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Scale-up of radiotherapy for cervical cancer in the era of human papillomavirus vaccination in low-income and middle-income countries: a model-based analysis of need and economic impact

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BACKGROUND:

Radiotherapy is standard of care for cervical cancer, but major global gaps in access exist, particularly in low-income and middle-income countries. We modelled the health and economic benefits of a 20-year radiotherapy scale-up to estimate the long-term demand for treatment in the context of human papillomavirus (HPV) vaccination.

METHODS:

We applied the Global Task Force on Radiotherapy for Cancer Control investment framework to model the health and economic benefits of scaling up external-beam radiotherapy and brachytherapy for cervical cancer in upper-middle-income, lower-middle-income, and low-income countries between 2015 and 2035. We estimated the unique costs of external-beam radiotherapy and brachytherapy and included a specific valuation of women's caregiving contributions. Model outcomes life-years gained and the human capital and full income net present value of investment. We estimated the effects of stage at diagnosis, radiotherapy delivery system, and simultaneous HPV vaccination (75% coverage) up to a time horizon set at 2072.

FINDINGS:

For the period from 2015 to 2035, we estimated that 9·4million women in low-income and middle-income countries required treatment with external-beam radiotherapy, of which 7·0million also required treatment with brachytherapy. Incremental scale-up of radiotherapy in these countries from 2015 to meet optimal radiotherapy demand by 2035 yielded 11·4million life-years gained, US$59·3billion in human capital net present value (-$1·5billion in low-income, $19·9billion in lower-middle-income, and $40·9billion in upper-middle-income countries), and $151·5billion in full income net present value ($1·5 billion in low-income countries, $53·6billion in lower-middle-income countries, and $96·4billion in upper-middle-income countries). Benefits increased with advanced stage of cervical cancer and more efficient scale-up of radiotherapy. Bivalent HPV vaccination of 12-year-old girls resulted in a 3·9% reduction in incident cases from 2015 to 2035. By 2072, when the first vaccinated cohort of girls reaches 70 years of age, vaccination yielded a 22·9% reduction in cervical cancer incidence, with 38·4million requiring external-beam radiotherapy and 28·8million requiring brachytherapy.

INTERPRETATION:

Effective cervical cancer control requires a comprehensive strategy. Even with HPV vaccination, radiotherapy treatment scale-up remains essential and produces large health benefits and a strong return on investment to countries at different levels of development.