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The Application of Operational Research Techniques to Service Improvement – Maternity: Direct Access to a Midwife

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Views expressed in this report are those of the academic researcher and not necessarily those of the Welsh Government

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Glossary of Acronyms

ABM	Abertawe Bro Morgannwg
ESRC	Economic and Social Research Council
GP	General Practitioner
KAS	Knowledge and Analytical Services
LHB	Local Health Board
MIDIRS	Midwifery Information
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NWIS	NHS Wales Informatics Service
ONS	Office for National Statistics
OR	Operational Research
WG	Welsh Government

Glossary of Terms

All Wales Maternity Notes	Set of hand held notes given to each woman to record all of her care during her pregnancy.
Antenatal care	Care of the woman during her pregnancy before the birth of her baby.
Birthrate Plus®	Software tool used to determine how many midwives are needed in each health board. It depends on the number of pregnant women and the level of care each is expected to require.
Consultant led care	Antenatal care led by an obstetrician for women with higher risk of complications.
Dashboard	Computer system where summary statistics are presented.
Direct Access to a Midwife	Scheme where the midwife is identified as the first healthcare professional a woman will see when she accesses care.
Electronic Record System	The computer system where patient records are housed.
Expert opinion	Information gathered from experts.
First point of contact	The first healthcare professional a woman will see when she accesses care.
Initial assessment	The visit a pregnant woman makes to the midwife where a full medical history is taken – typically at between 10 and 12 weeks.
Maternity pathway	The pathway a pregnant woman takes: visit GP or midwife, booking appointment, midwife or consultant led care, give birth.
Midwife	Healthcare professional who provides care to childbearing women during pregnancy, labour and birth and during the postnatal period.
Midwife led care	Maternity care provided by midwives to healthy women with straightforward pregnancies.
Operational Research	The discipline of applying appropriate analytical methods to make better decisions.
Simulation model	A computer model which represents what is thought to happen in real life.
SIMUL8	A software package that allows the creation of computer models that represent real life situations.

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Cwm Taf LHB

ESRC

Hywel Dda LHB

MIDIRS (Midwives Information and Resource Service)

ONS

Powys Teaching LHB

NWIS

Royal College of Midwives Wales

Welsh Government

1 Introduction

The overarching aim of the Welsh Government (WG) Programme to Maximise the Use of Existing Data is to identify and evaluate ways to maximise the use of existing data and expert knowledge in order to improve the evidence base for policymaking. Four Knowledge Transfer Research Fellows were jointly funded by WG and the Economic and Social Research Council (ESRC) for 2011-13, one of whom was given the remit to demonstrate how maximising the use of existing data could help with service improvement.

There is potential for Welsh Government and public services in Wales to improve the way services are delivered in terms of:

- improving the patient or service user experience;
- helping practitioners to do their jobs in the most effective way; and
- identifying efficiency savings.

In particular, techniques from the discipline of Operational Research such as simulation and computer modelling were identified as methods that could potentially add value in terms of informing service optimisation activities.

As the result of a prioritisation exercise for which around twenty potential projects were proposed by policy and analytical colleagues from across WG, two projects were chosen to demonstrate that information already collected as part of service delivery can be used to inform service improvement. A project on 'Maternity: Direct Access to a Midwife' was selected to be delivered by the Knowledge Transfer Research Fellow.

1.1 Policy background to Direct Access to a Midwife

In Wales, on average, over 35,000 babies are born each year[1]. Despite comparatively low maternal, perinatal, neonatal and infant mortality rates in Wales, health inequalities continue to represent a significant challenge e.g. the highest percentage of low birth weight babies in Wales are born in Blaenau Gwent, Newport and Merthyr Tydfil (Welsh Government (2011), p20).

In "A Strategic Vision for Maternity Services in Wales" (Welsh Government (2011) the Welsh Government sets out the results it wants for women and

[1] ONS Live Birth Figures 2010-12

their babies during pregnancy and childbirth and how the NHS in Wales will help to deliver those results. The report notes that there are challenges associated with delivering the commitment that “every woman, irrespective of location, social background, circumstances, or ethnicity has access to and receives safe, high quality care as close to home as possible”.

The Strategic Vision document states: “The Welsh Government’s vision for maternity services in Wales is of a service that promotes pregnancy and childbirth as an event of social and emotional significance where women and their families are treated with dignity and respect. For every mother wherever they live and whatever their circumstances, pregnancy and childbirth will be a safe and positive experience so that she, her partner and family can begin parenting feeling confident, capable and well supported in giving their child a secure start in life” (p.2).

In the foreword to the Strategic Vision document, the Minister for Health and Social Services states that “It is understood that the foundations for health and well-being start in pregnancy, with the months before and the years immediately after the birth crucial to the life chances of the mother, her child and her family. The health of the child is influenced by what happens through pregnancy so it is important that efforts to ensure the mother and baby are safe and healthy start well before the birth” (Welsh Government, 2011).

As part of the Strategic Vision, the National Health Service (NHS) in Wales is expected to take key actions to improve the delivery of maternity services. They include:

(1) Place the needs of the mother and family at the centre, so that pregnancy and childbirth is a safe and positive experience and women are treated with dignity and respect.

(2) Promote healthy lifestyles for pregnant women which have a positive impact on them and their family’s health.

(3) Provide a range of high quality choices of care as close to home as is safe and sustainable.

(4) Employ a highly trained workforce able to deliver high quality, safe and effective services.

(5) The key actions are constantly reviewed and improved.

The Strategic Vision identified the need for the midwife, where possible, to:

- become the "First Point of Contact" in terms of maternity provision; and
- to have a visible place in the community to ensure easy access for patients, and to subsequently direct women to the right type of care.

In part following discussions with those involved in the corresponding 'First Point of Contact' study in Scotland, 'First Point of Contact' was renamed 'Direct Access to a Midwife' (Feb 2012).

1.2 What is Direct Access to a Midwife?

'Maternity Direct Access to a Midwife' (formerly known as First Point of Contact) is a WG Programme for Government commitment under "21st Century Healthcare". It falls under the commitment to 'prevent poor health and reduce health inequalities' and will inform the implementation of the 2011 Maternity Strategy "to give all mothers choice and ensure high quality services".

The process that a woman follows during her pregnancy is known as her *maternity pathway*. Women are expected to follow the same pathway unless they have a risk of complications due to e.g. an underlying health condition. The first step in the pathway for a pregnant woman is to access maternity services for the first time. This tends to happen in one of three ways:

- Directly contacts GP surgery; sees GP and GP makes referral to midwife who, depending on risk assessment, refers to either the midwife or consultant obstetrician for antenatal care.
- Directly contacts the midwife (without seeing / attending the GP surgery at all) and referral for antenatal care is made by the midwife to the midwife service or a consultant obstetrician.
- Contacts GP surgery to report pregnancy but is redirected to the midwife by the receptionist with the referral for antenatal care made by the midwife.

The NICE guidelines (2008) advise that women should ideally have an initial assessment by 10 weeks. The guidelines advise that the first contact with maternity services, whether with the GP or midwife and whether before or at

the initial assessment, should be used to provide women with information about the screening programme and to promote public health messages including, where necessary, information about how to stop smoking, drinking or taking drugs. During the initial assessment a risk assessment should be undertaken and the midwife should make the decision whether to send the woman down the low-risk, midwife-led pathway or the high-risk consultant-led pathway.

The proposed change in maternity services policy for Wales is that the first point of contact (or 'direct access to a midwife') would be for women to go directly to their local midwife once they know they are pregnant. Women will therefore access the midwifery system sooner and there should be no duplication of that 'first contact' appointment between the GP and the midwife. Midwives are the lead professional for women with a low risk of complications. The early identification of the correct lead professional will ensure that women have their care led by obstetricians, GPs or midwives, with no duplication of care further down the pathway.

Direct Access to a Midwife is designed to deliver an initial assessment of the pregnant woman and her family as early as possible in the pregnancy, with clear lines of communication established between all members of the maternity team, including midwives, GPs and health visitors. This is designed to help the family, identifying specific forms of support that may be needed.

The aim of introducing Direct Access to a Midwife is to enable women to access services earlier in their pregnancy to provide them with:

- early advice on healthy lifestyles (healthy eating, exercise, vitamin supplements, reduced smoking, alcohol and drug intake);
- referral or signposting to support services e.g. smoking cessation services;
- information on local services i.e. support groups, antenatal exercise classes;
- an appointment for the initial assessment by 10 weeks of pregnancy; and
- early access to antenatal screening.

The expectation is that the midwife will become the first point of contact for the majority of pregnant women in Wales. The issue has been discussed for a

number of years in Wales and was mentioned in 2005 in the Welsh Government report *National Service Framework for Children, Young People and Maternity Services*. No specific deadline has been specified by which Direct Access to a Midwife is expected to be rolled out across Wales as it is a complex issue and each health board has progressed at a different rate towards achieving this (source: discussions with the WG Chief Nursing Officer).

1.3 Aims / objectives of the project

The project is part of the WG Programme to Maximise the Use of Existing Data. One of the key aims of the demonstration project is to engage WG officials in service optimisation issues and to demonstrate the contribution that Operational Research can make to the evidence base. Operational Research techniques such as computer modelling can be used to simulate existing services and model "what-if" scenarios.

By using Office for National Statistics (ONS) Live Birth data and expert opinion from practitioners, the aim of the demonstration project was to model how pregnant women currently contact maternity services in Wales and examine the potential impact on the delivery of maternity services of pregnant women using the midwife rather than the GP as the first point of contact. The results from the study will provide evidence to help policymakers communicate the move to 'Direct Access to a Midwife' to practitioners. As a demonstration project, the Study was designed to be relatively small scale and limited in scope – it was not designed to identify any improved health impacts for mother and child.

The objectives of the project were:

1. To undertake a review of where Direct Access to a Midwife (otherwise known as First Point of Contact) has been used internationally.
2. To develop a maternity pathway flowchart for a typical expectant mother.
3. To gather data and expert opinion about the way maternity services currently work in Wales from the Heads of Midwifery, consultant obstetrician, specialist GP and ultrasound managers to inform the simulation model.

4. To develop a simulation of the pathway expectant mothers take through the current system, focusing on the services with which she comes into contact during her pregnancy.
5. To use the model to demonstrate the effect of changing the percentage of women who access a midwife as their first point of contact.

1.4 Structure of the report

The methodology used in this project is discussed in Chapter 2 including information about the methods adopted for the literature review and how data and expert opinion were gathered and analysed. Chapter 3 provides the findings of the literature review. Chapter 4 discusses the strengths and weaknesses of the data that was available for this project. Chapter 5 summarises how maternity services operated in Wales and how midwives were deployed. The simulation model is presented in Chapter 6. Chapter 7 summarises the findings and the conclusions of the project.

2 Methodology

One of the key aims of the project was to help WG officials explore how maternity services in Wales will change when Direct Access to a Midwife is introduced. Operational Research techniques such as computer modelling and simulation have been used to model a variety of services. This project used simulation to provide an accurate representation of how women in Wales currently access maternity services during their antenatal care and, by building on this, to explore 'what if' scenarios around increasing the proportion of women using a midwife rather than a GP as their first point of contact.

To generate the best possible simulation model, accurate data and expert knowledge on the maternity services system was needed. The component parts of the project were:

1. A review of where Direct Access to a Midwife (otherwise known as First Point of Contact) has been used internationally. This would allow us to see if Direct Access to a Midwife had been used elsewhere. It would also identify any projects that had used simulation to model a similar service and to examine what techniques and data had been used.

2. Development of a flow chart to capture the maternity pathway for an expectant mother. The flow chart would show the services that women access during their antenatal care and would become the basis of the simulation model.

3. Gathering data and expert opinion to inform the simulation model and ensure that it was as accurate as possible. Even in the absence of robust data, Operational Research techniques can use expert opinion to provide estimates to inform a model. All LHBs store maternity data electronically but not to the level of detail that would have been required for this Project. Whilst all women who give birth in Wales each year have a set of hand-held All Wales Maternity Notes, this data was not available electronically. In the absence of electronically held data containing an appropriate level of detail for this project, expert opinion was gathered about the maternity pathway from appropriate practitioners.

4. A simulation of the pathway an expectant mother takes through the current system; focusing on the services with which she comes into contact during her pregnancy. The model was used to assess the effect of changing the percentage of women who access a midwife as their first point of contact with maternity services.

The methodology adopted for each component is described in the following sections. The findings for each component are reported in the following chapters.

2.1 Literature review

A literature review was carried out to identify where Direct Access to a Midwife has been used in other countries. A search on PubMed[2] was carried out with 'Direct Access to a Midwife', 'First Point of Contact' and 'Role of Midwife' as the search criteria. A similar search was also undertaken by MIDIRS (a not for profit organisation that provides an information resource for midwives). The aim of the literature review was to document where the approach had been used and whether it had been successful. The literature review also aimed to identify whether simulation models had been used in this area. A search on PubMed was carried out with 'Direct Access to a Midwife' and 'Simulation Models' as the search criteria.

2.2 Developing the maternity pathway

The maternity pathway is the set of appointments, scans and blood tests that a pregnant woman accesses during her antenatal care. The pathway is described by the National Institute for Health and Clinical Excellence (NICE) guidelines which indicate the services a pregnant woman should receive and was represented as a flow chart. The flow chart formed the basis of the structure of the simulation model. Discussions with each of the experts involved in this Project identified which practitioner delivers the care at a given appointment, scan or blood test along the pathway.

2.3 Data and Expert Opinion

Having developed the maternity pathway, we knew the basic structure the simulation model would need to represent and the data needed for the

[2] PubMed is an electronic library system which allows you to search scientific journals.

simulation model was identified. It became apparent that the electronic maternity data available within LHBs was not available at the level of detail that would be required to develop the simulations. Although every pregnant woman in Wales carries the handheld 'All Wales Maternity Notes' with them throughout their care, these records were not available electronically.

However, within Operational Research, expert opinion is often used to develop simulation models where some of the relevant data is not available. For example, mathematical modellers at the Veterinary Laboratories Agency have used this approach in the development of models for the Department of Food and Rural Affairs (DEFRA) that represent how cattle diseases spread through a herd (England TJ et al (2004).

It should be noted that although simulation models can be developed using expert opinion, this can mean that the estimates do not reflect the full variation that exists in the real life system. Practitioners will often give a single value as an estimate, for example of the proportion of women who see their midwife as the first point of contact, but in reality this percentage would lie within a range of values and would also change over time. As far as possible, then, practitioners are asked about any obvious variations they are aware of but simulations will always tend to be less complex than the reality they are attempting to represent.

In the absence of detailed electronic data on the maternity pathway, expert opinion was gathered from the relevant Heads of Midwifery, a GP representative, a consultant obstetrician and Local Health Board (LHB) radiology managers. For this Project, we needed information on how women accessed maternity services and the types of care each professional delivered during their maternity pathway. In particular, we wanted to know what percentage of women used a midwife as their first point of contact with maternity services, what percentage have a midwife as the lead professional and what percentage have high and low risk births. The organisations who contributed their knowledge and experience are listed in the acknowledgments section at the front of this report.

As there are seven LHBs in Wales, we contacted the Heads of Midwifery (or a chosen representative) and ultrasound managers in each LHB. Each of the Heads of Midwifery was initially contacted by the Director of the Royal College of Midwives (Wales) and informed about the project. Individual heads of midwifery were then contacted to arrange a detailed discussion with the Research Fellow, either face to face or, where that was impossible, by telephone or email. Each face to face meeting took between one and two hours. The information from each discussion was collated and fed into the development of the pathway flowchart and the simulation models.

Information from the consultant obstetrician was collected in a face-to-face meeting where the obstetrician was asked how women access his services during antenatal care. An initial version of the simulation model was presented and the consultant was asked to comment on the accuracy of the model and to supply estimates of some of the parameters included in the model. It was important that the model described the services provided by all of the clinicians involved as that would result in a more accurate and realistic model.

A phone meeting with a GP representative allowed the GP's perspective on the early part of a woman's pregnancy to feed into the simulation model.

Information on the different ultrasounds carried out during pregnancy and the number of ultrasound machines in each LHB was collected through email conversations with the ultrasound managers. The information on the number of available ultrasound machines was included in the simulation model as a resource used by pregnant women during antenatal care.

2.4 Quality Assurance

Where a significant amount of the data used to develop a simulation model is based on expert opinion and knowledge, it is particularly important to 'sense check' the simulation. This process can provide assurance that the resulting model is realistic i.e. that it genuinely represents the real life system and behaves as the real system would when changes are made.

For this Project, the simulations were presented to a Heads of Midwifery Advisory Group Meeting, to consultant and GP representatives and to a 'Challenge Meeting' where the simulations and findings were presented to a

range of analysts from WG Knowledge and Analytical Services. The findings have also been presented to external audiences at UK and International Conferences. The reports, including the methodology and simulation model assumptions, were quality assured by analysts in WG Knowledge and Analytical Services and Cardiff University Maths Department.

3 Literature Review

A review of the research and health policy literature was undertaken to determine how Direct Access to a Midwife (First Point of Contact) is currently being used in other countries and what the outcomes of its use have been. The review considered 'What is direct access to a midwife?', 'Has the same approach been used in other countries?' and whether simulation had been used to model maternity services.

3.1 What can we learn about Direct Access to a Midwife from the rest of the UK?

In *The Core Role of the Midwife Workstream* (Midwifery 2020), it states that:

- "Most UK Government Policy over the last 15 years has promoted the concept of the midwife as first point of contact for women accessing maternity services".
- "In most areas of the UK there is not a widely known established system to enable women to access a midwife without first going to a GP".
- "Women should know how and where to access a midwife. Ideally this contact should occur by 10 weeks gestation and should involve a discussion about pregnancy screening tests and public health messages".

In a 2003 report entitled "GPs' maternity role to change", Doult noted that the GB House of Commons health select committee believed that midwives, rather than general practitioners (GPs), should be the first point of contact for pregnant women, as this would be better for the woman and take the strain off GP surgeries. The report stated that most women used their GP as their first point of contact and that the GPs tended to refer the women to consultant-led units rather than midwives. However, the report was written at a very high strategic level and did not provide any evidence to support this statement. The report suggested that for all pregnant women to be able to contact a midwife in the first instance: all GP receptionists and hospital units should be provided with the midwife's contact details; and that GP surgeries and telephone directories should list contact information for midwife services.

First Point of Contact - Scotland

The responsibility for the health service in Scotland was devolved to the Scottish Executive in 1999. This has led to differences in how maternity services are delivered in Scotland compared with other parts of the United Kingdom (Winters, 2012). Changes within Scottish maternity services since 1999 have been documented in:

- A Framework for Maternity Services (Scottish Executive, 2001).
- Keeping Childbirth Natural and Dynamic (KCND) (Quality Improvement Scotland, 2009).

The KCND programme was developed to support the work outlined in the Framework for Maternity Services in Scotland. The aim of the programme is to make sure that each pregnant woman is given up to date, evidence-based care by the appropriate professional (QIS, 2009). The KCND programme gives details of the Scottish Government's plans to make midwives the first point of contact for antenatal care in Scotland (Smith, 2009). One of the key principles of the pathway for maternity care is the right of pregnant women to be provided with up to date evidence-based information and to be involved with decisions regarding their care and that of their baby. NHS Health Scotland was quoted as saying (Jan 2010): "We are giving women the option of attending a midwife as the first point of professional contact in pregnancy".

3.2 Has the same approach been used in other countries?

As part of the literature review, a search was undertaken to see how midwives' roles varied internationally. There is plenty of international evidence that midwives play an important role in the delivery of maternity services but very little on whether they are used as the first point of contact. In some countries, the midwife assumes the role of the main care provider during pregnancy and childbirth whilst in others she supports the obstetrician and/or GP (Wrede, Benoit, & Einarsdottir, 2008). In New Zealand, most lead maternity carers are midwives, although some GPs or obstetricians may carry out the role (Ministry of Health, 2012*)*. In Belgium, a woman would visit her GP who will play an active role in her prenatal care assisted by a gynaecologist or obstetrician in private practice *(AngloInfo, 2012)*. In the

Netherlands a woman will visit her GP who will confirm the pregnancy and refer her to the midwife (Angloinfo, 2012).

The literature provided little evidence of the use of midwives as the first point of contact outside the UK. Only one study examined this issue and it reported Direct Access to a Midwife being used in only two countries. In Finland, community midwives were made the first point of contact in the 1940s but in recent years this has changed and a public health nurse is now the first point of contact (Wrede, Benoit, & Einarsdottir, 2008). In Iceland pregnant women will see either a nurse-midwife or a GP as their first point of contact (*Wrede, Benoit, & Einarsdottir, 2008)*.

There was no evidence in the literature about whether improved outcomes resulted from the use of midwives as the first point of contact or the reason for the change.

3.3 Simulation modelling associated with direct access to a midwife

The literature review did not identify any research evidence of the use of simulation modelling relating to direct access to a midwife. At point of writing, the National Audit Office (NAO) were developing a simulation model for the Department of Health to consider how the birth of a baby might be affected by the introduction of one-to-one midwifery care in all settings (consultant led, midwife led care). The NAO project was not completed in time to include the findings in this review but discussions with NAO analysts supported the approach taken in this Project (source: discussions with the NAO, 2013).
As the literature review did not provide any research evidence, the findings of this study need to be publicised in peer-reviewed journals relating to simulation and midwifery.

4 Availability of Data on Maternity Services in Wales

In order to develop the simulation model information was needed about several aspects of maternity services e.g. the number of newly pregnant women, the percentage of women who use their midwife as the first point of contact. The full list of information required is given in Annex 1. The data fell into two distinct categories:

1. data on the numbers of women accessing antenatal care; and
2. data on the current maternity services available in Wales.

As data on the number of newly pregnant women wasn't available, the project used the number of live births in Wales to back-calculate the number of women accessing antenatal care eight months earlier. The model only considered pregnant women who went on to give birth; using this method, it wasn't able to consider the pregnancies that ended in miscarriage. The number of live births is Wales is shown in Section 4.1, below.

Data on the numbers of women using the GP and the midwife as the first point of contact with maternity services was not available at the time of this study. The Head of Midwifery for each LHB was therefore asked to provide an estimate of these percentages. In real life, there would be some variation in the percentage of women accessing each healthcare professional over time; had detailed data been available, it would have been possible to reflect the real variation over time in the model; however, since we were relying on estimates from the Heads of Midwifery, the simulation model assumed a constant percentage over time.

The Heads of Midwifery were also asked to provide estimates of the percentage of women who tend to follow the consultant-led vs. midwifery-led pathway, as these figures were not available. The estimates obtained through discussions with the expert practitioners are presented in Chapter 5.

4.1 Number of Live Births in Wales

In 2011 there were 35,598 births to Welsh residents (compared to 688,120 in England). The number of births by Local Authority area for 2009-2011 is given in Table 4.1, below. The number of births by Local Health Board is given in

Table 4.2, below. The data are used in the simulation model described in Chapter 6.

Table 4.1 Number of Live Births to Wales Residents by Local Authority (2009 - 2011)

Local Authority	Number of Live Births (2009)	Number of Live Births (2010)	Number of Live Births (2011)
Isle of Anglesey	775	828	771
Gwynedd	1,338	1,270	1,319
Conwy	1,135	1,169	1,187
Denbighshire	1,039	1,048	1,100
Flintshire	1,754	1,808	1,701
Wrexham	1,689	1,681	1,730
Powys	1,255	1,205	1,232
Ceredigion	651	720	613
Pembrokeshire	1,277	1,294	1,301
Carmarthenshire	1,877	1,963	1,932
Swansea	2,581	2,792	2,725
Neath Port Talbot	1,573	1,618	1,596
Bridgend	1,536	1,666	1,728
The Vale of Glamorgan	1,464	1,432	1,457
Cardiff	4,623	4,757	4,770
Rhondda Cynon Taf	2,904	2,976	3,007
Merthyr Tydfil	696	718	764
Caerphilly	2,140	2,280	2,091
Blaenau Gwent	791	804	789
Torfaen	1,090	1,079	1,089
Monmouthshire	802	861	786
Newport	1,947	1,983	1,910

Source: Office for National Statistics: Birth Summary Tables, England and Wales (2009-2011)

Table 4.2 Number of Live Births to Wales Residents by LHB (2009 - 2011)

Local Health Board	Number of Live Births (2009)	Number of Live Births (2010)	Number of Live Births (2011)
Betsi Cadwaladr University	7,730	7,804	7,808
Powys Teaching	1,255	1,205	1,232
Hywel Dda	3,806	3,977	3,846
Abertawe Bro Morgannwg University	5,690	6,076	6,049
Cwm Taf	3,600	3,694	3,771
Aneurin Bevan	6,770	7,007	6,665
Cardiff and Vale University	6,087	6,189	6,227

Source: Office for National Statistics: Live Births by local authority of usual residence of mother (2009-2011)

4.2 The All Wales Maternity Notes

Each pregnant woman in Wales is given a set of handheld notes which she keeps with her throughout her pregnancy. However, as noted above, this data

was not held electronically so was unfortunately not available to feed into the flowchart or the simulation.

The All Wales Maternity Notes contain information on the woman's family medical history and records details about all the appointments and scans she has during her antenatal care. The notes also contain the details of any previous pregnancies. A summary of what is contained in the All Wales Maternity Notes is given in Annex 2.

In response to a key action for the National Service Framework 2005, development and implementation of the All Wales Maternity Notes was led by WG in consultation with relevant stakeholders. The All Wales Maternity Notes contain a wealth of information about pregnant women in Wales and the care they receive. In future, if the data captured on these forms was electronically transferred to a patient record system it could be used to investigate research questions such as the effectiveness of midwives delivering public health messages about e.g. smoking, obesity, including identifying any influence on health outcomes.

As well as obtaining data for the development of the simulation model, the project has obtained some useful information about the maternity services in Wales and highlighted the importance of good data and how it could be used in the future. A summary of the electronic systems currently used throughout Wales is given in Table 4.3, below. The level at which the information on these forms has been transferred to electronic recording systems varies across the 7 local health boards.

Table 4.3 Electronic Record Systems in use by LHB

Health Board	Electronic Record System	Use
Betsi Cadwaladr University	Myrddin	Antenatal bookings, admissions and discharges.
ABM University	Myrddin	Antenatal bookings, admissions, discharges and transfers
Hywel Dda	Carmarthenshire & Pembrokeshire: Myrddin Ceredigion: Protos	Booking information Admissions and discharges
Cwm Taf	Maternity Information Technology System (MITS)	Information from the All Wales Maternity Notes
Cardiff and Vale University	Evolution	Antenatal data, birth notification
Aneurin Bevan	Protos	Antenatal bookings, births, postnatal events, inform public health
Powys Teaching	No electronic record system	

Source: Heads of Midwifery (2012)

The Heads of Midwifery from Betsi Cadwaladr University, ABM University, Cwm Taf and Cardiff and Vale University Health Boards suggested that digipens would make it easier for the midwives and other practitioners to transfer the All Wales Maternity Notes for every pregnant woman (irrespective of whether they are under consultant or midwife-led care) into an electronic record system such as Myrddin.

At time of writing, NWIS were in the process of assessing the quality of patient-level data held in the midwifery IT systems across Wales (David Hawes, NWIS, 2013), including the counts of women booking into antenatal care. The findings from this exercise will indicate the extent to which each LHB could provide detailed, electronic midwifery data on a regular basis. It is expected that the findings of this work may be published in the future by LHBs but details and timescales are still to be agreed (Communication with Gareth Griffiths, NWIS, 2013). If data of sufficient quality were to be made available electronically, it could be included in any future update of the simulation models.

5 How Maternity Services Work in Wales

The demonstration project ran between 2011 and 2012. The information presented in this chapter summarises the information provided to the researcher about how maternity services in each LHB were delivered during this period.

5.1 Maternity Services across each LHB

Healthcare in Wales was split across seven LHBs: Betsi Cadwaladr University, ABM University, Aneurin Bevan, Cardiff & Vale University, Cwm Taf, Hywel Dda and Powys Teaching Local Health Boards. A map of maternity provision in Wales as reported to the researcher during the Project is shown in Figure 5.1, below.

Betsi Cadwaladr University Health Board covers the local authorities of Gwynedd, Isle of Anglesey, Conwy, Denbighshire, Flintshire, and Wrexham. There were three consultant-led maternity units in Wrexham Maelor Hospital, Ysbyty Gwynedd and Ysbyty Glan Clwyd. There were four birth centres at Tywyn Memorial Hospital, Dolgellau and Barmouth Hospital, Bryn Beryl Hospital and Denbigh Infirmary.

The hospitals and birth centres in **ABM University Health Board** had been open since the NHS reconfiguration in 2008 (source: midwifery co-ordinator, ABM University Health Board). In ABM University Health Board, there were two hospitals and one birth centre providing maternity care. The Princess of Wales hospital in Bridgend was a high risk, consultant-led unit. Singleton Hospital in Swansea had a high risk consultant-led unit and a low risk midwife-led unit. In Neath and Port Talbot, there was a low risk midwife-led birth centre.

Hywel Dda Health Board was run as three separate counties with a county head of midwifery attached to each: Carmarthenshire, Pembrokeshire and Ceredigion. There were three consultant led units at Bronglais Hospital in Aberystwyth, Withybush Hospital and West Wales General Hospital.

Cwm Taf Health Board covers Rhondda Cynon Taf, Merthyr and the Upper Rhymney Valley. There were consultant led units at Prince Charles and Royal Glamorgan Hospital and a birth centre at Aberdare General Hospital.

Cardiff and Vale University Health Board covers the city of Cardiff and the Vale of Glamorgan. The University of Wales Hospital, commonly known as the Heath Hospital also provided tertiary care for women with specialist needs in foetal and maternal medicine from across South Wales.

Aneurin Bevan Health Board covers Blaenau Gwent, Caerphilly, Monmouthshire, Newport, Torfaen and South Powys. There were consultant-led units in the Royal Gwent Hospital in Newport and Nevill Hall Hospital in Abergavenny. There were also two birth centres at Ysbyty Aneurin Bevan and Ysbyty Ystrad Fawr. The Royal Gwent also had a low risk midwifery care unit located alongside a birth centre. Nevill Hall could accommodate high risk and low risk births. Ysbyty Ystrad Fawr was a new hospital with a stand-alone birth centre and an antenatal clinic.

Powys Teaching Health Board had six midwife led units (each with two beds) at Victoria Memorial Hospital, Montgomery County Infirmary, Llanidloes Hospital, Knighton Hospital, War Memorial Hospital and Brecon War Memorial Hospital. Although approximately 1,200 women resident in Powys have babies every year, the majority give birth outside the health board as there are no District General Hospitals, only midwife-led units.

5.2 Where were the Midwives based?

The Heads of Midwifery provided the following information on where the midwives in their health board were based.

In **Betsi Cadwaladr University Health Board** the midwives were based in community hospitals and birth centres.

In the Pembrokeshire region of the **Hywel Dda Health Board,** the midwives were based in GP surgeries and health centres. In the Ceredigion area of Hywel Dda, midwives have been based at their own homes due to their on-call commitment and the fact they offer a home-birth service. However, Hywel Dda LHB had just decided it would be more cost-effective if midwives were

based at the hospitals (Source: Maureen Jones, Ceredigion), so in future they will work out of Bronglais, and Withybush Hospital. In Carmarthenshire, the midwives were based at West Wales General Hospital.

In **ABMU LHB**, the midwives were based in consultant led units, stand-alone birth centres and midwifery led units.

In **Cwm Taf Health Board**, the midwives were based at the two main hospitals (Prince Charles and Royal Glamorgan), community hospitals, the birth centre at Aberdare General Hospital, and in some GP surgeries.

In **Cardiff and Vale University Health Board**, the midwives were based in the University of Wales Hospital.

In **Aneurin Bevan Health Board,** the midwives were based at the Royal Gwent Hospital in Newport and Nevill Hall Hospital in Abergavenny and the birth centres at Ysbyty Aneurin Bevan and Ysbyty Ystrad Fawr.

In **Powys Teaching Health Board,** midwives were based in birth centres attached to the community hospitals.

Figure 5.1 Map of Maternity Facilities across Wales

5.3 Midwife Care

5.3.1 Types of Midwife

There are four types of midwife in Wales:

- **Hospital midwives** are based in a hospital obstetric or consultant-led unit, a birth centre or midwife-led unit. They staff antenatal clinics, labour wards and postnatal wards.
- **Community midwives** often work in teams in the local community. In pregnancy they see women either at home or at an antenatal clinic. A community midwife will also visit the woman and baby at home for up to ten days after the birth. Community midwives provide postnatal care for women who have been looked after during labour by hospital midwives.
- **Specialist Midwives** in Wales have been set up whose objectives are to improve maternal and infant outcomes where health inequalities (due to geographical area, social class, gender and ethnicity) exist. Specialist midwives include:
    - ❖ Specialist Midwife for Black and Minority Ethnic Groups
    - ❖ Specialist Midwife for substance misuse
    - ❖ Infant Feeding Coordinator
    - ❖ Antenatal Screening Coordinator
    - ❖ Flying Start Midwife
    - ❖ Named midwife for safeguarding (ensuring the safety and well-being of mothers / babies).

  The types of specialist midwives employed vary by health board and are listed in Annex 3. The list includes community midwives with a specialist interest e.g. midwives with a specialist interest in Safeguarding (child protection) and Domestic Abuse.
- **Consultant Midwives** in Wales were organized to work at a strategic level, rather than as clinicians, to develop evidence based services for women. For example, in Cardiff and Vale University LHB, there were two

consultant midwives; one for 'the promotion of normality'[3] and one for Public Health.

5.3.2 Number of Midwives

The number of midwives in each health board is dependent on the number of pregnant women in each area. The number of midwives is determined using Birthrate Plus. Birthrate Plus is a workforce planning tool that determines the number of midwives required in each LHB based on the number of pregnant women and the level of care each is expected to require.. The following information about the number of midwives in each LHB was sourced from StatsWales and the Heads of Midwifery in each health board during the study period and was collected in order to feed, alongside information about the numbers of births, into the simulation model.

Table 5.1 Number of Midwives

Health Board	Number of Midwives
Betsi Cadwaladr University	277.74 whole time equivalents (WTE)
ABM University	231 WTE, 309 headcount
Hywel Dda (Carmarthenshire)	70 WTE, 90 headcount
Cwm Taf	150 WTE
Cardiff and Vale University	208 WTE, 300 headcount
Aneurin Bevan	252
Powys Teaching	38

Source: StatsWales and Heads of Midwifery

5.4 Profile of Women accessing maternity services

As well as knowing how the midwifery service currently operates, we asked what types of women currently use the service and whether any special needs might need to be kept in mind when researching Direct Access to a Midwife. For example, women from ethnic minorities may access services in a different way to other women.

[3] The promotion of normality means to encourage and support women with low risk pregnancies to have their babies at home or in a midwife-led unit, without epidural or medical intervention (source: head midwife, Cardiff and Vale LHB).

5.4.1: Ethnic Mix

In 2011, 3,824 (10.7%) births in Wales were to mothers who were born outside the United Kingdom with the majority having come from the Middle East and Asia (1,500). The report "Inequalities in Access to Maternity Services" (Rowe & al, 2003) highlighted that black and minority ethnic groups (BME) and asylum seekers were unlikely to demand or receive the appropriate care during pregnancy.

Each of the Heads of Midwifery was asked whether the ethnicity of the mother presents any specific challenges (language, tradition, expectation of care, etc.) in the women's maternity care. They mentioned that there are pockets of women from ethnic minorities in Cardiff, Newport and Llanelli and that they often expect their antenatal care from a GP and a consultant rather than a midwife. The Heads of Midwifery also mentioned that women from ethnic minorities may present at a later stage in their pregnancy than women born in Wales and that can present challenges to their care.

5.4.2 Public Health Issues

Anecdotal evidence from midwives suggested that health visitors can tend to be perceived as having a connection with social care and child protection so aren't necessarily welcomed in terms of providing public health messages, while midwives are not perceived this way (source: Heads of Midwifery, ABM University Health Board and Hywel Dda – Ceredigion). Public health messages midwives can therefore address during a woman's pregnancy are smoking, drinking, substance misuse, domestic abuse, obesity and mental health. Direct Access to a Midwife may enable midwives to pass on the appropriate public health messages and refer women to the appropriate services earlier in pregnancy, leading to improved outcomes.

<u>Smoking</u>

A Strategic Vision for Maternity Services in Wales (Welsh Government, 2011) states that women who smoke should be identified early in pregnancy and be offered help to quit rather than to cut down. The Strategic Vision for Maternity Services in Wales provided estimated figures for the prevalence of smoking among pregnant women in each health board in 2008 (Welsh Government, (2011). The percentages varied from 22% (in Powys) to 25% (in Cwm Taf).

Direct Access to a Midwife could benefit the health of mother and child by addressing the issue of quitting earlier in pregnancy.

Drinking

If a woman chooses to drink alcohol during her pregnancy, she is advised to drink no more than 1 to 2 units once or twice a week and to avoid getting drunk or binge drinking (Welsh Government, 2011). Excessive drinking during pregnancy may have a significant impact on the physical and mental health of the woman and can result in Foetal Alcohol Syndrome which can lead to lifelong intellectual and behavioural problems for the child (Welsh Government, 2011). Figures published in the 2011 Children and Young People's Wellbeing Monitor for Wales show 53 babies were diagnosed with foetal alcohol syndrome in Wales in 2009. Direct Access to a Midwife could benefit the health of mother and child by delivering public health messages earlier in pregnancy.

Domestic Abuse

It is thought that one in four women experience domestic abuse during their lives (source: http://www.nhs.uk/livewell/abuse/pages/domestic-violence-help.aspx). Thirty per cent of this abuse reportedly starts in pregnancy and existing abuse may get worse during pregnancy. Under Direct Access to a Midwife, public health messages relating to this issue could be passed on earlier in pregnancy (source: http://www.nhs.uk/conditions/pregnancy-and-baby/pages/domestic-abuse-pregnant.aspx).

Obesity

Wales has the highest overall prevalence of maternal obesity in the UK (Centre for Maternal and Child Enquires (2011)) at 6.5% (1 in every 15 pregnant women). In A Strategic Vision for Maternity Services in Wales (Welsh Government, 2011), it states that every opportunity should be used to provide women who are overweight and intending to become pregnant with information about the health benefits of losing weight before becoming pregnant. Obesity is known to have an effect on a woman's pregnancy and is associated with an increased risk of a number of pregnancy-related complications and adverse outcomes, and the babies of obese women have

an increased risk of perinatal mortality compared with the general maternal population. Studies have also highlighted that women who are obese are more likely to require a Caesarean section. Under Direct Access to a Midwife, public health messages relating to this issue could be passed on earlier in pregnancy. For example, it is important that any advice necessary about eating habits and exercise takes place as early as possible so that evidence based advice can be given e.g. to dispel the myth about “eating for two”.

5.5 Developing the Maternity Pathway: Maternity Appointments during Antenatal Care

Maternity care in Wales is delivered according to the NICE Guidelines 2008. First time mums and women who have had previous pregnancies receive a different number of appointments with their healthcare professional once booked. Women in their first pregnancy would expect to have an average of eight appointments and two scans whereas women that have had previous births would have an average of six appointments and two scans[4]. The appointments that women have during pregnancy are summarised in Table 5.2, below. The information provided below about when these appointments occur during antenatal care was fed into the simulation model.

[4] The number of ultrasound machines in each LHB is given in Annex 3

Table 5.2 Maternity Appointments

Appointment	Timing of appointment	Comments
Earliest contact with a health professional (GP or midwife) prior to booking	4-6 weeks	Public health messages delivered Screening programme explained
Initial assessment	10 – 12 weeks	Determine family history Risk assessment Arrange screening tests
Dating Scan	10 – 13 weeks	To estimate the due date
Appointment with consultant or midwife	16 weeks	Results of previous screening tests, blood pressure measurement
Down's Syndrome blood test	18 weeks	Blood test
Anomaly scan	18 – 20 weeks	Scan to check for any anomalies
Appointment with consultant or midwife (first time mums only)	25 weeks	general check-up, blood and urine checked
Appointment with consultant or midwife	28 weeks	Blood and urine checked
Appointment with consultant or midwife (first time mums only)	31 weeks	General check-up, blood and urine checked
Appointment with consultant or midwife	34 weeks	General check-up, blood and urine checked
Appointment with consultant or midwife	36 weeks	General check-up, blood and urine checked
Appointment with consultant or midwife	38 weeks	General check-up, blood and urine checked
Appointment with consultant or midwife	40 weeks	General check-up, blood and urine checked

5.6 Midwifery vs. Consultant led care

Each of the Heads of Midwifery was asked about the percentage of women who receive midwife-led care as opposed to consultant-led care. The figures are given in Table 5.3, below.

Table 5.3 Percentage of women receiving midwife-led vs. consultant-led care

LHB	Women receiving midwife-led care	Percentage receiving consultant-led care
Betsi Cadwaladr University	50%	50%
Cwm Taf	50%	50%
Hywel Dda	30%	70%
ABM University	49%	51%
Cardiff and Vale University	60%	40%
Powys Teaching	60%	40%
Aneurin Bevan	50%	50%

5.7 Costs Associated with antenatal care in Wales

The demonstration project considered how women in Wales access their maternity services during antenatal care. There is a cost associated with each service used. The estimated costs associated with a woman's antenatal care are summarised in Annex 4. These costs could be used to estimate the cost of antenatal care in Wales by combining the costs with the numbers of women at each stage of their pregnancy pathway estimated from the simulation model but this analysis fell outside the scope of the demonstration project.

5.8 Initial appointments with the midwife

This section focuses on where midwives were located, the earliest contact pregnant women had with health professionals during in the first few weeks of her pregnancy, and the initial assessment at 10-12 weeks.

5.8.1. Where were Midwives located?

Under Direct Access to a Midwife, every woman would be directed to a midwife as their first point of contact with midwifery services. Where midwives are located is a significant factor in making this happen. During the Project, midwives in Wales were based in various locations, including community hospitals, consultant-led hospitals, midwifery-led units, birth centres and GP surgeries. The Heads of Midwifery were asked where they would prefer to be based in future. The midwives reported that they would prefer a central, visible location, preferably alongside other practitioners (health visitors, social services etc.) with the facilities required to deliver specialist clinics such as parent craft sessions and breast feeding clinics.

5.8.2 To what extent was Direct Access to a Midwife already happening?

The Heads of Midwifery were asked when women in their LHB tended to have their first contact with a midwife. Table 5.4, below, summarises what heads of midwifery reported about when women tend to see their midwife for the first time.

Table 5.4 When do women in each LHB access their midwife for the first time?

Local Health Board	Timing (weeks) of earliest contact with the midwife
Betsi Cadwaladr University	Around the 8 week mark but it can be between 6 and 16 weeks.
ABM University	Between 6 and 8 weeks
Hywel Dda	Pembrokeshire: Between 8 and 10 weeks Ceredigion: Between 6 and 8 weeks, perhaps earlier at 4-6 weeks if Direct Access was in place
Cwm Taf	Around 6 weeks
Cardiff and Vale University	Around 6 weeks
Aneurin Bevan	Visit GP around 7 weeks
Powys Teaching	Around 4 weeks

Source: Heads of Midwifery

Maternity services in different LHBs work in different ways – some heads of midwifery reported that they preferred their midwives to see women for the first time in the home as it can highlight any background issues (e.g. safety concerns – domestic abuse, drug and alcohol, child protection, poverty); others reported preferring women to attend the hospital or birth centre so that more accurate measurements can be taken e.g. of BMI. In Betsi Cadwaladr University and ABMU LHB, the earliest visit was reported to take place in either the GP Surgery, a midwife-led unit or a birth centre. In Hywel Dda LHB, the earliest visit was reported to take place either in the woman's home or at a local clinic, whilst in Cardiff the earliest visits were reported to take place in a GP Surgery.

The Heads of Midwifery reported that in the majority of cases the midwife will use the earliest contact they have with a pregnant woman to gather basic details about her, give key public health messages and information about the All Wales Screening Programme and to book her initial assessment

appointment. In the remaining cases the first appointment with the midwife will be the initial assessment appointment, since the women would have had their earliest contact with their GP. The GP representative reported that if the first contact a pregnant woman has is with their GP, GPs will generally use this opportunity to convey public health messages about pregnancy such as the benefit of taking folic acid in the first trimester and to reduce or stop smoking as well as referring the woman to a midwife.

At what stage did women have their 'initial assessment'?

As noted above, some LHBs reported that the first time a pregnant woman would meet their midwife would be at the initial assessment appointment. The initial assessment appointment typically took around 45 minutes and was used to collect all the necessary family medical history and to assess the woman's pregnancy risk according to the NICE Guidelines. The woman would be weighed and the midwife would listen to the foetal heartbeat. The midwife would give the woman a set of All Wales Maternity Notes and start to fill in some of the details. The appointment could take place in the woman's home or at a clinic or hospital. In practice, the initial assessment was reported to take place at between 8 weeks and 12 weeks. The point at which the initial assessment tended to happen, as reported by heads of midwifery, varied by health board and is summarised in Table 5.5, below.

Table 5.5 The stage of pregnancy at which women were having their initial assessment by LHB

Local Health Board	Expected timing of initial assessment
Betsi Cadwaladr University	75% - 90% had initial assessment by 12 weeks
ABM University	by 12 weeks
Hywel Dda	12 weeks
Cwm Taf	11 weeks
Cardiff and Vale University	10 weeks
Aneurin Bevan	8 – 10 weeks
Powys Teaching	10 weeks

Source: Heads of Midwifery

It is now required that all pregnant women have their initial assessment by the end of the 10th week (Source: WG Chief Nursing Officer). The Welsh Government requires each LHB to collect data on the number of women who

have completed their initial assessment by the end of the 10th week. However, this data wasn't available at the time of the Study.

5.8.3 Direct Access to a Midwife - Progress towards All-Wales Rollout

The Heads of Midwifery in each LHB were asked (March 2012) about the extent to which they had achieved Direct Access to a Midwife. The County Head of Midwifery[5] from Ceredigion (Hywel Dda LHB) explained that the midwives in the county hadn't had time to look at Direct Access to a Midwife as the restructuring of services to make it midwife-led would take time. The midwives from Hywel Dda wanted time to make sure that they were providing a good service before looking at a new area. The Powys Head of Midwifery stated that "No one has really looked at Direct Access to a Midwife. Everyone is working towards it and some have had more success than others!" In ABMU LHB, their policy was already that the midwife should be the first point of contact.

Although no official figures were available about first contact, the Heads of Midwifery for Betsi Cadwaladr University, Powys Teaching and ABMU LHBs all reported anecdotally that very high percentages of women were contacting the midwife first rather than seeing the GP (source: discussions with Heads of Midwifery, Powys Teaching Health Board, ABM University Health Board).

Table 5.7 summarises the estimates given by the heads of midwifery of the extent to which women in their LHBs used the midwife as their first point of contact with maternity services. These percentages have been used in the simulation model (see Chapter 6).

For example, in Aneurin Bevan LHB, 'Point of Contact' phones have been put in place in midwife bases within the five AB LHB boroughs (Torfaen, Newport, Caerphilly, Monmouth and Blaenau Gwent) so that pregnant women can make contact with their local midwife on non-urgent, day-to-day matters, including as a means of making first contact[6].

[5] Hywel Dda has 3 County Heads of Midwifery: 1 each for Carmarthenshire, Ceredigion and Pembrokeshire

[6] Women can leave a message an an answerphone if the midwife is unavailable when they call.

Table 5.7 The extent to which the midwife is reported to be the first point of contact with maternity services by LHB

Local Health Board	Estimated percentage of pregnant women using midwife as first point of contact	Contextual comments from Heads of Midwifery
ABM University	90%-93%	More women in Bridgend tended to see the GP first and more women in Neath and Port Talbot tended to see the midwife first.
Hywel Dda (Carmarthenshire)	1-2%	It tended to be second time mums who contacted the midwife first.
Hywel Dda (Ceredigion)	1-2%	
Cwm Taf	10%	
Aneurin Bevan	10%	Pregnant women can use special phones located in midwife bases to contact their local midwife on non-urgent, day-to-day matters and also as a means of making first contact with maternity services
Cardiff and Vale University	0%	
Powys Teaching	65%	
Betsi Cadwaladr	65%	Within this broad picture there are 'hot spots' where the majority of women (80% - 90%) use their midwife as the first point of contact.

Source: Heads of Midwifery

The Heads of Midwifery from Betsi Cadwaladr University, ABMU, Powys Teaching and Hywel Dda commented that for Direct Access to a Midwife to work well:

- It would be really important to have a clear definition and set of instructions that clinicians and the public can understand and follow.
- It would need a change in the culture among the general public if women are to access their midwife first rather than going to the GP.
- A clear, well documented system would be required, where everyone knows the steps a pregnant woman needs to take during her antenatal care. This would make the process more cost-effective.

It was also suggested that if every woman follows the same pathway, it might be possible to book every woman's appointments using a central booking system in connection with the All Wales Notes.

6 The Simulation Model

A simulation model was developed for each Local Health Board representing the pathway a woman takes through maternity services and taking into account whether the woman sees a midwife or a consultant for her appointments. The model was based on the pathway developed in discussion with the relevant experts in each LHB. Each model takes into account the different resources available (midwives, GPs and consultants) and the different percentages of women estimated to follow each pathway (percentage of women who use their GP or midwife as first point of contact, percentage who have midwife-led care etc.). As noted above, the simulation models are not designed to investigate whether the outcome of the pregnancy will improve if public health messages are issued earlier through Direct Access to a Midwife.

The structure of each simulation model is the same and as an example, a screen shot of the ABM University model is shown in Figure 6.1. Full technical specifications for the models were documented in a separate Technical Report to WG, which can be made available on request to approved researchers undertaking similar modelling projects.

6.1 Resources and other estimates used in the model

Although the basic structure of the seven LHB simulation models is the same, the values that relate to the resources available (the number of midwives, consultants, GPs and ultrasound machines) and the estimated percentages of women following each pathway differ. The estimates were provided by the midwifery and ultrasound experts in each health board and are summarised in Table 6.1, below. The women were assumed to continue along the same risk pathway in the simulation model. In reality, there were would be some high risk women who became low risk and vice versa. For a more accurate model, transition rates between the risk categories at any time would need to be included in the model.

Figure 6.1: Screen shot of the ABM University simulation model

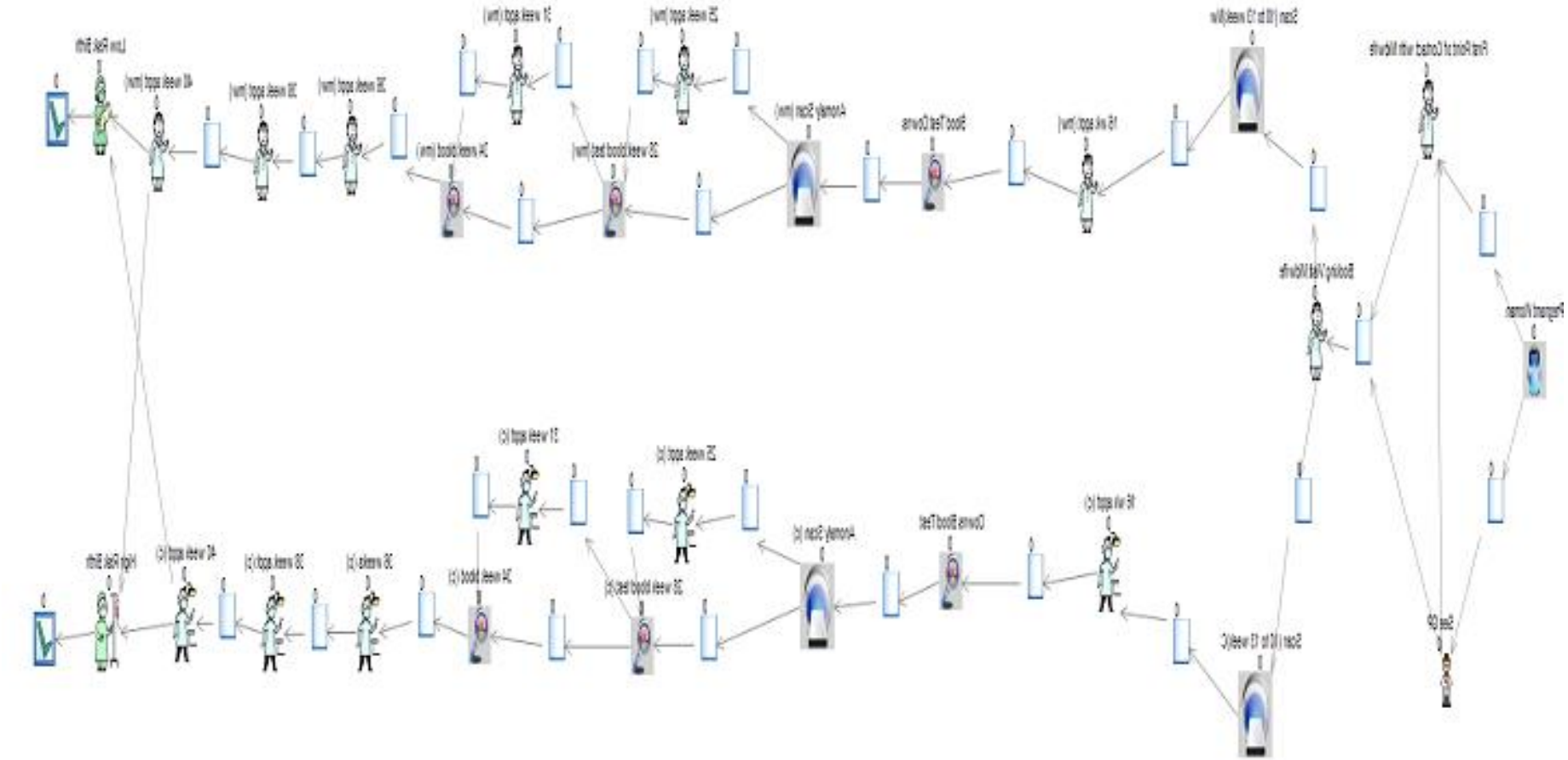

Table 6.1: Estimates used in the Simulation Model

Estimate	Aneurin Bevan	ABM University	Betsi Cadwaladr University	Cardiff & Vale University	Cwm Taf	Hywel Dda	Powys
Number of Midwives	252	231	278	208	150	135	38
Number of GPs	391	344	446	310	178	254	99
Number of Consultants	20	26	20	20	8	20	20
Number of Ultrasound machines	30	7	15	6	7	14	3
Estimated proportion of women who use GP as first contact	90%	10%	35%	100%	90%	99%	35%
Estimated proportion of women referred by GP to the midwife in time for pre-initial assessment meeting[7]	45%	5%	17.5%	50%	45%	49%	17.5%
Estimates proportion of women referred by GP to the midwife in time for initial assessment	45%	5%	17.5%	50%	45%	49%	17.5%
Estimated proportion of women who use Midwife as first contact	10%	90%	65%	0%	10%	1%	65%
Estimated average length of earliest (pre-initial assessment) midwife appointment (minutes)	20	20	20	20	20	20	20
Estimated average length of GP appointment (minutes)	10	10	10	10	10	10	10
Estimated average length of initial assessment (minutes)	45	45	45	45	45	45	45
Estimated proportion of women under midwifery led care	50%	49.3%	50%	60%	50%	30%	60%
Estimated proportion of women under consultant led care	50%	50.7%	50%	40%	50%	70%	40%
Estimated proportion of women under consultant led care with high risk births	50%	59.9%	83%	80%	67%	75%	77%
Estimated proportion of women under consultant led care with low risk births	50%	40.1%	17%	20%	33%	25%	23%
Estimated proportion of women under midwife led care with low risk births	50%	40.1%	17%	60%	33%	25%	23%
Estimated proportion of women under midwife led care with high risk births.	50%	59.9%	83%	40%	67%	75%	77%

Source: Heads of Midwifery, Consultants, and Ultrasound Managers in each LHB

[7] The estimates provided by the midwives and the GPs differed as to how many women were referred by the GP to a midwife in time for a pre-initial assessment meeting; as a result a 50:50 split was assumed.

Lengths of appointments

For the simulation models, the Heads of Midwifery, the consultant obstetrician, the GP and ultrasound managers provided the estimated length of each appointment and scan (see Table 6.2, below).

Table 6.2: The time estimated for each appointment and scan

Appointment / Scan	Length of appointment / scan (minutes)
Dating Scan	10
Blood Test for Down's Syndrome	15
Anomaly Scan	20
Earliest (if there is a pre-initial assessment) meeting with midwife	20
Appointment with midwife	15
Appointment with consultant	15
Blood test	15

6.2 Assumptions / caveats

The simulation model used the ONS Live Birth figures as a proxy for the number of women accessing maternity services in each health board and the estimates in Table 6.1 to divide them into those who went to the GP and those who saw the midwife as their first point of contact with maternity services. The simulation models relied on expert opinion for the percentages of women who visited their midwife vs. the GP.

The models assumed that a woman remains in the same risk category throughout her antenatal care. As separate models were built for each health board, the simulations weren't designed to represent the situation where a woman received antenatal care in one health board but gave birth in another.

As noted in Chapter 2, during development the models were shown to practitioners and analysts to asses the extent to which the expert opinion and assumptions fed into the models created a simulation that genuinely represented the real life system.

In summary, whilst the simulation models have been developed with expert opinion and ONS live birth data, the accuracy of each model would have been

improved by the inclusion of real life data and transition probabilities to account for the movement of women between the risk categories.

6.3 How the simulation could be improved / adapted in the future

As noted above, the demonstration project relied heavily on estimates provided by the relevant practitioners as the All-Wales Maternity Notes were not available electronically. However, if the appropriate electronic data became available in future, it could be incorporated into the models to make them more realistic.

The simulation model would have been more accurate if data had been available about the exact dates when women made their first contact with a GP or midwife and when they had their initial assessments. This would have allowed the model to include some variation e.g. around the point in pregnancy when women had the initial assessment.

In the same manner, if the appointment dates scans and blood tests were available, the exact time intervals between appointments could have been built into the simulation models, ensuring a more accurate result.

If in future more data is captured electrically from the All Wales Maternity Notes or is linked to data collected by other relevant research studies, it may be possible to adapt the model to examine the effect of public health messages such as smoking cessation advice on maternity outcomes.

It is likely that some women will move from high risk to low risk or vice versa as their pregnancy progresses. A further area of development would be to allow the model to include the possibility of a woman's risk category changing as her pregnancy pathway progresses. This could be addressed in future models by estimating the proportion of women moving between risk categories at each stage of the maternity pathway.

On a similar note, the movement of women between health boards during antenatal care and labour could be modelled by connecting the seven simulation models and determining the rate of movement between the LHBs. For example, as noted above, women in Powys are known to have their antenatal care within Powys LHB but to have their birth in one of the other health boards.

As discussed in Chapter 2, within the limited scope of the demonstration project, the information on cost provided in Annex 5 was not used. Future work could consider how the cost of each stage of a woman's antenatal care might be included in the simulation models. This would allow future projects to estimate the cost of providing maternity services in each LHB and to estimate whether there would be a cost implication in introducing Direct Access to a Midwife.

6.4 Model Results

This section reports the findings from the simulation models. As noted above, the simulation models for each LHB were run twice keeping the number of midwives, GPs and consultants the same. The models were run under two scenarios and the number of women accessing services at each stage of their pregnancy estimated under:

- The current situation, using estimates from practitioners of the percentage how women who were already going straight to a midwife when they found out they were pregnant; and
- Under *Direct Access to a Midwife* – where all women would see a midwife as their first point of contact with maternity services.

If *Direct Access to a Midwife* is successfully introduced and all pregnant women in Wales use a midwife as their first point of contact with maternity services, we would expect to see significant numbers of GP appointments being freed up for use by other patients and the earlier delivery of public health messages due to greater numbers of women seeing their midwife at an earlier date. As noted above, no additional workload for midwives would be expected as a result of moving to *Direct Access to a Midwife,* since the expectation would be that women would have their initial assessment earlier rather than being seen for an additional, earlier appointment.

The expert opinion gathered for the study suggested that the majority of women in Betsi Cadwaladr, Powys and ABMU LHBs used a midwife as the first point of contact with maternity services, whilst women in Cardiff and Vale, Aneurin Bevan, Hywel Dda and Cwm Taf LHBs tended to see their GP.

The simulation modelling confirms that the main impacts of moving to *Direct Access to a Midwife* would be a significant increase in the number of women seeing their midwife at an earlier date and the freeing up of a large number of GP appointments for other patients.

It must be emphasised that the estimates presented of the number of GP appointments that would be released by moving to Direct Access to a Midwife are based on figures that are, in turn, based on the expert opinion of practitioners and are therefore estimates themselves. These findings must be viewed with caution and should be considered rough estimates. However, to give some indication of the scale of the potential impact, an estimate of the number of GP appointments released has been made as well as an estimate of the number of full time GPs this would be equivalent to (see Table 6.3, below).

From the Teledermatology Operational Research Demonstration Project[8] we know that a GP sees around 16 patients in a morning clinic. GPs tend to have clinics on 4.5 days a week and to work 44 weeks per year, so we can estimate that each GP provides around 6,300 appointments a year.

It should be noted that the estimate of the overall number of appointments that were being used by pregnant women was based on live births rather than the number of women using maternity services, so, where it is estimated that 1 in 5 of women who know they are pregnant will suffer a miscarriage, this is likely to be an underestimate.

In Cardiff and Vale University LHB, where almost all pregnant women were estimated to see the GP first, there would be a significant change, with, at a rough estimate, over 6,000 GP appointments released per year – this is almost the equivalent of a whole GP. In contrast, in Powys and ABMU LHBs, where almost all women were estimated to go straight to a midwife, the number of GP appointments released would be much smaller, with a rough estimate of around 400 and 600 appointments per year respectively. In total, across all seven LHBs in Wales, we estimate that around 23,000 GP

[8] http://wales.gov.uk/statistics-and-research/application-operational-research-techniques-service-improvement/?skip=1&lang=cy / http://wales.gov.uk/statistics-and-research/application-operational-research-techniques-service-improvement/?skip=1&lang=en

appointments per year would be available for other patients. As a rough estimate, then, this would mean that successfully moving to Direct Access to a Midwife could free up appointment time equivalent to between 3 and 4 full-time GPs across Wales.

Using estimates provided by the heads of midwifery of the proportions of women using their GP and midwife as the first point of contact, we were able to estimate that the move to Direct Access to a Midwife would affect around 65% of pregnant women in Wales, resulting in them seeing their midwife sooner to be given important public health messages and other lifestyle and health promotion advice. As noted above, the project was not able to examine the potential impact of this change on the outcomes for mother and child but these impacts would be expected to be positive.

Table 6.3: Estimated number of GP appointments released for other patients by moving to Direct Access to a Midwife by LHB

	Estimated percentage of women using GP as first point of contact	Number of Live Births 2011	Estimated number of GP Appointments released	Estimated GP Appointments released as a proportion of a full time GP
Aneurin Bevan	90%	6,665	5,999	0.9
ABM University	10%	6,049	605	0.1
Betsi Cadwaladr University	35%	7,808	2,733	0.4
Cardiff & Vale University	100%	6,227	6,227	1.0
Cwm Taf	90%	3,771	3,394	0.5
Hywel Dda	99%	3,846	3,808	0.6
Powys	35%	1,232	431	0.1
All	65%	35,598	23,196	3.7

7 Conclusions

The Project demonstrated that the expert knowledge and experience of practitioners can be used to develop a simulation of a service even where relevant statistical data at the right level of detail is either limited or completely unavailable. Although the resulting simulation model may rely heavily on the assumptions that have been used to develop it, thorough sense checking can provide assurance that the resulting model is realistic and does genuinely both represent the real life system and behave as the real system would when changes are made.

The study showed that simulation modelling can provide a useful virtual, visual representation of a real-life system to allow the impacts of different service delivery options to be compared and discussed. Simulation modelling allows the impact of different policy decisions on the real life system to be estimated without running expensive real world trials.

As noted in Chapter 2, to sense check the simulation models, they were presented to a range of practitioners and analysts, including being presented back to the expert practitioners associated with the project. The feedback from these presentations demonstrated that practitioners and policymakers find evidence about optimising services more engaging when it is provided visually, either in the form of a patient flow diagram or a simulation model. Whilst this study has used simulation modelling in a health-related area, it could be applied to other services areas such as education, agriculture and transport.

The simulation models show that if the introduction of Direct Access to a Midwife was completely successful across Wales, midwives would see around 65% of pregnant women earlier in their pregnancy, allowing them to deliver important public health messages earlier. This effect would be more noticeable in Cardiff & Vale University, Hywel Dda, Cwm Taf and Aneurin Bevan LHBs, where large proportions of pregnant women were using their GP as the first point of contact with maternity services.

Appointment time that was being used by pregnant women using a GP as the first point of contact would also be released for use by other patients. As a

rough estimate, it was calculated that Direct Access to a Midwife could release appointment time equivalent to between 3 and 4 full-time GPs across Wales.

Next Steps

As noted above, the demonstration project relied heavily on data collected from the midwifery, consultant obstetric and radiology experts as there was a lack of sufficiently detailed, electronically held maternity data. However, if the appropriate electronic data became available in future, it could be incorporated into the models to make them more realistic.

The findings will be shared more widely at appropriate events and conferences.

The challenges that emerged during the demonstration process and the benefits of using OR methods to inform service optimisation will be explored in more detail in a Lessons Learned report, publication of which is to follow.

Annex 1: Data Required for the Simulation Model

- The number of newly pregnant women (each day / week / month) who are about to report their pregnancy to either a GP or midwife (each week). This gives the arrival pattern of women using the service.
- The percentage of women using their GP as their first point of contact. This figure will control the number of women who see their GP in the simulation model.
- The percentage of women using a midwife as their first point of contact. This figure will control the number of women who see their midwife in the first instance.
- The time (no. of weeks' gestation) when they see their healthcare professional for the first time. The NICE Guidelines suggest that this appointment takes place between four and six weeks. This data will enable the model to capture the number of women at each healthcare professional at a specified time in the model run time.
- The time (no. of weeks' gestation) of their initial assessment. The NICE Guidelines suggest that this appointment should take place between 10 and 12 weeks. This data will enable the model to capture the number of women that have had their initial assessment at a specified time.
- The number of women having an initial assessment appointment per year.
- The number of midwives in the health board. This provides the amount of midwifery support available to women in each health board and is needed in the model to show the available resource. The number of midwives (whole time equivalent) is recorded on StatsWales.
- The number of obstetric consultants in the health board provides the level of obstetric consultancy resource available to women in each health board and is included in the simulation model. The number of consultants is listed on each of the local health board websites.
- The percentage of women who receive consultant-led care. This figure controls the number of women who follow the consultancy-led pathway in

the simulation model and use the health board's obstetric consultants as a resource.

- The percentage of women who receive midwife-led care. This figure controls the number of women that follow the midwifery-led pathway in the simulation model and use the health board's midwives as a resource.
- The number of ultrasound machines used for dating and anomaly scans in each health board is used in the simulation model to show the resource available to women in the health board for each of the types of scan needed during antenatal care.
- Whether the information on the All Wales Maternity Note is collected electronically within the health board? This information would indicate if there is a source of electronic data that could be used to populate the simulation models with real-life data.
- What electronic record system (Myrddin, Protos, and MITS etc.) is used in the health board for capturing maternity records?
- The number of births each year. This could provide a means of validating the model; checking that the number of births in the simulation model matches the real-life data.
- The percentage of women who have high risk births and require a consultant. This figure controls the number of women who are categorised as high risk in the simulation model and represents those women that would have had their birth in a consultancy-led unit.
- The percentage of women who have low risk births. This figure controls the number of women who are categorised as low risk in the simulation model and represents those women that would have had their birth at a stand-alone birth centre or alongside midwifery unit.

Annex 2: Summary of the All Wales Maternity Record

The All Wales Maternity Notes is given to each pregnant woman. It captures all the information that relates to her pregnancy.

The first page in the All Wales Maternity Notes captures the following information:

- Name and Address
- Contact details
- Baby's due date
- Next of kin
- Emergency contact details

The second page in the All Wales Maternity Notes captures details such as the woman's marital status, her faith, whether she needs an interpreter and if she needs help reading. This page also captures details about the lead professional, GP and midwife involved in the woman's care. Information about the woman's partner is captured at the bottom of this page.

The All Wales Maternity Notes also capture all the information recorded at each antenatal appointment e.g. the baby's growth, the woman's intrapartum and postnatal care and any hospital admissions related to the current pregnancy.

The woman's housing, employment and social conditions are also recorded as well as the woman's full medical history. A risk assessment to the chance of deep vein thrombosis is also included.

The Notes also capture the woman's smoking, drinking, drug use and the woman's family history (in terms of her relatives). Topics that the midwife can discuss with the woman such as breastfeeding are also highlighted in the notes.

The All Wales Maternity Notes also capture the results from all the screening tests throughout the current pregnancy and information about all the woman's previous pregnancies. The notes also include some pages where the woman can include questions she wants to ask the midwife.

Annex 3: Types of Specialist Midwife in each LHB

Local Health Board	Types of Specialist Midwife
ABM University	Antenatal Screening Coordinator Named Midwife for Safeguarding Infant Feeding Coordinator Flying Start Black and Minority Substance Misuse
Hywel Dda	Child protection Substance misuse UNICEF Breastfeeding Flying Start Infant Feeding Coordinator Vulnerable Families
Cwm Taf	Child protection Substance misuse
Aneurin Bevan	Equality and Diversity Breastfeeding Safeguarding Substance Misuse
Betsi Cadwaladr University	Flying Start
Cardiff and Vale University	Substance Misuse Infant Feeding Advisor Safeguarding Domestic Abuse Asylum seeking
Powys Teaching	Safeguarding Domestic Abuse

Source: LHB Heads of Midwifery

Annex 4: Number of Ultrasound Machines per LHB

The number of ultrasound machines in each LHB are summarised below.

Local Health Board	Number of ultrasound machines
ABM University	7 (2 in Princess of Wales, 2 in Neath and Port Talbot and 3 in Singleton)
Aneurin Bevan	30 (8 in Neville Hall, 2 in County Hospital, 11 in Royal Gwent Main, 1 in Royal Gwent CT,3 in Caerphilly Miners, 1 in Brecon Hospital,2 in Ysbyty Aneurin Bevan, and 4 in Ysbyty Ystrad Fawr.
Betsi Cadwaladr	15 (8 in Wrexham, 3 in Deeside, 1 in Chirk, 1 in Dogelleau and 2 in Victoria Memorial Hospital.
Cardiff and Vale University	There are 6 machines in the antenatal department which are used to date pregnancies. There are another 4 /5 machines in the radiology department which are used for the anomaly scans.
Cwm Taf	No information available.
Hywel Dda	14 (3 in Bronglais, 4 in Glangwili, 3 in Prince Philip and 4 in Withybush). In Bronglais Hospital, there are two machines in the radiology department and one in antenatal. In Glangwili Hospital, there are three in radiology and one in antenatal. In Prince Philip Hospital, all the machines are in the radiology department. In Withybush, there are three machines in radiology and one in antenatal care.
Powys	3, although women travel to surrounding hospitals

Source: Discussions with the Ultrasound Managers in each Health Board

Annex 5 Costs (per visit) associated with antenatal care in Wales

Item	Cost (£)
Obstetrics	
Consultant led first appointment, consultant's time only	119
Non-consultant led first appointment	119
Consultant led first appointment, multi profession	154
Non-consultant led first appointment, multi profession	154
Consultant led follow up appointment, consultant's time only	60
Consultant led follow up appointment multi profession	60
Non-consultant led follow up appointment, single profession	60
Non-consultant led follow up appointment, multi profession	60
Gynaecology	
Consultant led first appointment, consultant's time only	138
Consultant led first appointment, multi profession,	142
Consultant led follow up appointment, consultant's time only	81
Consultant led follow up appointment multi profession	99
Midwife Episode	
Consultant led first appointment, consultant's time only	119
Consultant led first appointment, multi profession	154
Consultant led follow up appointment, consultant's time only	60
Consultant led follow up appointment, multi profession	60
Non-Consultant led first appointment, single profession	119
Non-Consultant led first appointment, multi profession	154
Non-Consultant led follow up appointment single profession	60
Non-Consultant led follow up appointment multi profession	60
Ultrasound scan	
Less than 20 minutes	47
More than 20 minutes	63
GP Visit	
For 11.7 minutes appointment	43
For 17.2 minutes appointment	63

Source: Payment by Results 2012-2013

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