A preliminary investigation into the effect of missing data on the published NMPA 2015/16 clinical results

On 9th November 2017, the National Maternity and Perinatal Audit (NMPA) published a set of 16 clinical measures. These were derived, for the first time, on data from three countries, from over 140 different individual data sources and encompassing almost 700 000 births.

Following publication, the NMPA team were alerted by several units that their caesarean section rate was lower than expected. The team conducted an initial investigation into this and found that the common feature which linked these units was a high level of missing data about the presentation of the baby (cephalic, breech or other) in caesarean births.

Since this initial alert, the team have undertaken a systematic analysis to determine whether this or similar issues affected the published measures, and to what extent.

The effect of unequal data completeness in caesarean and vaginal births

To make the NMPA measures as meaningful as possible, many (including the caesarean section rate) were calculated for singleton, term, cephalic births.

In other words, births were only included for these measures if the records of these births contained information that allowed the NMPA to ascertain whether the birth was singleton, term and cephalic. This approach is known as a 'complete case analysis' and is commonly used in analysing audit data.

However, this approach is only valid if the balance of missing information is equal between those records which were eligible for the measure (the denominator) and those for which the event of interest occurred (the numerator).[i]

This assumption is not met for information about fetal presentation (cephalic, breech or other). The chance of this information being complete was higher for vaginal births than caesarean births (Figure 1). Overall, approximately three-quarters of caesarean birth records contained the required information while almost all vaginal birth records did. This led to an unbalanced inclusion of records of vaginal births compared to caesarean births, and consequently an under-estimation of the rate of caesarean section.

While the NMPA quality checking process excluded from analysis sites which did not enter sufficiently complete data, it did not exclude sites with selective completeness of data (i.e. lower completeness for caesarean versus vaginal births).

Figure 1. Impact of unequal data completeness by mode of birth on complete case analysis
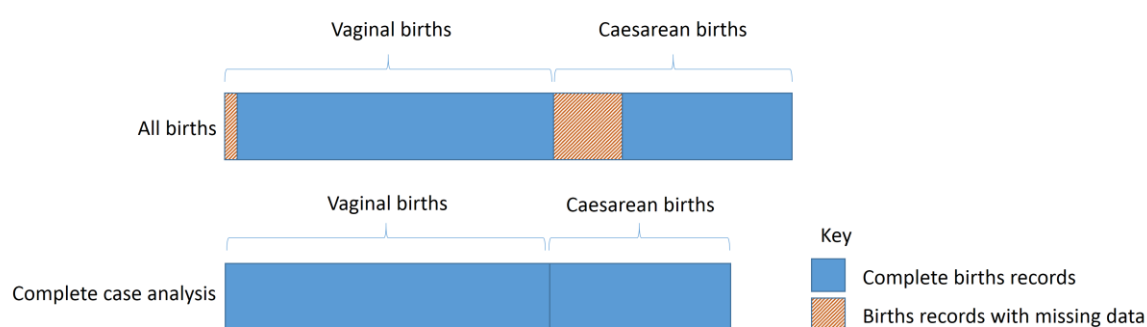
Measures affected

Measures affected are those which either directly measure caesarean section rates or those that measure something which is either more or less likely to occur in caesarean births compared with vaginal births.

These measures are:

1. Mode of birth (caesarean, instrumental and spontaneous vaginal birth)
2. Induction of labour
3. Postpartum haemorrhage ≥1500ml
4. Vaginal birth after caesarean

Preliminary analyses suggest that other measures are not affected since data on fetal presentation are either not required to construct the measure or are not selectively complete within the included records (Table 1).

Effect on site-level results

The unequal data completeness in caesarean and vaginal births had an impact on the published results for less than a quarter of sites included in the report. For the majority of those sites, the effect is small (less than 1%) or would have resulted in the site being removed from analysis due to incomplete data, had the initial data quality checks identified this issue.

Effect on country level and overall results

The effect on country results is more varied. For Scotland and Wales, particularly large sites are affected, and therefore the impact on the national mean results is larger than it is in England. In Wales, one large site will need to be excluded from all 2015/16 measures in the revision, due to selectively missing data on gestational age. This means that national means for all measures may change for Wales, not just the four measures listed above.

Next steps

The NMPA team will issue a revised report in early 2018. This will present results for the above measures in singleton, term births, and will <u>not</u> make the further restriction of limiting the measure to cephalic births. Doing so will not only avoid the issue above but will also enable results to be published for more units across England, Scotland and Wales. This will also be the approach used in the next NMPA clinical report based on births between 1st April 2016 and 31st March 2017.

The unequal data completeness in caesarean and vaginal birth will have ongoing implications for those who seek to calculate measures in maternity care for clinically relevant subgroups of women in Britain (including Robson groups for caesarean section).[ii] We will be publishing our methodological approach to address this issue to ensure that this situation does not arise again in the future.

The second round of clinical data collection for the NMPA is now taking place. Participating trusts and boards can help us greatly by continuing local efforts to ensure that data submitted to the NMPA is as complete as possible. As our recent report highlights, improving the completeness and accuracy of

electronic maternity data is an important national priority needed to support improvements in the care of women and babies.

We welcome your feedback on this summary of our post-publication review. Please do not hesitate to contact us at nmpa@rcog.org.uk should you have any concerns you wish to discuss with us or if you would like any further information.

Table 1. Identification of affected measures

Measure	Is the rate of this measure affected by differences in completeness of data on fetal presentation?
Smoking cessation in pregnancy	No
Induction of labour	Yes
Elective deliveries before 39 weeks without a documented clinical indication	No
Babies born small for gestational age not born before their due date	No
Mode of birth (caesarean section, instrumental vaginal delivery, spontaneous vaginal delivery)	Yes
Vaginal birth after caesarean section	Yes
Episiotomy	No*
Third and fourth degree tears	No*
Obstetric haemorrhage of 1500ml or more	Yes
Apgar score at five minutes of age	No
Skin to skin contact within 1 hour of birth	No
Babies given breast milk at first feed	No
Babies given breast milk at discharge home	No
Unplanned maternal readmissions within 42 days	No

* These measures are restricted to vaginal births only. For vaginal births, fetal presentation was over 99% complete in the birth record

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[i] For example, for the NMPA caesarean section measure the calculation would be:

Numerator =   Number of women giving birth to a singleton baby in the cephalic position at term who had a caesarean section

Denominator =   Number of women giving birth to a singleton baby in the cephalic position at term

Both the numerator and the denominator are restricted to records that contained the required information, in this case gestational age, number of infants, fetal presentation and mode of birth.

[ii] M.R. Torloni, A.P. Betran, J.P. Souza, M. Widmer, T. Allen, M. Gulmezoglu, *et al.* Classifications for cesarean section: a systematic review. PLoS One, 6 (1) (2011), p. e14566