | 0 | 28 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 804 | 25 | 0 | 0 | 874 (9) |
| M4: Maternal medical and surgical conditions | 0 | 512 | 0 | 10 | 7 | 0 | 182 | 0 | 23 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 738 (7.6) |
| M5: No maternal condition | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4766 | 0 | 4766 (49.3) |
| Y85 Sequelae of transport accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 (0.0) |

| | | | | | | | | | | | | | | | | | |
|-------------------|--------------|--------------|----------------|--------------|-------------|----------|--------------|----------|-------------|----------|--------------|--------------|--------------|--------------|----------------|------------|------------|
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 (0.1) |
| Total n(%) | 531 (5.5) | 512 (5.3) | 1274 (13.2) | 174 (1.8) | 38 (0.4) | 0 (0) | 182 (1.9) | 0 (0) | 25 (0.3) | 0 (0) | 434 (4.5) | 653 (6.8) | 806 (8.3) | 260 (2.7) | 4766 (49.3) | 6 (0.1) | 9661 |

contributing maternal condition identified (M5 in ICD-PM and group 11 in ICD-MM). Each of the other main ICD-PM groups (M1-M4) map to between 3 and 6 ICD-MM groups.

Each of the ICD-PM groups M1-M4 corresponds to a single 3 character ICD-10 code main disease category. If these same cases are re-coded using the ICD-10 codes outlined in ICD-MM, that disease category becomes multiple, more specific main disease categories. Figure 1 explores the maternal conditions captured in the ICD-PM system when ICD-MM codes are used instead, using the example of group M4 from ICD-PM (Maternal medical and surgical conditions). The 712 cases in group M4 in ICD-PM (identified by a single 3 character code main disease category) become 14 different main disease categories when the ICD-MM is instead applied to the same deaths.

Within each main disease category in ICD-PM, there are more specific disease sub-groups which sit within that group and provide more information about the maternal condition. At this level, if ICD-MM groupings are applied to maternal conditions instead, a single specific sub-group in ICD-PM becomes multiple main disease categories using ICD-MM. The main disease categories in ICD-MM can be further exploded in to more specific disease sub-groups. Figure 2 explores the spread of maternal conditions captured by one most specific sub-group ICD-PM code when the ICD-MM codes are used instead, using the example of fetus and newborn affected by other specified complication of labour and delivery (a specific disease sub-group within ICD-PM group M3). This most specific categorisation in ICD-PM becomes preterm labour and delivery, obstructed labour, obstetric trauma, and

Figure 1: Exploring the maternal conditions captured by ICD-PM group M4 using ICD-MM codes (N=712)

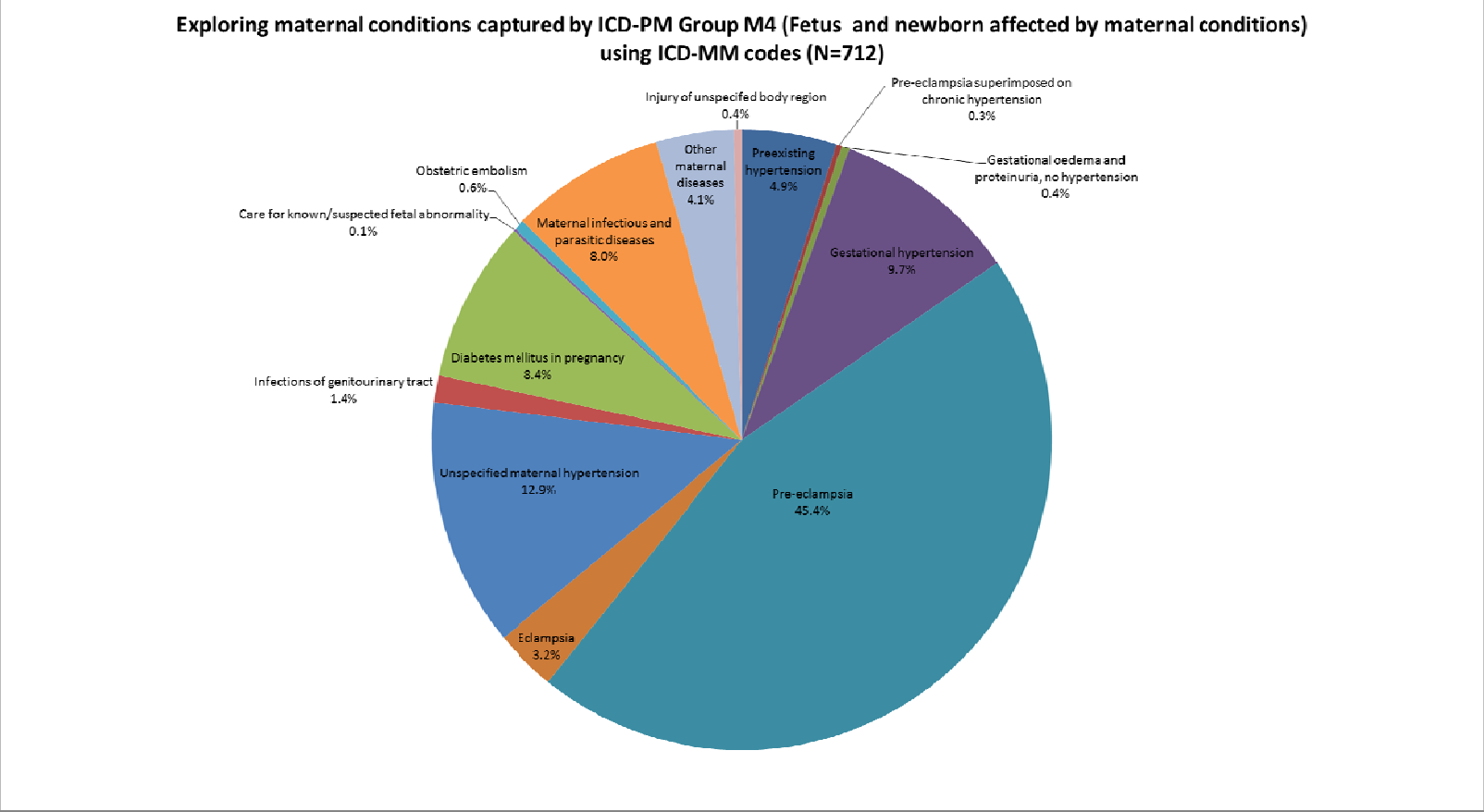
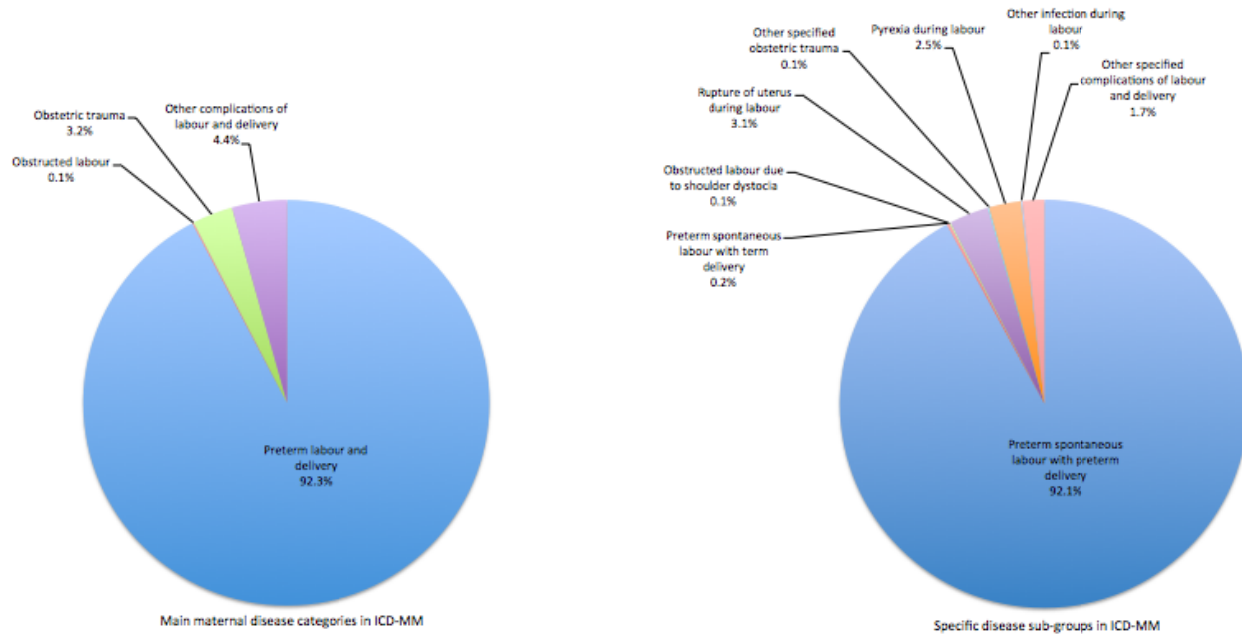


Figure 2: Exploring the maternal conditions captured by the specific ICD codes within ICD-PM using ICD-MM codes

Exploring the maternal conditions captured by the most specific sub-group level of ICD-PM (fetus and newborn affected by other specified complication of labour and delivery) using ICD-MM



other complications of labour and delivery at the main disease category level when replaced with ICD-MM codes. Figure 2 also shows the more specific disease sub-groups captured if these main disease categories in ICD-MM are explored.

It is also important to look at the application of ICD-MM codes to ICD-PM by focusing on each country example, with South Africa representing a middle-income setting and the United Kingdom representing the high-income setting. Results separated by country are presented below.

South Africa

In both ICD-PM and ICD-MM, the largest reported groups (249 cases, 36.1%) are those capturing the mothers without a contributing condition (M5 in ICD-PM and group 11 in ICD-MM). Each of the other ICD-PM groups (M1-M4) became multiple ICD-MM groups (groups 1-10). For example, the 162 (23.5%) cases under M4 in ICD-PM (maternal medical and surgical conditions) are expanded in to groups 2 (hypertensive disorders), 4 (pregnancy-related infections), 7 (non-obstetric complications), and 10 (maternal morbidity conditions) when the ICD MM codes are used instead. (Table S2)

The main disease categories in each of the ICD-PM groups are each mapped to multiple main disease categories if the ICD-MM is instead applied to the cases. For example, fetus and newborn affected by maternal conditions that may be unrelated to the present pregnancy became pre-existing hypertension, gestational hypertension, pre-eclampsia, eclampsia, infections of the genitourinary tract, diabetes mellitus, maternal infectious and parasitic disease, and other maternal diseases complicating pregnancy.

At the next level of coding, each of the most specific disease sub-groups in ICD-PM becomes multiple main disease groups when the ICD-MM codes are instead applied to the cases. For example, fetus and newborn affected by maternal hypertension in ICD-PM became pre-existing hypertension, gestational hypertension, pre-eclampsia, and eclampsia in ICD-MM. The most specific disease sub-group within ICD-PM also becomes multiple specific disease sub-groups when the ICD-MM codes are instead used. For example, fetus and newborn affected by other specified complications of labour and delivery in ICD-PM became preterm spontaneous labour with preterm delivery, preterm spontaneous labour with term delivery, and obstructed labour due to shoulder dystocia in ICD-MM.

UK

In both ICD-PM and ICD-MM, the largest reported groups (4517 cases, 50.3%) are those capturing the mothers without a contributing condition (M5 in ICD-PM and group 11 in ICD-MM). Each of the other ICD-PM groups (M1-M4) became multiple ICD-MM groups (groups 1-10). For example, the 2180 cases (24.3%) in M1 in ICD-PM (complications of placenta, cord, and membranes) became groups 3 (obstetric haemorrhage), 4 (pregnancy-related infections), and 10 (maternal morbidity conditions) when ICD-MM codes were used instead. (Table S3)

The main disease categories in each of the ICD-PM groups are each mapped to multiple main disease categories if the ICD-MM is instead applied to the cases. For example, fetus and newborn affected by complications of placenta, cord, and membranes in ICD-PM became other disorders of amniotic fluid and membranes, premature rupture of membranes, placental disorders, placenta praevia, premature separation of placenta,

antepartum haemorrhage, and labour and delivery complicated by umbilical cord complications in ICD-MM.

At the next level of coding, each of the most specific disease sub-groups in ICD-PM becomes multiple main disease groups when the ICD-MM codes are instead applied to the cases. For example, fetus and newborn affected by other maternal conditions in ICD-PM became gestational oedema and proteinuria without hypertension, diabetes mellitus in pregnancy, care for known/suspected fetal abnormality, obstetric embolism, maternal infectious and parasitic disease, and other maternal diseases in ICD-MM. The most specific disease sub-group within ICD-PM becomes multiple specific disease sub-groups when the ICD-MM codes are instead used. For example, fetus and newborn affected by other abnormalities of membranes in ICD-PM became infection of amniotic sac and membranes, premature rupture of membranes-onset of labour within 24 hours, premature rupture of membranes-onset of labour after 24 hours, and premature rupture of membranes-labour delayed by therapy in ICD-MM.

Discussion

Main findings:

We have demonstrated the increased clarity, specificity and applicability of a change in ICD-10 coding rules such that the codes used for the maternal condition of the time of perinatal death in ICD-PM would be the same as those currently used for the maternal condition in ICD-MM. At a grouping level, and other than the cases of no maternal condition, each of the ICD-PM groups become multiple ICD-MM groups in the change of coding of the maternal condition at the time of a perinatal death. Further to this, even the most specific disease

sub-groups in ICD-PM become more specific, clinically relevant and informative if either main or sub-group disease categories in ICD-MM are used instead. The move between the two systems from 53 to 702 useable codes demonstrates this improvement in specificity.

Strengths and Limitations:

This is the first application of ICD-PM in two large databases from different resourced settings to inform the further development, dissemination, and implementation of ICD-PM globally. This is a valuable opportunity to advocate for changing the coding rules as we move towards the 11th revision of ICD to improve the specificity, applicability, and relevance of the maternal condition captured in perinatal death. The disparate sizes of the two databases limit a direct comparison of data from applying the ICD-PM. The deaths in the South African database included stillbirths from 28 weeks gestation onwards or 1000gr (the WHO definition of stillbirth for global comparison), whereas the UK stillbirths were captured from 24 weeks gestation according to the national definition. While this wouldn't change the application of the system, it may change the overall ratios of causes of death and maternal conditions. In addition, the two datasets, being retrospective when pilot tested, were not compiled using the same standardised instructions, which may have affected the coding. Both databases are English language databases. These limitations underline the importance of using standardised definitions across settings, including non-English language settings, and the need for training to increase local capacity to capture perinatal death.

Interpretation:

One of the challenges in classifying a perinatal death centres around the lack of ability to obtain detailed information about the entire clinical picture and the mother baby dyad from

the cause of perinatal death alone. This may come from an inability to investigate in great detail the cause of perinatal death, particularly but not exclusively in the settings where most of the deaths occur(14, 15). Due to the challenges of classifying the perinatal death(9), it is even more critical that maximal information is extracted from the classification of the maternal condition at the time of perinatal death. Assigning the underlying cause of death from the perinatal point of view can be challenging, given that many settings lack of resources to fully investigate the cause of death, and a lack of clarity around when to assign a particular cause of death. The ICD-PM document attempts to address these issues, however it is still difficult in many scenarios to assign the underlying perinatal cause of death. Nonetheless, adding the maternal condition adds depth to the clinical interpretation of a perinatal death, and consequently the global picture of why such deaths occur. Many of the codes currently used in ICD-10 for the maternal condition in a perinatal death are not, at their most specific level, adequate to give enough information such that appropriate interventions could be taken to address the mother baby dyad. Maternal conditions cannot be separated from perinatal deaths(14, 16, 17) and so we are beholden to optimise the information captured about these conditions.

Not only does the use of ICD-MM for maternal condition in the case of perinatal deaths give a clearer picture of the conditions that are resulting in poor perinatal outcome, the same maternal conditions are represented in maternal mortality reviews, truly highlighting the impact that a single intervention could have on the mother baby dyad. For example, obstructed labour, antepartum haemorrhage, sepsis, and maternal hypertensive disorders all increase the risk of maternal death(18, 19), and equally all are represented as maternal conditions in this analysis of perinatal deaths. It is clear that the maternal conditions that

may result in a perinatal death and those that may result in a maternal death are aligned, and the lack of maternal deaths in our dataset does not preclude significant maternal morbidity or near miss. Having a perinatal death classification system that can give both meaningful perinatal and maternal data further strengthens the global focus on the intertwined health of women and their babies.

The current challenges for clinicians surrounding the use of ICD-10 at the time of perinatal death is demonstrated in existing country level reports. The ICD 10 coding rules clearly outline the codes that may be used for the maternal condition in perinatal death (P00-P04) and that when one wishes to tabulate a single cause of death table, it is the perinatal condition (cause of death), which can be any code *other* than maternal codes of P00-P04, that is to be used(20). Multiple country level perinatal mortality reports shows that a number of middle or high income countries have used a maternal code in place of the perinatal cause of death code in the single cause of death tables. While the ICD-PM clarifies the right use of maternal codes in perinatal death, having these codes aligned with those used in maternal mortality will likely result in more consistent reporting of both maternal and perinatal mortality data. Inaccurate data is potentially significant and in depth perinatal mortality analysis can be limited by this.

The ICD-PM is the first perinatal death classification system developed with the specific intention of global applicability. The document, and the perinatal audit guide to be released alongside it, gives guidance on assessing perinatal deaths and capturing in detail the causes.

In pursuing a globally applicable, standardized system, we aim to improve the depth and consistency of information captured.

One of the aims of the WHO Application of ICD-10 to Perinatal deaths is that it is clinically relevant and easy to use. While we believe we have demonstrated this(9), a change in rules with the upcoming 11th revision of ICD(21) such that the ICD codes from ICD-MM can be used in the ICD-PM would further strengthen this aim. It is clear from our analysis that the ICD-MM codes are also applicable for the main maternal condition in ICD-PM. ICD-MM has previously been demonstrated as a system that provides clinical specificity(22) and is easy for clinicians to use(23). Aligning the codes in the two applications will potentially further deepen the clinicians understanding of the mother baby dyad, and of the ICD system, as has been shown when clinicians use ICD-MM(24) for maternal mortality.

Conclusion

ICD-PM uses the current coding rules of ICD-10. We have demonstrated that data becomes more informative when these existing rules are modified to allow the use of the same codes as are used for maternal morbidity and mortality. As we move towards ICD-11 and revisions are being considered, the use of more specific, applicable, and relevant codes outlined in ICD-MM for both maternal deaths and the maternal condition at the time of a perinatal death would be preferable. Not only will this add weight to the data around perinatal death, it will strengthen the link between perinatal and maternal outcomes, highlighting the importance of considering the mother and the baby as an inseparable dyad.

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Ethics

The PPIP program has ethical approval from the University of Pretoria. The data is collected with permission from the South African Department of Health. This secondary analysis was approved by the PPIP technical task team. The UK data was collected by the West Midlands Perinatal Institute. Maternal consent was obtained by provision of information about the use of the data and opportunity for opt-out. The Institute's confidentiality and consent protocol was approved by the UK Information Commissioner and NHS Connecting for Health.

Disclosure of interests:

JJHM, VJF, JFF, JG, and RCP have all been involved in the development of a perinatal death classification system. There are no other disclosures of interests to declare. The ICMJE disclosure forms are available as online supporting information.

Contribution to authorship:

EA and OT drafted the manuscript. JG and RCP provided access to the databases and guidance for the pilot testing. EA and AQ undertook the analyses. EA, OT, JG, AF, RCP, JPV, JJHM, VJF, JFF, JN, AQ, DC, MM, LS, AMG reviewed the drafts and approved the final version of the manuscript.

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