

# BMJ Open Quality Improving the uptake of cervical screening in pregnant and recently postnatal women: a quality improvement project

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## ABSTRACT

**Background** In 2018, cervical screening uptake was at its lowest level since screening began, particularly in those aged 25–35, coinciding with the peak incidence of cervical cancer and average age at first delivery.

**Problem** Retrospective baseline data of pregnant women found 47.3% (n=123/260) were overdue for screening by delivery, of whom 74% (n=91/123) remained overdue by 6 months postnatal.

**Methods** We undertook a quality improvement project from April 2018 to April 2019 to improve cervical screening uptake in pregnant and postnatal women. We mapped out the screening process and canvassed stakeholders. The main theme was inconsistency of advice received by women. From February 2018 to May 2020, we undertook a prospective audit of 10 women per week who gave birth in our maternity department, recording screening status at delivery and 6 months postnatal.

Interventions included introducing evidence-based guidelines about cervical screening in pregnancy and the postnatal period, flow charts for maternity staff, multiprofessional teaching for all maternity staff and information dissemination to women (via the HANDiApp platform, a social media campaign and adapting results letters following colposcopy, highlighting dates when screening would be due). Primary care opening hours were extended for screening and women received a letter from their midwives, if they required cervical screening in pregnancy.

**Results** Locally, the percentage of women overdue for cervical screening by 6 months postnatal improved by 8.0% during this project, compared with a 1.6% change in national screening rates in women aged 25–49.

**Conclusions** We increased the percentage of local pregnant and postnatal women attending cervical screening by introduction of a package of information, targeted education and widening access to screening appointments.

## INTRODUCTION

The incidence and mortality from cervical cancer has halved since the introduction of the National Health Service Cervical Screening Programme (NHS CSP) in 1988.<sup>1,2</sup> The NHS CSP is well monitored, with quality assurance targets for primary and secondary

### WHAT IS ALREADY KNOWN ON THIS TOPIC?

⇒ In 2018, cervical screening uptake rates in England were at the lowest level since screening was introduced 30 years ago, especially in younger women. Pregnant and recently pregnant women, who are in this same age cohort, have multiple contacts with health professionals during their pregnancy, providing opportunities to promote cervical screening.

### WHAT THIS STUDY ADDS?

⇒ We found that lack of knowledge and misinformation were the main barriers to accessing screening. We developed educational resources for pregnant women and midwives, and improved screening rates by 8%.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY?

⇒ Listening to the women undergoing screening, and their reasons for non-attendance, underpinned our change ideas. Educational measures, targeted at both midwives and pregnant women, can dispel misinformation and increased uptake.

care. The NHS CSP standard for cervical screening coverage is 80% uptake in order to achieve the aim of preventing cancer and deaths from cancer.<sup>1</sup> In 2018, cervical screening rates were the lowest they had been since the NHS CSP was introduced in 1988. The national audits of women with invasive cervical cancer demonstrate that women who do not attend for screening make up a disproportionate number of cases of cervical cancer; around 60% of women diagnosed with cervical cancer were either never screened or overdue for screening.<sup>3</sup>

By 2019, cervical screening coverage rates in England were around 70%, although in some parts of the country this was as low as 50%.<sup>4</sup> There were particular groups of women in whom screening uptake was even lower: women under 35 years; those in same-sex



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relationships; and those who were less well educated or in lower socioeconomic groups.<sup>2 5–7</sup>

In the future, the success of Human papillomavirus (HPV) vaccination at reducing the rates of cervical cancer in those vaccinated at the age of 12–13 by 90%,<sup>8</sup> and increased sensitivity of HPV testing for cervical screening, will mean that vaccinated women may only need one cervical screening test in their lifetimes.<sup>9</sup> However, as vaccine efficacy rates are lower for those who were vaccinated after exposure to HPV,<sup>8</sup> and for the unvaccinated, cervical screening will continue to be a cornerstone of cervical cancer prevention, and pregnancy will remain a key opportunity to influence public health, not limited to cervical cancer prevention.

Jo's Cervical Cancer Trust, a UK charity for women affected by cervical cancer and precancer, commissioned a report into the cost-effectiveness of cervical cancer screening and the effect of coverage rates.<sup>10</sup> This found that, based on 2014 figures, if the overall cervical screening rates were increased by 7% (from 78% to 85%), it would reduce the number of cervical cancer deaths by 27% over 5 years, saving the NHS £9 million/year.

Jo's Cervical Cancer Trust also performed research to ascertain why women did not attend for screening.<sup>11</sup> They collated local efforts to improve screening uptake into one comprehensive document. This served as a useful review of different strategies that had already been employed elsewhere.<sup>12</sup> Qualitative research revealed the decision to attend for screening was based on whether the woman thought screening was relevant or would provide value.<sup>13–15</sup> Relevance was influenced by beliefs about the causes of cervical cancer, current life stage, health status and family history. Screening was seen as a physical and emotional threat, due to its potential to reveal cancer, the physical experience of having screening undertaken and the concurrent emotional experiences of these. Women also cited practical barriers to screening attendance, such as clinic location, appointment availability and competing demands on their time.

However, women also viewed cervical screening as a normative behaviour and as a good thing to do.<sup>14</sup> If participants did not attend, reasons cited were fear of the test, not liking the test (invasion of privacy of their body) or the gender of the healthcare professional (HCP) due to perform the test. Many women referred to having cervical screening as the 'correct' form of behaviour with notions of deviance associated with non-attendance.<sup>15</sup> Some women did not want to reveal private parts of their body to a stranger. Women who did not attend for screening had a deficit of knowledge and understanding about screening, which they were not motivated to overcome. They found that communications directly from their general practitioner (GP) regarding screening carried additional weight.

When women were asked directly how the screening service could be improved, they suggested more publicity for cervical screening, ability to see a female HCP, encouragement to attend for screening by their own

HCP and flexible opening hours of the clinic to attend for screening.<sup>16</sup> Sabates and Feinstein demonstrated that women with children aged less than 5 years were less likely to have screening and that those living in areas where GP waiting times were higher than average were also less likely to have undergone screening.<sup>7</sup>

Quantitative research supports these qualitative findings. Invitation letters increased screening uptake (RR=1.44; 95% CI 1.24 to 1.52) and an additional letter from a woman's own GP also increased uptake (RR=1.13; 95% CI 1.05 to 1.21).<sup>6 17 18</sup> Healthcare provider recommendations, including reminder letters (OR=2.6; 95% CI 2.09 to 3.35), and creating a prompt system for physicians, also increased screening rates (OR=1.39; 95% CI 1.02 to 1.89). Cervical cancer education increased screening rates 2.5-fold.<sup>17</sup> Musa *et al*<sup>17</sup> postulated that knowledge of health risks and benefits creates preconditions for change; if people lack knowledge about how their lifestyle habits affect their health, they have fewer reasons to put themselves through the efforts of changing those habits.

The peak incidence of cervical cancer in 2016 was in the 25–30 years age group, which coincides with the average age of a first-time mother in England and Wales (29 years).<sup>19 20</sup> During pregnancy and the postnatal period, women have multiple interactions with HCPs and discussions regarding screening for a range of conditions, for both themselves and their baby, at multiple points during and after pregnancy. This time period is therefore an opportunity to inform, educate and facilitate the uptake of cervical screening, helping women to make informed choices.

Between 2016 and 2017, our local invasive cervical cancer audit identified six pregnant or recently postnatal women who were diagnosed with cervical cancer out of a total of 43 women diagnosed with cervical cancer over this time period in our department. Some of these women had been eligible for cervical screening in pregnancy or postnatally, but had not had screening. This was despite these women having multiple encounters with HCPs and discussions about other pregnancy-related screening tests during and after pregnancy. In 2017, three women were diagnosed within a year of their last pregnancy, all of whom had missed opportunities for screening in their most recent and, in the case of two women, preceding pregnancies. Overall, 14 of the 24 women diagnosed with a cervical cancer were out of date for cervical screening, the majority of whom had had a pregnancy previously. This correlates with the results of the latest Public Health England (PHE) Invasive Cervical Cancer Audit, which found that people diagnosed with cervical cancer were statistically less likely to be up to date with screening than controls (20%–27% compared with 63%).<sup>21</sup> Unfortunately, this national audit does not report data on parity or recent pregnancy status.

Since quality improvement (QI) methodology has been introduced into healthcare, it has been shown that the success of a project is dependent on the implementation of the project within an organisation as opposed to the

specific QI methodology used, for example, Lean Six Sigma.<sup>22</sup> We therefore sought to follow these principles in this project, allowing us to address multiple challenges simultaneously and adapt solutions to the context of the organisation.

### Specific aims

We aimed to improve the proportion of women out of date for cervical screening at the end of their pregnancy by 6 months postnatal by 10% by February 2020.

## METHODS

### Setting

Our maternity department is located within a medium-sized, district general, NHS Foundation Trust hospital, serving a local population of 340 000 and specialist services to a wider population of 800 000. The maternity department delivers ~3200 babies annually. It is within the same site as our Gynaecological Cancer Centre. The Gynaecological Cancer Centre includes a colposcopy department and delivers specialist gynaecological cancer services to the wider population, taking referrals from other hospitals. However, as the maternity department is relatively small and well connected within the local community, many staff working in the department were aware of women diagnosed with cervical cancer during or shortly after a pregnancy. This knowledge meant that there was already a degree of engagement with the proposed project.

Three of the authors worked in the Gynaecological Cancer Centre, but had worked in the maternity department previously, so there were well-established professional relationships. Leadership in both departments was orientated towards QI, with one author co-leading QI teaching for newly qualified doctors in the hospital (Postgraduate Year 1). The midwifery department were early adopters of QI methodology, with senior leaders keen to help make the project work.

This project was also timely, as a national campaign, launched by PHE to increase the uptake of cervical screening, commenced a year after the start of this project.<sup>23</sup> This provided useful opportunities to amplify national information and promote screening information locally.

### Understanding the problem

We sought to understand the barriers to women accessing cervical screening in an after pregnancy from the literature (see the Introduction section) and from our own stakeholders.

We collected baseline data regarding the number of women overdue for cervical screening at the end of their pregnancy and by 6 months postnatal via a retrospective audit of a random sample of 10 women per week who gave birth in our maternity unit between January and June 2016. We found that nearly half (47.3%) of all pregnant women were out of date for their cervical screening by the end of their pregnancy and over half

(74%) remained out of date by 6 months postnatal (online supplemental figure 1). Data demonstrated that, of the 260 women sampled, only 78.5% of the cervical screening status recorded at booking was correct, when this was cross-checked with cervical screening data held in the NHS CSP information technology (IT) system (Open Exeter),<sup>24</sup> suggesting that midwives relied on patient self-reporting, rather than confirming screening status on their GP records, to which they had access.

We undertook interviews and meetings with different stakeholder groups, including pregnant women, young women on follow-up following a diagnosis of cervical cancer, primary care providers (GPs, practice nurses and admin/reception staff), maternity staff (midwives and midwifery students, maternity healthcare workers and doctors) and colposcopy clinic staff (nursing and admin staff). We used process mapping techniques to identify points in pregnancy care where there were opportunities to discuss cervical screening and noted where this information was recorded in the maternity care record.<sup>25</sup>

We generated ideas for change with stakeholders. Women requested better, more consistent information from HCPs and easier access to booking screening, performed at more convenient times. One woman reported that despite being advised to have screening undertaken in pregnancy, as per national guidance, her requests to book had been blocked by receptionist and again by the practice nurse in primary care.

We conducted a formal survey of postnatal women using an online platform sent out to 400 women who had previously taken part in the Trust's antenatal preparation classes. One hundred women responded to the questions about cervical screening and suggestions for improvement. The quantitative data were complemented by qualitative comments (online supplemental figure 2a–e and online supplemental table 1). The themes of the comments mirrored those from the literature and our stakeholder interviews.

A driver diagram was produced to represent change ideas from all stakeholders, using an Ishikawa diagram as a tool to understand the problem in stakeholder meetings (online supplemental figures 3 and 4).<sup>26</sup>

QI methodology was used to develop the interventions to be tested using plan, do, study, act (PDSA) cycles.<sup>22</sup> The ideas for change were produced by the stakeholders: the individuals and organisations that have a vested interest in improving screening uptake. Stakeholders were pregnant and postnatal women, maternity staff and local GP practice staff. The stakeholders were invested in the change process and the ideas generated by them correlated with those in the available literature. We were hopeful, therefore, that the interventions would have an impact on screening uptake.

### Interventions

From root cause analysis of stakeholder engagement, as detailed above, we identified four main areas for improvement:

**Table 1** Timeline of project interventions

|                | Information provision   | Information dissemination  | Accessing screening  |
|----------------|---|--|--|
| February 2018  | Literature search.<br>Gathered relevant documentation.  |  |  |
| March 2018     |   | Meetings with midwifery leaders regarding project and their ideas for promoting cervical screening.  |  |
| April 2018     | Survey sent out to cohort of women who had attended antenatal classes and were currently postnatal.   |  |  |
| May 2018       | Creation of tear-off slip for colposcopy results letter.<br>HANDiApp information created.   |  |  |
| June 2018      | Creation of flow chart and midwifery letter.  | Colposcopy clinic results letters altered to include tear-off slip.  | Colposcopy clinic results letter highlights the date next screening invite will occur and contact details if pregnant when due.  |
| July 2018      | Adaptation of flow chart and midwifery letter.  |  |  |
| August 2018    | Adaptation of flow chart and midwifery letter.  |  |  |
| September 2018 | Survey results generated from cohort of women who had attended antenatal preparation classes.<br>Final versions of flow chart and midwifery letter. | Commenced teaching sessions for maternity staff.<br>GP education lead contacted to disseminate to practices in locality.   |  |
| October 2018   | Discussion with lead midwife for digital transformation about how software system could be adjusted to incorporate prompts for cervical screening.  |  |  |
| November 2018  |   | Virtual meeting with PHE South West to discuss progress and identify areas for further work.<br>Guideline for managing cervical abnormalities in pregnancy and postnatally created.                |  |
| December 2018  |   | HANDiApp information went online.<br>Meeting with local GP practice championing the work.<br>Encourage use of HANDiApp through midwifery promotion.<br>GP education day on gynaecological cancers. | Production of individualised reminder letter from the practice annually.<br>Contact chamber of commerce highlighting 'time to test' campaign to allow employees to access screening appointments during working hours. |
| January 2019   |   | Cervical cancer prevention week—advertisement stand in hospital and posters throughout relevant departments.   |  |
| February 2019  | Created recordings of patient story ready for social media.   |  |  |
| March 2019     |   | Social media campaign launched to coincide with PHE national campaign.   |  |

GP, general practitioner; PHE, Public Health England.

1. Information provision.
2. Information dissemination to staff.
3. Information dissemination to women.
4. Access to screening.

The timings of each intervention in the context of the project as a whole can be seen in [table 1](#), which outline the change ideas introduced and adaptations made over the project period.

#### Information provision

Evidence-based guidelines from the Royal College of Obstetricians and Gynaecologists and the NHS CSP informed when women should be advised to have screening. Either during pregnancy, if previous cervical abnormalities, or deferred until 12 weeks postnatal, if previously normal screening.<sup>27 28</sup> However, stakeholder meetings revealed that most midwifery staff believed that smears should not be performed in pregnancy, as it was not

safe for the pregnancy. Prior to the NHS CSP being introduced in 1988, cervical screening was often performed opportunistically in pregnancy, as part of routine pelvic examination at booking.<sup>29</sup> However, interpretation of cervical cytology is more challenging in pregnancy and the puerperium,<sup>30</sup> hence why routine screening, in those with a normal history, is deferred until after 12 weeks after pregnancy.<sup>31</sup> Many of the women who require screening during pregnancy are those who have had recent colposcopic examination and/or treatment. Previously, results letters from our colposcopy clinic advised repeat screening anywhere between 6 and 36 months' time. We redesigned the colposcopy results letters to include a 'tear off' slip at the bottom. This contained the date by which they would be invited for their next cervical screening test and advice to contact the colposcopy clinic, if pregnant at that time (online supplemental figure 5). We introduced



local guidelines about cervical screening and pregnancy. This incorporated two key documents: (1) a flow chart for staff to help identify those women who needed screening in pregnancy (online supplemental figure 6); and (2) a letter for community midwives to provide to the woman to facilitate accessing screening during pregnancy in primary care (online supplemental figure 7). These documents went through several iterations, tested in PDSA cycles, with critique by a multidisciplinary team of doctors, nurses, support workers and administrative staff working in the colposcopy clinic, and feedback from patients (three cycles for the colposcopy results letter; three cycles for the cervical screening guideline; eight cycles for the flow chart for midwives; four cycles for the midwifery letter). The final versions of the guidelines and letters were also approved by Obstetric and Midwifery staff through the maternity governance pathway.

### Information dissemination to staff

The guidelines regarding cervical screening in pregnancy were disseminated to maternity staff via usual channels. In addition, all maternity staff (including doctors, midwives and support staff) had a 10 min teaching session incorporated to their mandatory study days. The new guideline and template letters were discussed, and questions invited and answered. These sessions were delivered by one of the authors 14 times in a 10-month period. This was coordinated through the midwifery lead for mandatory training, who had an interest in QI methodology. As part of the educational package, midwives were encouraged to confirm screening history in GP notes, rather than relying on patient self-reporting.

The maternity department had recently converted to a 'paperlite' IT system. Working with a 'digital champion' midwife, a reminder about cervical screening was added onto the new maternity IT system. This reminder would prompt the midwife to ask the woman, at various points in her pregnancy, if she wanted to be screened, where a woman was overdue for screening at the beginning of pregnancy. Hyperlinks to the guideline and template letters were embedded within the software. The IT system is used in both community and hospital settings, so was accessible to all maternity staff. Unfortunately, it was not possible to automatically link cervical screening history from either the national cervical screening system (Open Exeter) or the GP records to the maternity IT system.

The local coordinator for GP education disseminated a *precis* about the project, guideline and template letters, and a template of an individualised reminder letter to women out of date with their screening, to all GP practices in the locality. An education update day for GPs about gynaecological cancers was held in the hospital and details about the project were included in this presentation.

### Information dissemination to women

The hospital had developed a smartphone application, HANDiApp, containing information for women about antenatal, delivery and postnatal care.<sup>32</sup> We added

information about screening to this application. For geographic areas where sociodemographic features made it less likely that women owned a smartphone, paper leaflets were available.

Women who had had a diagnosis of cervical cancer were asked if they would consider being a part of a social media campaign to highlight the importance of cervical screening. Two women, with very different routes to diagnosis, stage at diagnosis and treatments, very kindly agreed to take part and their stories were made into videos. Videos were released via hospital social media platforms to coincide with the national campaign launched by PHE.

### Access to screening

Accessing screening was made easier by the clinical commissioning group (CCG) extending opening hours for a range of GP practices across the locality. Appointments could be made at any of the practices that signed up to the scheme. This might result in greater travel distances and being screened by an unknown HCP, but increased opportunity of appointments at a time when childcare might be more available.

The new template colposcopy letter and midwifery letter (online supplemental figures 5 and 7) aimed to negate barriers in primary care identified by women trying to book screening during pregnancy.

### Study of the interventions

A quantitative approach was used to assess the impact of the intervention, as this enabled comparison with the baseline data. Data were plotted on a statistical process control (SPC) chart to allow discrimination between natural variation, chance and statistically significant changes in the outcome variables.<sup>33</sup> If the intervention improved screening uptake, the SPC chart would also allow assessment of any sustained change.

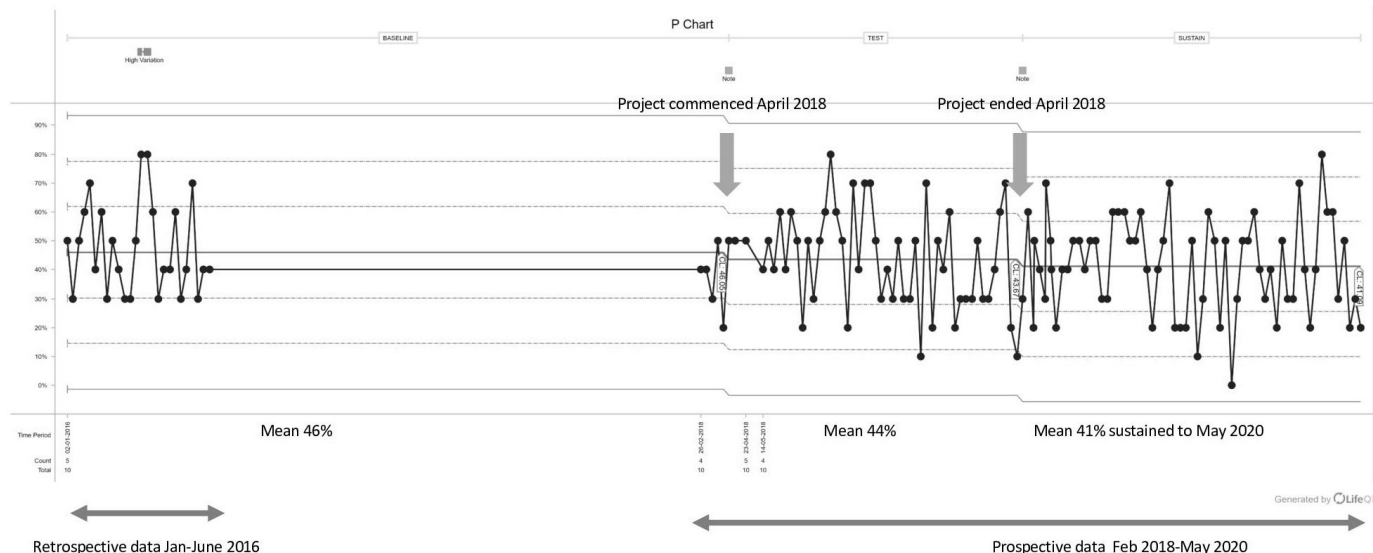
### Measures

We audited a random sample of 10 women per week, who gave birth in the Trust, from February 2018 to May 2020 to assess cervical screening status during pregnancy and again at 6 months postnatal, if overdue during pregnancy. This represented 16% of the women who delivered in the Trust each week. This random sample was produced by the maternity IT team from the maternity IT system and forwarded to the QI team to enable audit and analysis.

We cross-checked data provided with the hospital pathology results system for accuracy of cervical screening status. If the result was not available on the local pathology system, we interrogated Open Exeter,<sup>24</sup> the NHS CSP IT system. Plotting the data on an SPC chart enabled us to assess the validity and reliability of the data using Life QI system software.<sup>34</sup> Contextual elements responsible for impacting on the outcome measure were not assessed.

### Analysis

We performed quantitative analysis of the data using an SPC chart to collate and interpret the data alongside PDSA cycles.<sup>33</sup> By auditing the screening status of 10



**Figure 1** Statistical process control (SPC) demonstrating percentage of women out of date for cervical screening by the end of pregnancy over the time (2016–2020).

women per week over a 14-month period, there were well over the 25 data points required by an SPC chart to identify any change in screening uptake that could potentially be attributed to the intervention.

### Ethical considerations

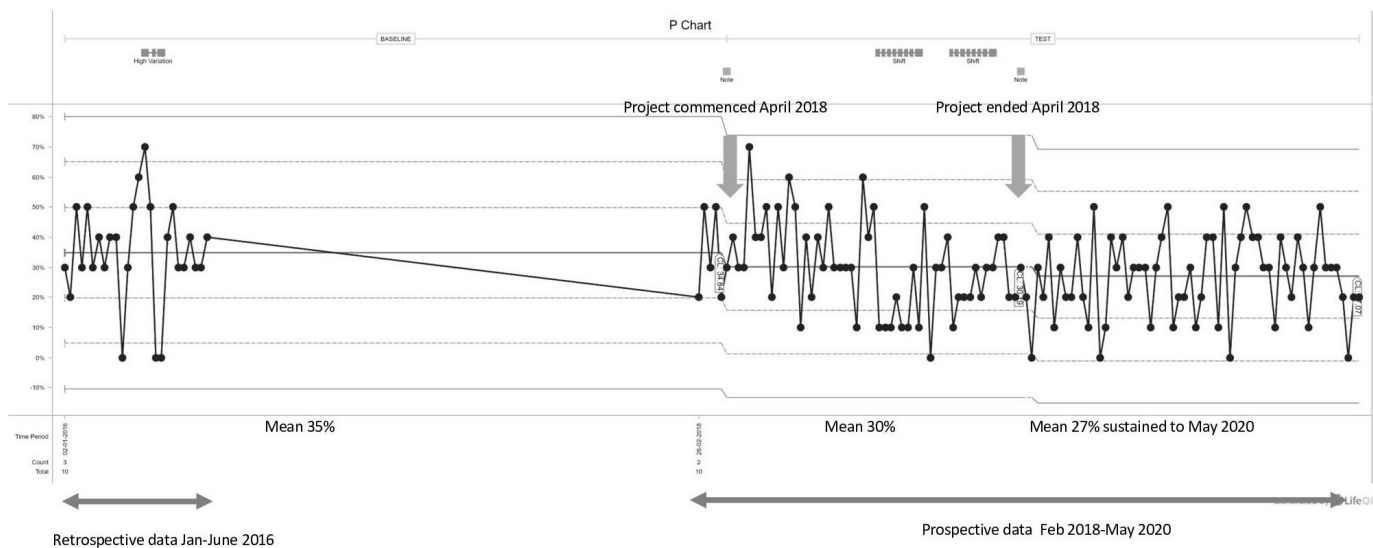
The NHS Trust Ethics lead was approached with the full details of the project and confirmed that ethical approval was not required.

### RESULTS

Outcome measures were the median number of women out of date with their cervical screening by the end of their pregnancy and the median proportion of those women who remained out of date at 6 months postnatal (figures 1 and 2).

Initial retrospective baseline data revealed that 47.3% ( $n=123/260$ ) of women were overdue cervical screening by the end of pregnancy. Further prospective baseline data, following initial stakeholder meetings, which acted to raise the profile of the problem, especially within the midwifery team, demonstrated an improvement to 43.5% ( $n=248/570$ ). As the project progressed, there was a shift in the average to 40.5% ( $n=247/610$ ), which was sustained in May 2020 when data collection was discontinued, due to the COVID-19 pandemic and the suspension of cervical screening (figure 1).

Initial retrospective baseline data found that 74.0% ( $n=91/123$ ) of women per week (of those who were out of date by the end of pregnancy) remained out of date with their cervical screening by 6 months postnatal. Prospective baseline data demonstrated, again following stakeholder



**Figure 2** Statistical process control (SPC) demonstrating percentage of women out of date for cervical screening by 6 months postnatal over the time (2016–2020).

meetings, indicated an improvement to an average of 70.2% (n=174/248). As the project progressed, the average fell significantly and was sustained at an average of 65.6% (n=162/247) of women per week in May 2020. Overall in our sampled cohort, the number of women out of date for cervical screening by 6 months postnatal fell from 34.8% to 27.1% (figure 2).

## DISCUSSION

### Main outcomes

The project was associated with a decrease in the number of women out of date with their cervical screening by 6 months postnatal, greater than that seen nationally or regionally over the same time frame. The aim of the project was to improve uptake of screening by 10%. The average number of women remaining out of date with their screening by the end of pregnancy fell from 47.3% to 40.5% and by 6 months postnatal fell from 74.0% preintervention to 65.6% postintervention. This improvement in average takes us nearer to the 80% NHS CSP coverage target and was a significant achievement, given the minimal effect observed nationally. As the report commissioned by Jo's Trust showed that a 7% increase in screening rates would reduce the number of cervical cancer deaths by 27% over 5 years, this is a clinically meaningful difference, especially as this is a cohort with higher incidence of cervical cancer.<sup>10</sup>

The national campaign launched by PHE to promote the uptake of cervical screening began in March 2019 coinciding with the end of the funded time period of the intervention. Data recently released by PHE show that during the time period of the national campaign there was a significant 3.2% increase in screening for women aged 25–49 from 42.5% in 2018 to 45.8% in 2019 (p<0.001).<sup>35</sup> After the national campaign, the screening rates fell back to trend.

We also compared national screening rates for women aged 25–49 in the local CCG with the CCGs for the surrounding areas, derived from the NHS CSP Open Exeter system.<sup>36</sup> In 2018–2019, all areas reported a 1.6% increase in screening rates. However, in 2019–2020 quarter 2, our CCG reported a 2.3% increase compared with the preceding 12 months. The surrounding CCGs did not show such an increase. This project may have contributed to that increase as our cohort had a greater increase in screening rates than seen either regionally or nationally. Furthermore, the increase in screening rates in our cohort was sustained until the end of data collection in May 2020, when the COVID-19 pandemic ceased the cervical screening programme temporarily.

Stakeholders in this project identified the same reasons for non-attendance for screening as those found in the qualitative literature. Previous quantitative studies showed that invitation letters from a GP (in addition to nationally produced invitations) resulted in increased screening uptake.<sup>6</sup> Studies have also demonstrated that education about cervical cancer, and creating a reminder system

for HCPs to discuss screening with women, increases screening rates.<sup>17</sup>

Our project achieved improvements in screening rates, outside of a controlled clinical trial setting, therefore it is difficult to disentangle which specific element of the project was most successful. A package of interventions that were context specific, based on the change ideas produced by the different stakeholder groups, led to the improvement observed.

Behaviour change models can be used to explain why women may not attend for cervical screening. The health belief model attempts to explain why individuals may not participate in a health initiative that could prevent and detect disease (online supplemental table 2).<sup>37</sup> It is, however, difficult to measure which of the individual constructs have the biggest impact on decision-making.

The precaution adoption process model (PAPM) (online supplemental figure 8) is a more complex model than the health belief model and attempts to explain how an individual must consciously decide to adopt a new precaution, that is, a healthier behaviour.<sup>37</sup> The PAPM can be seen to focus on the risk perception of the health behaviour.

The principles of this project could be extended to other cancer screening programmes. Any QI project has to be context specific to have a chance of success, it is not sensible to attempt to 'port' the change ideas identified and implemented in this project without assessing the local situation and context. We have generated a roadmap to help guide introduction of this project in other centres (online supplemental figure 9).<sup>38</sup>

### Strengths

#### Project team

Three authors had worked in the departments involved in the project previously. Professional relationships to move the project forward were already in existence and could be built on.

#### Timing

The project was well timed, coinciding with the recent introduction of a new maternity IT system, which was able to adapt to include prompts and key questions about cervical screening. Furthermore, we were able to align elements of the project with a national cervical screening awareness campaign and a national project to improve postnatal care, allowing amplification of key messages between projects. The impact of the project on people and systems was positive, empowering other staff to take ownership and suggest ideas of change. Once the project had been running for around 10 months, maternity staff began to contact us directly with further ideas and questions about the project.

#### Team dynamics

The departments involved had a number of key individuals orientated towards QI. There was some reticence initially within the colposcopy clinic about the new



guideline creating an additional workload, as the clinic was the 'backstop' of the flow chart. The flow chart went through many versions ensuring colposcopy became the last resource when all other attempts at finding the relevant information were exhausted. Although not measured separately, which would have been a useful balancing measure in retrospect, we have the impression that the flow chart has reduced unnecessary informal enquiries to the team.

### Limitations

The majority of interventions introduced were educational, although with the same message delivered to different target audiences and in different ways, supported by guidelines and tools. We believed that the key to the success of the project would be consistency of messages given to women from different sources, including midwives, general practice, colposcopy and electronic patient-specific information. It would therefore be difficult for us to evaluate individual items separately, since mixed-messaging would have undermined the effectiveness of any individual change. Because of this, it is impossible for us to disentangle these effects to determine which specific change was most effective. This need to 'ensure accurate and consistent messaging, particularly around informed choice' is emphasised in the NHS public health functions agreement for cervical screening.<sup>39</sup>

There was a gap in data collection between June 2016 and February 2018, it is unknown what was happening to screening rates in our cohort during this time, but the median was very similar between the retrospective and prospective data and no significant change was observed from national or CCG-level data.

Local stakeholders developed the change ideas, implemented within the specific institution that was QI orientated. Therefore, the package of interventions implemented may not be transferrable to other contexts. If a different geographical area were to implement a similar project, they would need to ensure that they engage their relevant local stakeholder groups and look at how changes can be made within the context of their local systems and identify an individual/team able to drive the project forward. However, recognising the need for system-wide consistency of messaging would be important for any service, and identification of how, where and when women receive this information is key.

The midwifery education package was handed onto the midwifery mandatory training lead, delivered by the midwifery educators, to improve sustainability. An additional project would be the development of an e-learning package, but we preferred the more interactive session, with ability to ask questions and update with ongoing results, as this helped to embed learning.

It is hard to disentangle whether the changes were sustained due to the implementation of this project, or the national campaign that was launched at the end of the project, or a combination of both elements. However,

the improvement rate in our cohort was over fourfold that observed from the national data, and proceeded the national campaign, suggesting that our project was causally related to the observed improvement.

One change idea that we were not able to introduce during our project was self-sampling for those who decline conventional cervical screening, as studies have shown this is acceptable to women,<sup>40</sup> and is safe to use within a screening programme.<sup>41</sup> A clinical trial of self-sampling commenced in England in 2021 for patients within the NHS CSP.<sup>42</sup> However, this was not available at the time of our project, outside of clinical trials.

A further potential limitation is that we do not have data on HPV vaccination rates in our cohort. However, as these data would not have influenced the necessity for, nor frequency of, cervical screening in England at that time, these data were not pertinent to our study, which was focused on cervical screening uptake. Furthermore, as these women were (1) pregnant and (2) outside of the age cohort eligible for HPV vaccination, this information would not have influenced clinical management for these women.

### CONCLUSIONS

Cervical cancer incidence is highest in women under the age of 35 years and the average age of a first-time mother in England coincides with this age group. Decreasing the incidence of and mortality from cervical cancer, which predominately affects young women, is important to women and society as a whole. Cervical screening is one of the few cancer screening programmes with a robust evidence base demonstrating significant impact on mortality. Improving the uptake of screening is therefore useful.

A package of information, education and widening access to screening appointments increased the number of pregnant and postnatal women being screened. The interventions were implemented in such a way that it was hoped they would be sustainable. The cycles of change implemented finished in April 2019, but the data beyond that show that the changes made were sustained up to the COVID-19 pandemic.

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## REFERENCES

- Willoughby BJ, Faulkner K, Stamp EC, *et al*. A descriptive study of the decline in cervical screening coverage rates in the North East and Yorkshire and the Humber regions of the UK from 1995 to 2005. *J Public Health* 2006;28:355–60.
- Clement KM, Mansour D. Invasive cancer of the cervix: does the UK National health service screening programme fail due to patients' non-attendance? *Eur J Gynaecol Oncol* 2013;34:28–30.
- Kitchener HC, Gittins M, Rivero-Arias O, *et al*. A cluster randomised trial of strategies to increase cervical screening uptake at first invitation (strategic). *Health Technol Assess* 2016;20:1–138.
- NHS Digital. Report shows decrease in cervical screening coverage in England, 2017. Available: <https://digital.nhs.uk/news-and-events/news-archive/2017-news-archive/report-shows-decrease-in-cervical-screening-coverage-in-england>
- Public Health England. Cervical screening coverage, 2018. Available: <https://app.box.com/s/iz06m3hui0wjt88hldxooe4uervco63r>
- Everett T, Bryant A, Griffin MF, *et al*. Interventions targeted at women to encourage the uptake of cervical screening. *Cochrane Database Syst Rev* 2011:CD002834.
- Sabates R, Feinstein L. The role of education in the uptake of preventative health care: the case of cervical screening in Britain. *Soc Sci Med* 2006;62:2998–3010.
- Falcaro M, Castañón A, Ndlela B, *et al*. The effects of the National HPV vaccination programme in England, UK, on cervical cancer and grade 3 cervical intraepithelial neoplasia incidence: a register-based observational study. *Lancet* 2021;398:2084–92.
- Gallagher J. *Vaccines could mean only one smear test a lifetime*. BBC News, 2022.
- Salter J. *Behind the screen*. London: Demos, 2014.
- Jo's Cervical Cancer Trust. Barriers to cervical screening among 25–19 year olds, 2016. Available: [https://www.jostrust.org.uk/sites/default/files/ccpw17\\_survey\\_summary.pdf](https://www.jostrust.org.uk/sites/default/files/ccpw17_survey_summary.pdf)
- Jo's Cervical Cancer Trust. Cervical screening awards case studies, 2017. Available: [https://www.jostrust.org.uk/sites/default/files/screening\\_awards\\_resource\\_doc\\_final\\_2017\\_winners.pdf](https://www.jostrust.org.uk/sites/default/files/screening_awards_resource_doc_final_2017_winners.pdf)
- Chorley AJ, Marlow LAV, Forster AS, *et al*. Experiences of cervical screening and barriers to participation in the context of an organised programme: a systematic review and thematic synthesis. *Psychooncology* 2017;26:161–72.
- Jepson RG, Hewison J, Thompson A, *et al*. Patient perspectives on information and choice in cancer screening: a qualitative study in the UK. *Soc Sci Med* 2007;65:890–9.
- Young B, Bedford L, Kendrick D, *et al*. Factors influencing the decision to attend screening for cancer in the UK: a meta-ethnography of qualitative research. *J Public Health* 2018;40:315–39.
- Schwartz M, Savage W, George J, *et al*. Women's knowledge and experience of cervical screening: a failure of health education and medical organization. *Community Med* 1989;11:279–89.
- Musa J, Achenbach CJ, O'Dwyer LC, *et al*. Effect of cervical cancer education and provider recommendation for screening on screening rates: a systematic review and meta-analysis. *PLoS One* 2017;12:28.
- Tseng DS, Cox E, Plane MB, *et al*. Efficacy of patient letter reminders on cervical cancer screening: a meta-analysis. *J Gen Intern Med* 2001;16:563–8.
- Cancer Research UK. Cervical cancer statistics: cancer research UK, 2020. Available: <https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/cervical-cancer>
- Office for National Statistics. Births by parents' characteristics in England and Wales, 2016. Available: <https://www.ons.gov.uk/peopl-lepopulationandcommunity/birthsdeathsandmarriages/livebirths/bulletins/birthsbyparentscharacteristicsinenglandandwales/2016>
- Castanon A, Sasieni P. *Cervical screening: invasive cervical cancer audit 2013 to 2016*. Public Health England: London, 2019.
- Boaden R, Harvey G, Moxham C. *Quality improvement theory and practice in healthcare*. Coventry, UK: NHS Institute for Innovation and Improvement, 2008: 149.
- Public Health England. 'Cervical screening saves lives' campaign, 2019. Available: <https://www.gov.uk/government/news/phe-launches-cervical-screening-saves-lives-campaign>
- NHS Digital. Open Exeter: National health application and infrastructure services, 2019. Available: <https://digital.nhs.uk/services/nhais/open-exeter>
- NHS Improvement. Conventional process mapping: act Academy, 2018. Available: <https://improvement.nhs.uk/documents/2143/conventional-process-mapping.pdf>
- Ishikawa K. *Guide to quality control*. Tokyo: Asian Productivity Organization, 1968.
- Public Health England. Colposcopy and programme management document 20, 2016. Available: [https://www.bsccp.org.uk/assets/file/uploads/resources/NHSCSP\\_20\\_Colposcopy\\_and\\_Programme\\_Management\\_\(3rd\\_Edition\)\\_2\\_.pdf](https://www.bsccp.org.uk/assets/file/uploads/resources/NHSCSP_20_Colposcopy_and_Programme_Management_(3rd_Edition)_2_.pdf)
- Royal College of Obstetricians and Gynaecologists. Cervical smears and pregnancy patient information leaflet, 2013. Available:



- <https://www.rcog.org.uk/globalassets/documents/patients/patient-information-leaflets/pregnancy/cervical-smears-and-pregnancy.pdf>
- 29 O'Donovan P, Gupta JK, Savage J, *et al.* Is routine antenatal Booking vaginal examination necessary for reasons other than cervical cytology if ultrasound examination is planned? *Br J Obstet Gynaecol* 1988;95:556–9.
  - 30 Huff BC. Abnormal cervical cytology in pregnancy: a laboratory and clinical dermatologic perspective. *J Perinat Neonatal Nurs* 2000;14:52–62.
  - 31 NHS Cervical Screening Programme. *Colposcopy and programme management*. Third Edition. Public Health England, 2016.
  - 32 Technical Health. HANDi maternity APP Launched at Musgrove Park, 2017. Available: <https://technicalhealth.co.uk/news/2017/handi-maternity-app-launched-at-musgrove-park>
  - 33 NHS Improvement. Statistical process control: library of quality, service improvement and redesign tools, 2017. Available: <https://improvement.nhs.uk/documents/2171/statistical-process-control.pdf>
  - 34 Life Qi system. Available: <https://www.lifeqsystem.com>
  - 35 InPublic Health England. *Cervical screening uptake*. Department of Health, 2021. <https://www.gov.uk/government/publications/be-clear-on-cancer-first-national-cervical-screening-saves-lives-campaign/cervical-screening-uptake>
  - 36 Screening and Immunisation Teams, NHS Digital. Cervical screening interactive resource for clinical commissioning groups (CCG) [Internet], 2021. Available: <https://app.powerbi.com/view?r=eyJrljoi> OGIZODcxY2YtZDQwYS00NDRLWFhMjctNjlkZWJjMzQzODg2liwi dCI6IjUwZjYwNzFmLWJiZmUtNDAxYS04ODAzLTY3Mzc0OGU2Mjll MilsImMiOjh9 [Accessed 18 May 2021].
  - 37 Glanz KRB, Viswanath K, eds. *Health Behavior and Health Education: Theory, Research and Practice*. 4th Revised ed ed. San Francisco, California, USA: John Wiley & Sons, 2008.
  - 38 Scoville R. Improvement Project Roadmap Cambridge, Massachusetts, USA: Institute for Healthcare Improvement; [Available from. Available: <http://www.ihl.org/resources/Pages/Tools/ImprovementProjectRoadmap.aspx>
  - 39 Public Health England with NHS England and NHS Improvement Public Health Commissioning. *Nhs public health functions agreement 2019-20. service specification No.25. cervical screening programme*. London: NHS England and NHS Improvement, 2019.
  - 40 Nelson EJ, Maynard BR, Loux T, *et al.* The acceptability of self-sampled screening for HPV DNA: a systematic review and meta-analysis. *Sex Transm Infect* 2017;93:56–61.
  - 41 Stanczuk GA, Currie H, Forson W, *et al.* Self-Sampling as the principal modality for population based cervical screening: five-year follow-up of the PaVDaG study. *Int J Cancer* 2022;150:1350–6.
  - 42 Public Health England. Recruitment for cervical screening self-sampling study now underway: public health England, 2021. Available: <https://phescreening.blog.gov.uk/2021/04/28/cervical-screening-self-sampling-study/>