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## HPV vaccination has dramatically reduced inequalities in cervical cancer, but the most deprived group remains at highest risk

England's routine school-based human papillomavirus (HPV) vaccination programme is delivering greatly reduced rates of cervical disease and is helping towards the reduction of inequalities between socioeconomic groups, but there's still room for improvement

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Inequalities in cervical disease are well documented and have been attributed partly to better accessibility and uptake of cervical screening in less deprived groups in the eligible population.<sup>1,2</sup> With the global efforts to meet cervical cancer elimination targets<sup>3</sup> and the growing evidence about the positive impact of vaccination on cervical cancer rates,<sup>4</sup> now is a good time to focus on what works to reduce inequalities in cervical cancer and to consider how we should measure and value that.

Our research study recently published in *The BMJ* used English population-based cancer registration data between 2006 and mid-2020 to examine the impact of the national HPV Vaccination Programme on grade 3 cervical intraepithelial neoplasia (CIN3) and invasive cervical cancer by quintile of the index of multiple deprivation (IMD).<sup>5</sup> Our findings show that the routine, school-based HPV vaccination programme—with high coverage of girls offered the vaccine at age 12–13 years—has substantially reduced incidence of cervical neoplasia in all socioeconomic groups in England, reduced the long-entrenched, steep slope of increased disease with increased deprivation, and averted more cases of cervical cancer and CIN3 in the most deprived groups.

A recent study in Scotland with individual-level vaccination data similarly found that women from more deprived areas benefitted more from being vaccinated than those from less deprived areas.<sup>7</sup> In both studies, the reduction in inequalities results from the benefits of vaccination applying to higher disease rates seen in more deprived groups. For vaccinated populations or individuals, disease rates remained higher in the more deprived groups, but less markedly than in unvaccinated populations or individuals. However, our study also shows that even subtle differences in implementation can be important. The vaccination programme in England was less successful in this regard among women eligible for the catch-up vaccination campaign that targeted older age and achieved lower coverage overall, especially in more deprived groups.<sup>6</sup>

Health inequalities are rightly looked at in both absolute and relative terms. Narrowing relative inequalities requires greater reach or higher effectiveness of interventions in the more deprived groups. Evaluating absolute differences is more pragmatic and focuses on the rates of disease that ultimately affect people's lives,<sup>8,9</sup> therefore we think that what matters most to society is the absolute difference between groups. For example, for cervical

cancer in the routine vaccination cohort in our study, we observed a similar percentage of averted cases (around 84%) in the most and least deprived groups. However, we estimated that the absolute difference in rates between the most and the least deprived would have been sixfold higher without vaccination.

In health economic analyses of public health interventions, it is important to think of the value to society of reducing health inequalities. Surveys exploring public perceptions of inequalities in England indicate that the population values healthcare gains in the most deprived groups between six and seven times more than gains in the least deprived.<sup>10</sup> There is not an established approach to incorporating these value judgments into health technology assessment in the UK. These value judgments could be incorporated in the same way that NICE values healthcare gains in those experiencing severe conditions at between 1.2 and 1.7 times higher than the value of gains in the rest of the population, depending on the level of severity.<sup>11</sup> Doing this would increase the estimated value of routine HPV vaccination in cost effectiveness analyses. Improving the coverage of vaccination for the more deprived groups should also add value by reducing the absolute rate of cervical disease in the women at highest risk and so contributing disproportionately towards the WHO targets for elimination of cervical cancer.<sup>12</sup> The greatest room for improvement probably remains in the uptake of cervical screening, which is below that of vaccination overall and lower among more deprived groups. Incorporating the value of reducing inequalities could increase the investment in improving uptake in more deprived groups.

While the success of the HPV vaccination programme in England is evident and is, we believe, providing added value via its effect on reducing inequalities for cervical cancer, there is still room for improvement. We must not be complacent. Any falls in routine HPV vaccination coverage—especially if the falls are greater among the most deprived groups—could erode the huge strides made by HPV vaccination to reduce inequalities in cervical cancer if not identified and tackled swiftly.

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