Introduction & Background

Since 1993, maternity care policy in England has promoted women's choice of place of birth (Cumberlege 1993). This became the national *choice guarantee* in Maternity Matters policy document in 2007 (Department of Health 2007) with three options: birth in a maternity hospital (obstetric unit or OU); birth in two types of midwifery unit (MU), either alongside [AMU] or freestanding [FMU]; or birth at home. Midwifery units are home-like environments that avoid the routine use of technology and are considered especially suitable for women with a straightforward pregnancy and an anticipated normal birth. They are also referred to as 'birth centres' in the international maternity care literature (Hermus, Boesveld et al. 2017). Alongside midwifery units are situated within a hospital complex that has an existing OU. They may be in an adjacent corridor, on another floor, in another wing and occasionally in a separate building. What they all share is the facility to transfer labouring women to the obstetric units if complications occur in labour via walking, wheelchair or bed (McCourt, Rayment et al. 2014). Freestanding midwifery units are geographically separate from their host obstetric units and women transfer via ambulance if complications develop in labour (Christensen and Overgaard 2017).

Midwifery units exist in many other national maternity care systems, and, over the past three decades, a considerable body of evidence has accumulated demonstrating that both AMUs and FMUs reduce labour and birth interventions in women (Walsh and Downe 2004, Hodnett, Downe et al. 2012, Alliman and Phillippi 2016, Christensen and Overgaard 2017). Women who use them express high levels of satisfaction and midwives who work in them a sense of well-being and autonomy (Bernitz, Øian et al. 2016, McCourt, Rayment et al. 2016). Studies inside and outside of the UK suggest they are also more cost effective (Bernitz, Aas et al. 2012, Schroeder, Petrou et al. 2012, Kenny, Devane et al. 2015).

The Department of Health (England) commissioned research into childbirth in different settings (home, MUs, OUs) in 2004, specifically examining low risk women. The subsequent Birthplace in England research programme consisted of a suite of studies including a mapping of MUs and OUs in England, a prospective cohort study of perinatal and maternal outcomes by planned place of birth and an economic evaluation of the cost effectiveness of different places of birth. The cohort study reported that outcomes for low risk women were better and care was less costly if births were planned in MUs, both AMUs and FMUs, rather than OUs, without compromising the safety of babies. In particular, having a baby in a MU reduced caesarean section rates by two thirds (Brocklehurst, Hardy et al. 2011). There was also a reduced risk of instrumental delivery or of receiving medical interventions such as augmentation, epidural or spinal analgesia, general anaesthesia, or episiotomy and significantly greater likelihood of having a normal birth (Brocklehurst et al., 2011b). The linked economic study also found that cost per woman was less than traditional labour wards and care more cost effective (Schroeder, Petrou et al. 2012).

Subsequently, the National Institute for Clinical Excellence (NICE), the body that develops clinical guidelines for the English National Health Service (NHS), updated their guidelines on intrapartum care and now advises low risk women that MUs are particularly suitable for them (NICE 2014). Specifically the guidelines state that 'the maximum choice for women would comprise access to an Obstetric Unit with an AMU and access to a FMU within the Trust boundaries or in a neighbouring Trust'. However, despite the advantages of MUs, a NAO survey (National Audit Office 2013) found that MUs were not equally distributed with only 11% of women giving birth in one while the vast majority continued to give birth in OUs. In addition, MUs were not equally distributed across the country. A third of local maternity services (also called Trusts) had no MUs, and, in those that did, the percentage of women birthing in them as a proportion of all women birthing in the Trust was extremely variable with only a few achieving over 20% (National Audit Office 2013).

The reasons for these variations are unclear. There may be a range of context-specific or more general barriers to establishing and operating MUs. It is possible that financial constraints currently impacting on the NHS (Iacobucci 2016), a shortage of midwives (Wise 2014) and the increasing medicalisation of birth (Johanson, Newburn et al. 2002, Beech 2011) are among relevant factors. Little is currently known about such barriers or what facilitates MU provision. However, the unequal provision results in many low risk women birthing in OUs and therefore being exposed to an increased risk of caesarean section and to a birth experience that is less satisfying (Hodnett, Downe et al. 2012). In addition, local maternity services (Trusts) are not realising the cost savings of MUs.

The aim of this paper is to report on the types, numbers and utilisation of MUs in England 6 years on from the Birthplace study and presents the results from the first part of a larger funded study of the facilitators and barriers to optimal use of MUs. The paper compares the results with the Birthplace Mapping survey (Redshaw, Rowe et al. 2011) and comments on the changes that have occurred over that time. In addition, it discusses in more depth the potential utility of MUs to birth a greater proportion of low risk women.

Methods

Definition of Alongside Midwifery Units

To enable accurate mapping of service configuration it was first necessary to review how terms are operationalized. Midwifery units are defined as a clinical location offering care to women with straightforward pregnancies during labour and birth in which midwives take primary professional responsibility for care. Whilst the definition of an FMU is clear (midwife led unit that is a geographical distance from a host obstetric unit and therefore requires a vehicle transfer if complications occur in labour), the definition of an AMU is less clear. The Birthplace Study defined it as a midwifery unit where diagnostic and therapeutic medical services, including obstetric, neonatal and anaesthetic care are available, should they be needed, in the same building, or in a separate building on the same site (Redshaw, Rowe et al. 2011). Transfer will normally be by trolley, bed or wheelchair. Follow-on research projects from Birthplace add that AMUs should be able to accurately identify their admissions and births in their record systems (Rowe, Townend et al. 2013). However, these criteria allow for a number of hybrid arrangements e.g.

- midwifery-led rooms within the physical space of a traditional labour ward
- a midwifery-led area adjacent to a labour ward but with no separate staffing or management
- midwifery-led area that allows for labour interventions like continuous fetal monitoring
- midwifery-led area that is regularly used for labour ward overflow
- no separate data collections of processes or outcomes within the MU

Within our team, we had extensive discussions before agreeing the following criteria for defining AMUs for the mapping stage of our study:

1. Midwifery-led care setting
2. 'Low risk' women, with case by case exceptions only
3. Separate physical space from OU with minimum demarcation being a line on the floor that excludes, for example, having a AMU-style room within an obstetric labour ward
4. Only emergency secondary/tertiary level care is permissible within the space; epidurals, continuous electronic fetal monitoring, medical induction/augmentation require transfer to the adjacent obstetric unit
5. Does not provide care for labouring high risk women when OU short of rooms (unless exceptional circumstances)

6. Ability to measure number of births/year in AMU

These criteria are slightly more restrictive than the Birthplace study and we estimate that they resulted in the exclusion of a very small number (possibly two or three) AMUs included in the previous research. Our dataset therefore reflects this number.

Data Collection

Our data collection was aided by information provided by BirthChoiceUK and the consumer organisation, 'Which?'. Both of these provide web-based information about maternity service provision across the UK. BirthChoiceUK holds a database containing details of maternity unit configurations, which was supplied to 'Which?' for the development of the 'Which? Birth Choice' website (Which? Birth Choice, 2017). 'Which?' also audits MU provision and utilisation across the UK. We entered into a data agreement with 'Which?' for them to share the details of maternity units and configurations along with information they had collected about birth numbers in MUs in England. We developed our own data collection proformas after consulting both the Birthplace mapping data collection tool (Redshaw, Rowe et al. 2011) and pages on the 'Which? Birth Choice' website relating to maternity units. Heads of Midwifery (HoMs) in the 134 Trusts across England were sent a survey. We then telephoned the HoMs who provided current maternity service data for entry into the survey. These calls, which lasted up to 30 minutes, took place over a three-month period between March and May of 2016. Actual yearly number of births was completed using the 'Which? Birth Choice' data and sometimes subsequently updated in the telephone calls.

Ethics

This first stage of the research was classed as service evaluation and thus did not require ethics committee approval.

Sample

One hundred and thirty four NHS Trusts providing all publicly funded maternity care in England were contacted. Home birth was excluded.

Analysis

Descriptive summary statistics and narrative description of configuration, organisation, operation of AMUs and FMUs were undertaken.

Results

All 134 Trusts participated in the survey (response rate 100%).

The results will be presented in four ways: number and type of MUs as an indicator of place of birth choice; changes since the Birthplace study; the number of births/year in AMUs compared with FMUs; and thirdly MU births as a percentage of all births within each individual Trust, excluding home birth. The latter gives some indication of the utilisation of MUs as defined by percentage of women on a midwifery-led pathway that birth in them.

1. *Number and Type of MUs*

It should be noted that the local configuration of maternity services (Trusts) in England is constantly evolving. There has been a tendency for Trusts to expand and merge so that there are now fewer Trusts in England providing maternity services than at the time of the Birthplace Mapping study in 2010, reduced from 148 to 134. There has been a similar reduction in the overall number of OUs, reduced from 177 to 159. Many of the existing small OUs operate in areas that are more rural. Most Trusts have just one obstetric unit (n=106), but 25 Trusts now have two OUs and one Trust has three.

One hundred and thirty-two Trusts have at least one OU and of these, 65% have at least one AMU. The majority of Trusts (52.2%) have one OU and one AMU. Almost 27% of Trusts have one OU and no AMU. Ten Trusts with 2 OUs have no AMUs. The Trust with three OUs, has two OUs with an attached AMU and one OU without an AMU. This accounts for all 97 AMUs (Table 1).

Table 1. Numbers/Percentages of Trusts with Different Services Configurations: OUs and AMUs within the same Trust

		Number of OUs in the Trust									
		0		**1**		**2**		**3**		**Total**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
No. of AMUs in the Trust	**0**	2*	1.5	36	26.9	10	7.5	0	0.0	**48**	**35.8**
	1	0	0.0	70	52.2	5	3.7	0	0.0	**75**	**56.0**
	2	0	0.0	0	0.0	10	7.5	1	0.7	**11**	**8.2**
Total No./% of Trusts		**2**	**1.5**	**106**	**79.1**	**25**	**18.7**	**1**	**0.7**	**134**	**100.0**

*Two Trusts have no OU or AMU but provide maternity services with an FMU

Only 29% of all Trusts (39 out of 134) have an FMU. Of these, six Trusts have two FMUs, five Trusts have three FMUs and two Trusts have four FMUs, with the majority of Trusts with FMUs having only one. Of these, there are two FMUs that are not part of a Trust with an OU. Multiple FMUs were found to exist exclusively in rural areas. In total, there are 61 FMUs (Table 2).

Table 2. Numbers /Percentages of Trusts with Different Services Configurations: OUs and FMUs within the Same Trust

	Number of OUs in the Trust									
	0		**1**		**2**		**3**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**

No. of FMUs in the Trust	**0**	0	0.0	79	59.0	16	11.9	0	0.0	**95**	**70.9**
	1	2	1.5	16	11.9	8	6.0	0	0.0	**26**	**19.4**
	2	0	0.0	5	3.7	0	0.0	1	0.7	**6**	**4.5**
	3	0	0.0	4	3.0	1	0.7	0	0.0	**5**	**3.7**
	4	0	0.0	2	1.5	0	0.0	0	0.0	**2**	**1.5**
Total No./% of Trusts		**2**	**1.5**	**106**	**79.1**	**25**	**18.7**	**1**	**0.7**	**134**	**100.0**

In summary, there are 23 Trusts with an AMU attached to an OU and at least one FMU

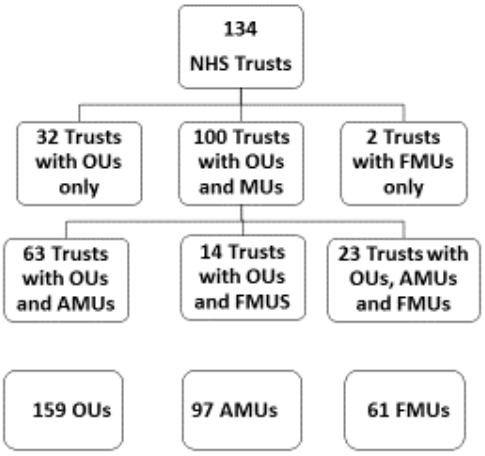
Within these 23 Trusts there are:

- Three Trusts with two AMUs and one FMU
- Eight Trusts one AMU and two FMUs
- Three Trusts with one AMU and three FMUs
- One Trust with one AMU and four FMUs

The clusters of FMUs e.g. three or more attached to five Trusts (hub and spoke arrangement) tend to exist in counties that are more rural.

The Flow Diagram below represents the current configuration.

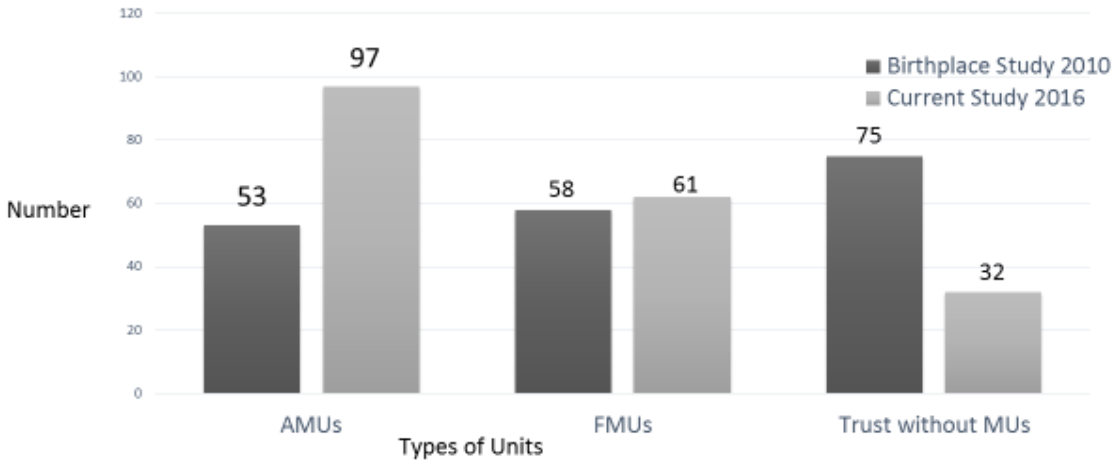
Figure 1. Flow Chart of Trusts, AMUs, FMUs and OUs



2. *Changes since the Birthplace Study*

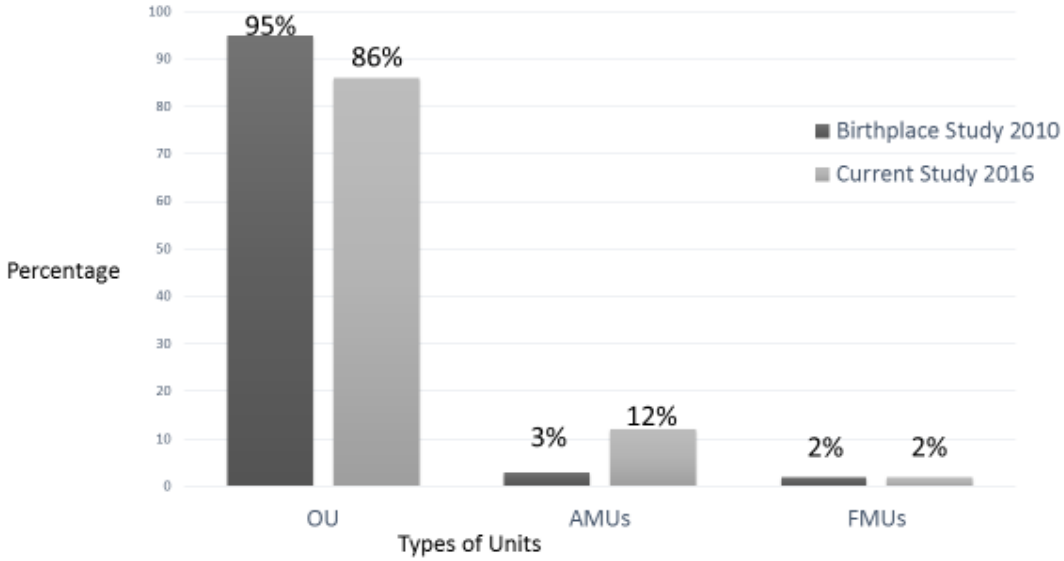
Over a six-year period, there has been an increase of 44 AMUs and 3 FMUs since the Birthplace mapping survey under taken in 2010 (Redshaw, Rowe et al. 2011). The number of Trusts without an MU has fallen from 75 (50%) to 32 (24%) and of the 32, twenty-seven have one OU and five have two OUs (Figure 2).

Figure 2. Numbers of AMUs, FMUs, and Trusts without MUs in England: Change since Birthplace Study



The increase in the number of MUs is reflected in a higher national percentage of all births occurring in such units. In comparison with findings from the Birthplace Mapping study, MU births across England increased from 5% to 14% of all births over the six-year period, almost entirely related to the increase in AMU provision (Figure 3).

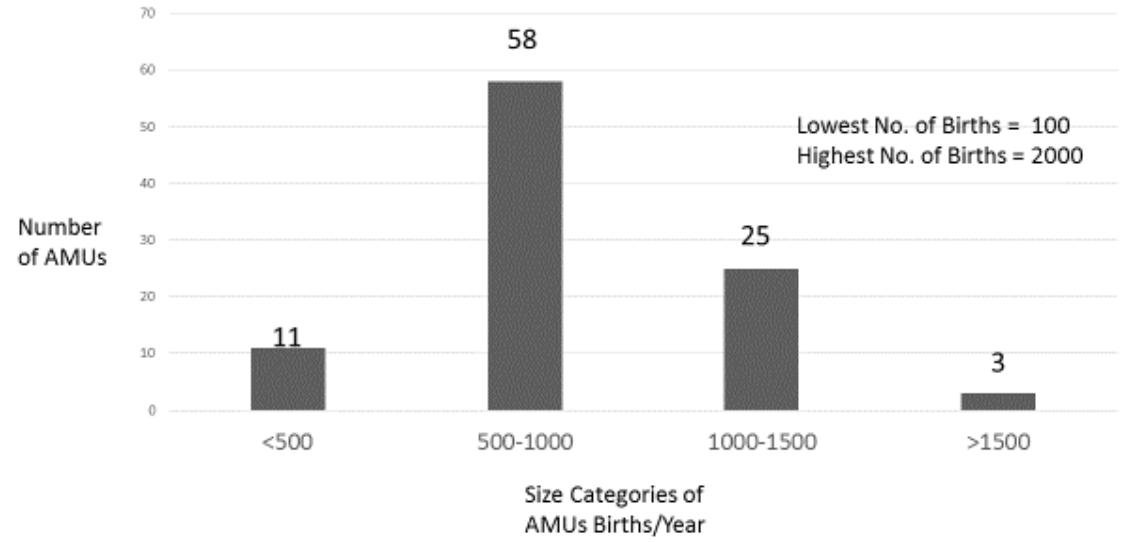
Figure 3. Percentage of Births in OUs and MUs: Change since Birthplace Study



3. *Number of births/year in MUs*

The number of births in each AMU varies considerably, from 100 births/year to 2000 births/year, but most range between 500 and 1000. Below we have categorised AMUs into bands based on their number of births/year (Figure 4).

Figure 4. Size of AMUs: Numbers of Births/Year

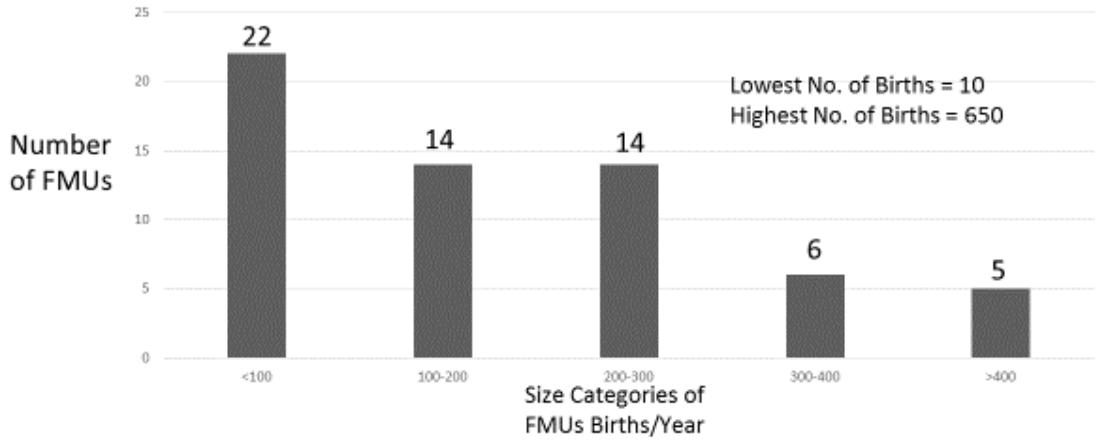


The differences in the number of births/year between AMUs is partly related to the number of births in their linked OU. For example, three of the five largest AMUs in England are linked to the three

largest OUs. But it is also dependent on each local maternity service's ability to optimise access to their AMUs. A later section of the findings highlights this.

The number of births in FMUs is much smaller than AMUs because they generally serve smaller population areas, typically more rural communities (Redshaw, Rowe et al. 2011). They appear to have more restrictive access criteria (Rowe, Fitzpatrick et al. 2012) e.g. women planning a vaginal birth after a previous caesarean section are not encouraged to birth in FMUs but it became clear in our survey that some local services allow this in AMUs as we asked a question about access criteria for the two types of MU. The range was between 10 births/year to 650 births/year, with the majority between 10 and 200 births. As above, we categorised FMUs into bands based on their number of births/year (Figure 5).

Figure 5. Size of FMUs: Number of Births/Year

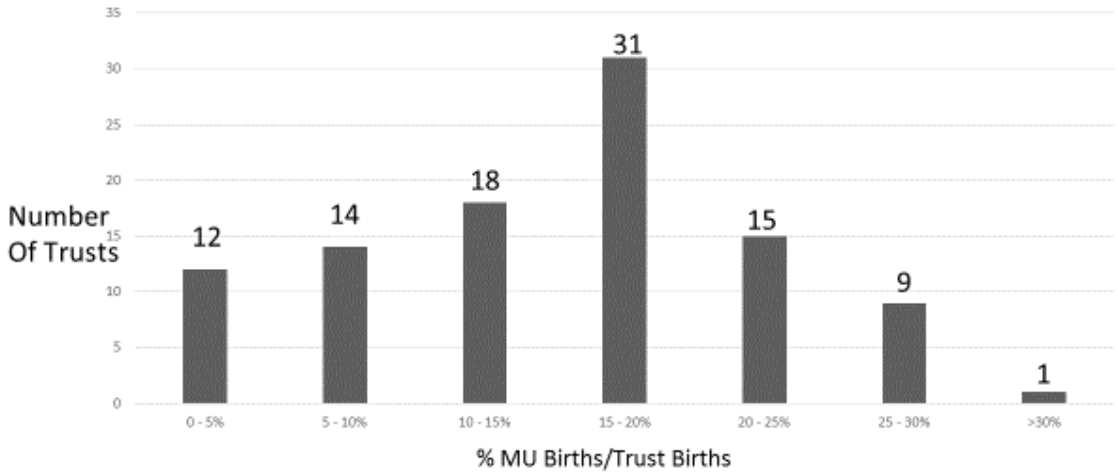


Thirty-six of the 61 FMUs (59%) are supporting fewer than 200 births/year. There has been a small but steady trend towards metropolitan FMUs opening in a town or city where an obstetric unit (OU) has closed over the past 15 years (Dodwell, 2013). Three FMUs with the highest number of births in England were established in the last 5 years because of this change. Two other FMUs, supporting in excess of 400 births, opened in large cities where existing obstetric units were situated.

4. *MU Percentage of all Births/linked Trust*

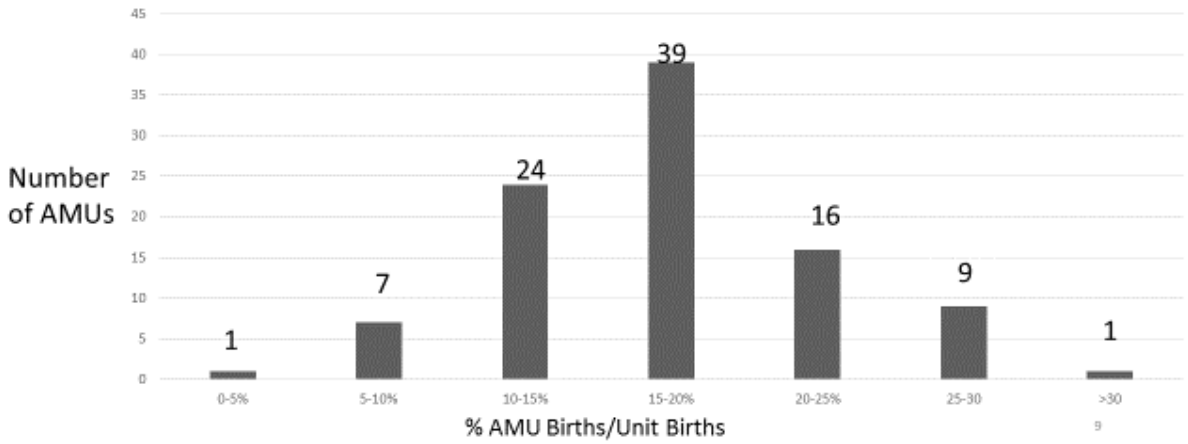
After excluding home birth, the number of MU births as a percentage of all births/ linked Trust gives some indication of their optimum utilisation. This is based on the assumption that the best care for women on a midwifery-led pathway includes access to MUs for labour and birth. For the purpose of this paper, we calculated the number of MU births as a percentage of all Trust births, excluding home births (in Trusts with both AMUs + FMUs, Trusts with just AMUs, Trusts with just FMUs) to reflect utilisation. We then counted the number of Trusts who had MUs birthing women according to different percentage bands (0 -5%, 5-10%, 10-15%, 15-20%, 20-15%, 25-30%, >30%). This revealed wide variations (Figure 6).

Figure 6. Utilisation of MUs: Numbers of Trusts by Percentage Bands of MU Births/all Trust Births



The Trust with the lowest percentage of all births in their MU(s) measured 4% and the Trust with the highest was 31%. Seventy two percent (72%) of MUs were birthing less than 20% of their total Trust births, excluding home births, with only 11% achieving above 25%. AMU utilisation (number of AMU births as a percentage of all attached Unit births) was similar (Figure 7).

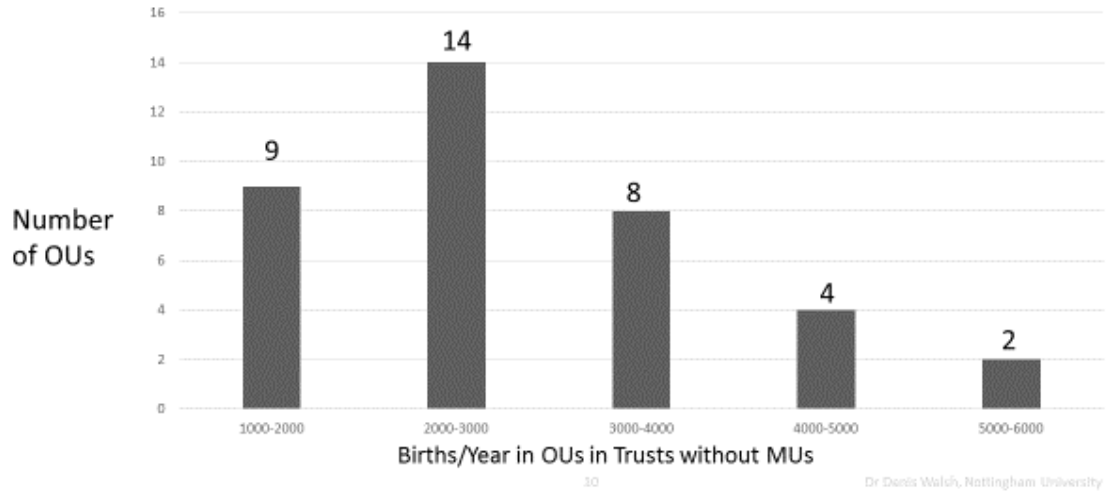
Figure 7. Utilisation of AMUs Numbers of OUs by Percentage Bands of AMU Births/all Units Births



Trusts without any MUs

Of the 32 Trusts without MUs, 5 consist of 2 OUs. Of these 5 Trusts, 4 have their OUs in different towns or cities covered by the Trust and the other has 2 obstetric units in one large city. The size of all these OUs vary from 1300 births/year to 5700 births/year (Figure 8).

Figure 8. Size of OUs without MUs: Number of Births/Year



Size of OUs does not appear to affect whether an AMU is established or not. Variations in choice of MUs are particularly striking in large metropolitan areas where we found examples of a city having two AMUs for a population of 10,000 births while a city in the same region with a similar number of births had no MUs.

Discussion

Although significant improvements have occurred in both the availability and utilisation of MUs across England since 2010, it is clear from this national mapping exercise that unequal provision persists. There are only 23 Trusts in England (17%) that have an AMU and an FMU. According to NICE Intrapartum Guidance (2014), optimum provision consists of having an AMU attached to each Trust and the option of an FMU in 'the local area or in a neighbouring area'. As the guidance does not define 'neighbouring area', it is not clear whether this means that every Trust should have an FMU. The National Maternity Review (NHS England 2016) provided more policy guidance saying "...women should have access to each of the birth settings recommended in NICE guidelines, although all four may not necessarily be available within each local maternity system." Our mapping results indicate that women's access to FMUs in particular, are poor in some major population centres. This needs to be considered in the context of the recent publication of a sub-analysis of the Birthplace study, which 'support the recommendation that 'low risk' women can be informed that planned birth in an FMU is associated with a lower rate of instrumental delivery and a higher rate of 'straightforward vaginal birth' compared with planned birth in an AMU..' (p2) (Hollowell, Li et al. 2017). Furthermore, although improvements have occurred over the past 6 years regarding AMU provision, 46 Trusts do not have an AMU.

Optimal utilisation of MUs is harder to define, as there is no consensus on what this means. One approach is to assume that all women on a midwifery-led pathway should have access to MUs as evidence concludes that labour and birth intervention rates are fewer, satisfaction with the birth experience higher and costs reduced compared to OUs (Brocklehurst, Hardy et al. 2011, Hodnett, Downe et al. 2012, Schroeder, Petrou et al. 2012). It follows that birthing as many suitable women as possible in MUs should be an objective for maternity care providers. This approach to optimal utilisation excludes women who have a preference for birthing in MUs, but are considered ineligible because of risk factors. It is known that some women with risk factors that would normally exclude them from planning an MU birth do utilise MUs e.g. women planning a vaginal birth after a previous caesarean section (VBAC) (Lieberman, Ernst et al. 2004). Another approach to optimum utilisation would be to examine the usage of individual birth rooms within a MU to see if the number of rooms is commensurate with the daily number of births. This would enable a judgement to be made about the rational use of space within birthing areas. However, we are more interested in investigating the pathways for low risk women and have therefore chosen to examine the first approach.

Working out what percentage of childbearing women could birth in MUs is complicated. Any calculation depends on numbers of healthy women at key markers during pregnancy and birth: in early pregnancy, at onset of labour and at the birth. We were unable to find any robust UK data stating the percentage of women suitable for a midwifery-led pathway after the health assessment in early pregnancy. However, Sandall and colleagues' (Sandall, Murrells et al. 2014) population-based cross-sectional study, on the maternity workforce and the implications for safety and quality in maternity care in England 2010-11, showed 45% of women were eligible for midwifery-led care at the end of pregnancy. During the intrapartum phase, a transfer rate to obstetric care from midwifery care of 20% can be expected according to the Birthplace in England study (Brocklehurst, Hardy et al. 2011). This leaves 36% of women remaining in midwifery care. Thus, a pragmatic calculation of the percentage of women that potentially could birth in MUs after obstetric referrals in pregnancy and during labour is 36%.

Very recently, the Lead for Women's & Children's Care at NHS England stated that achieving 30% of all births either at home or in midwifery units was a reasonable target for maternity services (Thomas, 2017). Home birth rates have hovered around 2% nationally for many years and even Trusts that have specifically set an objective to increase them by another 2% have struggled (Noble 2015). We chose deliberately not to include home births in our study because in the past 10 years the growth in non-institutional birth has been in MUs. In addition, MUs have been shown to be particularly suitable for women have their first baby (Brocklehurst, Hardy et al. 2011).

In our study, only one Trust achieved over 30% of their total population birthing in MUs and a relatively small number achieved between 20 and 30% (Figure 6). This suggests a level of under-performance in realising the benefits of a midwifery-led pathway in the access, organisation and operation of MUs. Numerous dimensions of local maternity care may impact on this from clinical guidelines, staff interface with newly pregnant women, strategic leadership or organisational culture (McCourt, Rance et al. 2011, McCourt, Rayment et al. 2014). In theory, optimising utilisation of AMUs compared to FMUs should be easier to address because women in early labour arriving at maternity units with an AMU are clinically assessed at that point and therefore could be sent to the AMU if they are on a midwifery-led pathway. The reasons why some Trusts with an MU are achieving over 20% of birth in these settings could be harnessed and adopted by others, which is why the case studies component of our research is so important. This work is completed and currently being analysed. MUs birthing more than 20% of their population were found across the spectrum of size of Trusts as measured by their total births, though generally MUs linked to smaller Trusts (<3000 births/year) were underutilised.

The other striking finding from this mapping exercise is that the increase in the percentage of women birthing in midwifery units (up from 5% to 14% over the past 6 years) has occurred almost exclusively in AMUs, rather than FMUs. There are now an extra 44 AMUs in England compared with 2010, while FMU numbers have only increased by three, from 58 to 61. Regarding FMUs, this figure masks a more complex picture of closure of long-standing FMUs and of recently opened ones, as well as completely new FMUs on the sites of previous OUs. The opening and closing of FMUs has been tracked for a report to the Royal College of Midwives (Dodwell, 2013) which identified that in England in February 2013 there were 59 freestanding midwife-led units (FMUs) compared with 53 in April 2001. During these twelve years, 30 new units opened and 21 units were permanently closed. A further three were temporarily closed, with the possibility that they will not reopen. Previous studies have documented the cyclical struggle for survival of FMUs in England where their small size and invisibility rendering them vulnerable to closure by their larger host organisations (Walsh 2006, Deery et al. 2010). This is of interest, given evidence from the Birthplace study that FMUs outperform AMUs regarding reductions in labour and birth interventions (Hollowell, Li et al. 2017). They are also more cost effective than AMUs in relation to the primary outcome of neonatal adverse outcome and the secondary outcome of maternal morbidity, though this is reduced if you compare only low risk women without complications at the onset of labour (Schroeder, Petrou et al. 2012). In addition, organisational research has found that midwifery satisfaction is very high in these settings (McCourt, Rayment et al. 2016) and they are much less prone to problems of staff recruitment and retention which are a contemporary challenge to the sustainability of the maternity workforce (Kirkham, Morgan et al. 2006).

Inequality of provision of maternity services is especially noteworthy in Trusts with neither FMUs nor AMUs. Though the number of Trusts without MUs has decreased from 75 to 32, this still means that around 24% of all Trusts in England do not offer women this choice and, therefore, according to best evidence, are exposing women to increased risk of caesarean section and running a more expensive service, without any benefits in overall safety of the baby. Potentially, this could represent around 45,000 low risk women/year in England who could birth in an MU but currently have no access to one.

Our case studies will explore these issues in more detail in the second stage of the project. During this phase we are examining in-depth the characteristics and culture of 6 Trusts with varying levels of access and utilisation of MUs with the aims of determining facilitators and barriers to the establishment and utilisation of MUs.

Strengths & Limitations

Securing a 100% response rate is important when undertaking a service mapping of all provision of MUs in England. However, service configurations are constantly changing, in terms of both Trusts merging and the opening of AMUs and FMUs and the closing of FMUs in particular. Data on the number of births in MUs were revised sometimes by HoMs when their initial figures were at variance with 'Which?' data that we already had. Which? updates their data yearly and some HoMs has access to more current data, though the variance was minor.

Conclusion

Maternity care policy has remained consistent since 2007 on the need for women to be offered choice regarding place of birth in England, to specifically include MUs, both alongside and freestanding as well as provision for home birth care. Since 2014, the NICE intrapartum guidelines

have recommended MUs for low risk women because they reduce labour and birth interventions, notably caesarean section rates. Our mapping shows that there are now more MUs than ever before and that the growth has been in AMUs. There has been an associated increase in the percentage of birth in MUs in England by 9% over a 6-year period. However, the growth in MUs is unequally distributed across the country and there remains a minority of Trusts without any and the provision of FMUs is limited as compared with AMUs. In addition, the utilisation of MUs is extremely variable and shows evidence of underutilisation with the majority providing birthing services for less than 20% of their total population. Best available evidence suggests this figure could be as high as 36% with optimal utilisation but only one Trust in our survey exceeded 30%.

The stagnation in the numbers of FMUs is also concerning, given their marginally better evidence base, both clinically and in cost-effectiveness, compared with AMUs.

One can extrapolate from these results that many low risk women continue to birth in OUs where the risk of caesarean section and other birth interventions is increased, maternal satisfaction is decreased and care is more expensive. We therefore recommend that providers urgently review their MU provision and utilisation.

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