Institution: De Montfort University		
Unit of Assessment: 3		
Title of case study: Identifying Regional Practice Variations in Maternity and Perinatal Care to Deliver Better Outcomes for Women and Babies		
Period when the underpinning research was undertaken: 2016–2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Tina Harris	Associate Professor	1995–present
Period when the claimed impact occurred: November 2017–31 December 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Research at DMU into the design of clinically meaningful and technically robust quality measures for NHS maternity and perinatal services in Britain has led to: (1) better care outcomes for women and babies, including reductions in maternal haemorrhage and 3rd/4th degree tear rates, (2) improved maternity data capture and quality for comparative purposes nationally and internationally, (3) increased awareness of unexplained geographical variation in maternity care outcomes, which has driven quality improvement strategies, (4) integration of research-based clinical measures into data strategies of the NHS and changes to regulatory and policy processes for maternity care.

2. Underpinning research

Most women giving birth in the UK receive a safe, effective service. However, the stillbirth rate is higher in the UK than in many European countries. There is evidence of significant variation in maternity care outcomes between NHS Trusts in different regions, which has led to concerns over a postcode care lottery for women and babies.

Research led by Harris at DMU has used novel methods to identify geographical variations in maternal and perinatal care so that unwarranted variation can be investigated and reduced. This work involved designing clinically relevant measures and being at the forefront of linking established datasets to report maternal and neonatal outcomes. Her studies were carried out as part of the GBP4,000,000 National Maternity and Perinatal Audit (NMPA), funded by the Healthcare Quality Improvement Partnership and the first comparative analysis of maternity care across England, Scotland and Wales, for which Harris is Senior Clinical Lead. Novel clinical measures were derived from the use of explicit criteria (validity, fairness, sufficient statistical power, adequate technical specification) and balanced to cover various dimensions of care. These methodological approaches were peer reviewed through consultation with clinical researchers and the Royal Colleges; they underpinned the publication of peer-reviewed clinical evaluations and technical studies, and a cohort study of 276,766 women across 87 NHS Trusts to determine the risk of complicated birth, published in *The BMJ* [R1].

In August 2017 the first evaluation of how the NHS delivers maternity care was published [R2]. New measures were designed to evaluate variations in the availability, configuration and staffing of services; Harris led on identifying and defining the measures. Significant variation was found in the types of maternity units available to women, with only a fifth of Trusts/Boards offering the full range of birth settings and there was a wide variation in numbers of beds per midwife. The results provided a baseline for the reconfiguration of services in the wake of government maternity care reviews in England, Scotland and Wales. A second organisational evaluation [R3], in 2019, revealed that data from the first study had been used to improve clinical practice and the organisation of care.

The first evaluation of clinical outcomes was published in November 2017, based on 696,738 births between April 2015 and March 2016 [R4]. Representing the largest ever study of the state of maternity care in Britain, it presented 16 clinical measures of maternity and perinatal care,

with each evaluated for feasibility, quality and statistical power. Rates of measures were adjusted for risk factors, such as age and ethnicity. For the first time the study, led by Harris, identified outliers, i.e. units with clinical outcomes outside of the expected range. Key findings, which led to improvements in data collection, quality assurance processes and improvements in care, included:

- Significant unexplained variation in rates for maternity process and outcome measures.
- Women were twice as likely to suffer postpartum haemorrhage (PPH) and severe tears during childbirth in some hospitals.
- Wide variation in proportion of babies receiving skin-to-skin contact within their first hour.
- Significant issues in measuring outcomes due to poor quality data and data missingness.

A number of peer-reviewed research reports were published in 2019/2020 (and are available at www.nmpa.org.uk). One of these publications established the feasibility of linking maternity data with intensive care data for the first time, finding that women with a higher BMI, an older age at birth or of black ethnic origin are more likely to require admission to intensive care [R5]. Harris led on identifying and defining the clinically relevant measures, which linkage of the datasets made possible. These findings were used to influence the development of new definitions to improve data gathering. The second clinical report, based on 728,620 births from April 2016 to March 2017, was published in September 2019 and included three new neonatal clinical measures and one composite measure: Birth Without Intervention [R6]. Harris led on defining clinical measures and identifying the clinical implications of the findings. Media coverage raised awareness of the impact of obesity on maternal outcomes.

Further research led by Harris involved the analysis of specific elements of maternity care to further inform care improvements and health policy changes. Harris sought to improve the classification of risk of complicated birth. This study, published in *The BMJ* and shared widely on social media (reaching an upper bound of 821,000 people on Twitter according to Altmetric), found that parity and obstetric history are the key determinants of the risk of a complicated birth at term. It demonstrated a need for services to give greater weight to parity in determining risk [R1].

3. References to the research

[R1] Jardine, J., Blotkamp, A., Gurol-Urganci, I., Knight, H., Harris, T., Hawdon, J., van der Meulen, J., Walker, K. and Pasupathy, D. (2020) 'Risk of complicated birth at term in nulliparous and multiparous women using routinely collected maternity data in England: cohort study', *The BMJ*, 1 October, 371: 3377; https://doi.org/10.1136/bmj.m3377

This paper's Altmetric Attention Score places it in the top 5% of all outputs scored by Altmetric. https://bmj.altmetric.com/details/91542386 and reached an upper bound of 821,000 people on twitter https://bmj.altmetric.com/details/91542386/twitter

The following publications were peer reviewed prior to publication by expert academics, clinicians, HQIP, NHS England and the Scottish and Welsh governments, third-sector organisation representatives and the NMPA Women and families group.

[R2] Blotkamp, A., Cromwell, D., Dumbrill, B., Gurol-Urganci, I., Harris, T., Hawdon, J., Jardine, J., Knight, H., MacDougal, L., Moitt, N., Pasupathy, D. and van der Meulen, J. (2017) *National Maternity and Perinatal Audit: Organisational Report 2017*, London: RCOG; https://www.hqip.org.uk/resource/national-maternity-and-perinatal-audit-organisational-report-2017/#.YAbAzxanx7M

This study provided the first clear evidence of variation in maternity service provision across Britain and enabled evaluation of clinical outcomes and processes within an organisational context.

[R3] Blotkamp, A. and NMPA Project Team (Aughey, H., Carroll, F., Gurol-Urganci, I., Harris, T., Hawdon, J., Heighway, E., Jardine, J., Knight, H., Mamza, L., Moitt, N., Pasupathy, D., Thomas, N., Thomas, L. and van der Meulen, J.) (2019) *National Maternity and*

Perinatal Audit: Organisational Report 2019, London: RCOG; https://www.hqip.org.uk/resource

This study provided evidence of change and variation in maternity service provision across Britain as a result of action taken over the data from the findings in R2.

[R4] Blotkamp, A., Cromwell, D., Dumbrill, B., Gurol-Urganci, I., Harris, T., Hawdon, J., Jardine, J., Knight, H., MacDougal, L., Moitt, N., Pasupathy, D. and van der Meulen, J. on behalf of the NMPA Project Team (2017) *National Maternity and Perinatal Audit: Clinical Report 2017*, London: RCOG; https://www.hqip.org.uk/resource/national-maternity-and-perinatal-audit-clinical-report-2017-2/#.YAbCYBanx7M

The largest of its kind evaluation of the state of maternity care across Britain, allowing comparison between maternity units of 16 clinical process and outcome measures for the first time.

[R5] Jardine, J. and NMPA Project Team (Aughey, H., Blotkamp, A., Carroll, F., Cromwell, D., Gurol-Urganci, I., Harris, T., Hawdon, J., Knight, H., Mamza, L., Moitt, N., Pasupathy, D. and van der Meulen, J.) (2019) *Maternity Admissions to Intensive Care in England, Wales and Scotland in 2015/16: A Report from the National Maternity and Perinatal Audit*, London: RCOG; https://maternityaudit.org.uk/FilesUploaded/NMPA%20Intensive%20Care%20sprint%20report.pdf

This study identified for the first time that it is possible to link routinely collected data from NHS maternity care to intensive care data.

[R6] NMPA Project Team (Aughey, H., Blotkamp, A., Carroll, F., Geary, R., Gurol-Urganci, I., Harris, T., Hawdon, J., Heighway, E., Jardine, J., Knight, H., Mamza, L., Moitt, N., Pasupathy, D., Thomas, N., Thomas, L. and van der Meulen, J.) (2019) *National Maternity and Perinatal Audit: Clinical Report 2019. Based on births in NHS maternity services between 1 April 2016 and 31 March 2017*, London: RCOG; https://www.hqip.org.uk/resource/national-maternity-and-perinatal-audit-nmpa-clinical-report-2019/#.YAbDtRanx7M

This study identified substantial variation in maternity care and outcomes among maternity care providers and it was possible for the first time to compare two years of data across three countries.

4. Details of the impact

The collection and analysis of high-quality linked data, led by Harris at DMU [C1], made it possible, for the first time, to compare the care that maternity units provide to women in Britain. The evaluation, the largest of its kind, identified priorities for improvement in care, where unexplained variation in outcomes for women and babies exist, identified areas of good practice and detected gaps in policy and guidelines. Harris led on a strategy to engage the midwifery community in the findings and drive quality improvement with published articles in *Midwives*, the RCM's magazine (48,000 members), and *Midwifery Matters*, and presenting at conferences. Evaluation findings are freely accessible to healthcare professionals, policymakers and members of the public via the NMPA website (www.nmpa.org.uk). For the first time, units in England, Scotland and Wales are comparing their risk-adjusted findings with those of others and against the national mean to take action accordingly.

(1) BETTER CARE OUTCOMES FOR WOMEN AND BABIES

The research identified a significant percentage of NHS Trusts/Boards as potential outliers for one of three measures (>3 SD above the mean): PPH (18%), Apgar score (13%), third- or fourth-degree perineal tear (14%) [R4]. A quarter of all Trusts/Boards (38 out of 155) said they had reviewed their local data following the 2017 clinical evaluation [R4] and conducted case note reviews and internal audits [C2]. Fourteen services carried out staff training and 21 undertook formal investigations into cases or systems, demonstrating the powerful impact that the research has had on quality assurance processes to drive improvements in care [C2].

Fifty-one services volunteered as case studies to present the work they had done in response to the findings in R4 and the effect this has had on clinical measures. There is clear evidence from testimonials that changes in practice as a result of the research have improved care for women and babies. Northampton General Hospital reports that, following implementation of an action plan, the percentage of women experiencing a PPH of 1500ml or more was reduced by more than one-sixth, or 0.7 percentage points, from 4.1% to 3.4% by September 2018 [C3]. Stockport NHS Foundation Trust implemented the Stockport Perineal Care bundle and reported a reduction in the incidence of severe perineal tears [C4]. Yeovil District Hospital NHS Foundation Trust reported a significant improvement in PPH rates following their response to the clinical evaluation findings, which included improvements in calculating blood loss accurately, documentation and multidisciplinary training [C4].

Data collected as part of the second organisational survey [R3, C5] found that NMPA data had been used to make improvements in the organisation of care within Trusts/Boards (59% of respondents) in collaboration with Local Maternity Systems/networks (32%). Services also used the data to inform women about their services (15% of respondents), to guide local audit (50%) and to make improvements to data (44%) [C5].

(2) IMPROVED MATERNITY DATA CAPTURE AND QUALITY

Many services contacted Harris and other members of the research team to request additional support on how to improve the quality of their data, as a direct response to concerns around missing data that were identified through the research [R4]. This led to alterations in data fields in local Maternity Information Systems as well as the flow of data through the local system before reaching national initiatives like the NMPA. Data capture improved from 92% in the 2017 clinical report to 97% for the 2019 Clinical Report with a similar improvement in data capture of individual items [R4: 11, R6: xi].

(3) INCREASING AWARENESS OF UNEXPLAINED GEOGRAPHICAL VARIATION IN MATERNITY CARE OUTCOMES AND EMPOWERING INTEREST GROUPS TO PUSH FOR FURTHER IMPROVEMENTS

NMPA advisory groups include third-sector groups and members of the public; advice and support are provided by the Women and Families Involvement Group. The NMPA findings have been published in user-friendly reports on its website, which are designed to inform women's choices over where and how to have their baby. The website has seen 10,100 new users and more than 99,000 unique page views[C6]. The average time spent on the site is five minutes, with an average of six pages viewed, indicating high levels of engagement with the data. Users are predominantly based in Great Britain (78%) but there is significant interest from the USA (6%), China (5%) and other countries (11%), illustrating the data is relevant to the international maternity community. This is supported by the research literature; for example, Souter et al (2020, https://doi.org/10.1097/01.AOG.0000663696.09421.af) have benchmarked outcome measures in a US birth cohort against those published by the NMPA. The website has seen significant spikes in visitors coinciding with the publication of key reports (and accompanying media coverage [C5]), with 200% increases in weekly traffic [C6].

Both the 2017 and 2019 clinical reports received significant media coverage in the UK [C5]. Upon publication of the 2017 findings, the BBC reported on calls from the RCOG to investigate unexplained variation, quoting its president as saying: 'We urge all maternity units to examine their own results and those of their neighbours both to identify role models and to drive quality improvement locally' [C5,p4]. A *Guardian* article [C5,p2] highlighted a finding that fewer than one in six women who give birth every year sees the same person throughout her pregnancy and aftercare, despite promises that this should happen. It quoted a senior policy adviser at parenting charity NCT as saying that the research 'reveals a number of problems including staffing shortages that puts safe care at risk, and postnatal care that often leaves mothers struggling alone'.

The clinical findings published in 2019 [R6] reported that the proportion of pregnant women overweight or obese had risen to more than half for the first time (50.4%), and increasing risk of miscarriage and stillbirths, was covered widely [C5]. *The Daily Telegraph* quoted the director of the National Obesity Forum as saying the figures were 'hugely depressing' and calling on the UK

Government to do more to ensure the risks of a high BMI were taught to girls in schools [C5,p5]. The 2019 Clinical Report was widely reported across local news media to highlight regions in which there were concerns around care outcomes. For example, *Wigan Today* reported that women who give birth in Wigan were more likely than average to suffer serious blood loss; it also gave the Wrightington, Wigan and Leigh NHS Foundation Trust the opportunity to clarify that the Trust had bettered the national average for 10 of the 13 NMPA clinical outcome measures [C5,p5].

(4) INTEGRATION OF CLINICAL MEASURES INTO DATA STRATEGIES AND CHANGES TO MATERNITY REGULATORY AND POLICY PROCESSES

Harris and the project team have worked closely with national dataset teams, regulators, clinicians and service providers to share learning related to data collection and quality. NHS England has acknowledged that the study programme acts as 'an important benchmark for local areas, helping identify where improvements can be made, including ensuring the right staffing levels for the women and babies they care for' [C5]. Crucially, three of the 16 clinical measures in R4 (PPH of 1500ml or more, low Apgar score and third/fourth-degree perineal tear rates) were adopted as quality improvement metrics by NHS Digital's Maternity Dashboard, a dataset that helps maternity teams improve their clinical outcomes, and which was set up in 2016 in response to NHS England's 'Better Births' five-year vision [C7]. Study findings have also influenced the development of new metrics for Version 2 of NHS Digital's Maternity Services Dataset (MSDS), a patient-level dataset that captures information about activity carried out by maternity services in England [C8]. Another HQIP-funded programme is the Confidential Enquiry into Maternal Deaths in the UK. A November 2019 report from this enquiry endorsed the following NMPA recommendation, which was published in [R5]: 'data gathering on maternal critical illness should be re-examined and strengthened by new definitions in order to capture lessons about good care and near miss events' [C9]. The research team shared its 'outlier' findings with the Care Quality Commission (CQC). As a result, CQC uses NMPA metrics in its regulatory process [C10]. This ensures maternity services are held accountable for their findings and called to respond as appropriate, with action or justification for results that are unexpected.

5. Sources to corroborate the impact

[C1] Corroborating statement from the NMPA project manager.

[C2] NMPA impact report and anonymised responses from Trusts/Boards re actions taken as a result of outlier reporting.

[C3] Corroborating statement (incl. PowerPoint presentation) from a consultant obstetrician at Northampton General Hospital detailing the response to, and impact of NMPA outlier reporting.

[C4] Clinical Cases 2019 report.

[C5] NMPA impact report 2020 including details of media coverage and commentary from interest groups.

[C6] Google Analytics report for NMPA website for the period November 2017 to July 2020.

[C7] NHS Digital's Maternity Dashboard webpage, which signposts NMPA measures.

[C8] Maternity Services Dataset v2.0 webpage.

[C9] Saving Lives, Improving Mothers' Care, Confidential Enquiry into Maternal Deaths in the UK.

[C10] Corroborating statement from the Care Quality Commission.