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Indirect cost of HPV-attributable cancer in the UK

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Background

- In the United Kingdom (UK), the total cost of cancer across the care pathway was estimated at £20.4 billion in 2018(1). This vast economic burden results not only from direct healthcare system expenditure, but also informal care (14.0%) and indirect costs resulting from premature mortality (28%) and morbidity (6.4%) productivity losses(1).
- Human papillomavirus (HPV) is a preventable disease that is an established cause of several cancer types including some head and neck (oral cavity, pharynx, and larynx), cervical, vulval, vaginal, anal, and penile, in addition to other diseases.
- The direct cost of HPV-related cancers has been explored(2), but there is a gap in evidence for the economic impact due productivity losses as a result of disease morbidity and early mortality.

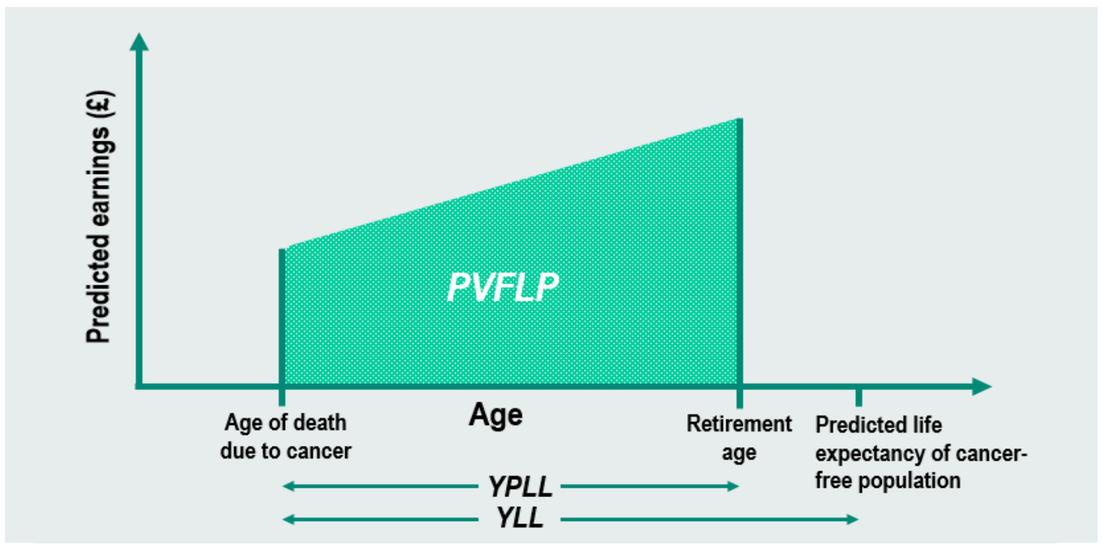
OBJECTIVE

- To estimate the number of deaths, and subsequent indirect cost of productivity loss as a result of early mortality, due to HPV-attributable cancer in the UK.

Methods

- UK mortality data stratified by age for 2019, to avoid discrepancies as a result of the COVID-19 pandemic, was sourced from country-specific databases(3,4,5,6) using ICD-10 codes for the following cancer types: head and neck (C00-14, C32), cervix uteri (C53), vulval (C51), vaginal (C52), anal (C21), and penile (C60). The proportion of deaths due to HPV were estimated by multiplying the number of deaths by the HPV-attributable fractions obtained from the published literature(2).
- Years of life lost (YLL) and years of productive life lost (YPLL) were calculated from the mortality data using the expected UK life expectancy and retirement age for males and females, respectively, sourced from ONS and WHO estimates(7).
- A monetary value was assigned to the YLL using the average UK wage and labour force participation(8) by age to estimate the present value of future lost productivity (PVFLP). A 3.5% annual discount rate was applied to bring future costs into the present value. A scenario analysis was included using GDP per capita.
- Results were stratified by country (England, Scotland, Wales, and Northern Ireland), sex, and cancer site.

Figure 1. Diagram of model estimating indirect cost of HPV-related cancer mortality



Abbreviations: PVFLP, present value of future lost productivity; YPLL, years of productive life lost; YLL, years of life lost.
*Figure adapted from Bencina et al. 2022(9)

Results

- The total UK mortality in 2019 due HPV-attributable cancer is estimated at 3,145 deaths, which translates to 47,952 YLL and 15,831 YPLL.

Table 1. Estimated HPV-attributable cancer deaths in the UK in 2019

Cancer sub-type	Male	Female	Total
Oral cavity and pharynx	886	423	1309
Larynx	263	67	330
Cervix uteri	N/A	844	844
Vulva	N/A	160	160
Vagina	N/A	43	40
Anus	204	174	378
Penis	82	N/A	82
Total	**1,435**	**1,710**	**3,145**

- Oral cavity and pharynx contributed the largest mortality (1309 deaths), with 67.7% (886 deaths) occurring in the male population.
- Despite this, due to a younger population and greater female life expectancy, cervix uteri mortality contributed to the greatest total YLL (19,823 years) and YPLL (8,771 years).

Table 2. YLL and YPLL due to HPV-attributed cancer mortality in the UK in 2019

Cancer sub-type	YLL			YPLL		
	Male	Female	Total	Male	Female	Total
Oral cavity and pharynx	10,579	6,354	16,933	3,037	1,450	4,487
Larynx	2,497	822	3,319	548	139	687
Cervix uteri	N/A	19,822	19,823	N/A	8,771	8,771
Vulva	N/A	1,761	1,761	N/A	230	230
Vagina	N/A	576	576	N/A	128	128
Anus	2,254	2,425	4,679	677	576	1,253
Penis	861	N/A	861	215	N/A	215
Total	**16,191**	**31,762**	**47,952**	**4,476**	**11,355**	**15,831**

- The total PVFLP in the UK in 2019 due to mortality from HPV-attributable cancers is estimated at £279,908,202.
- Cervical cancer deaths contributed to the greatest PVFLP (£125,353,865), closely followed by oral cavity and pharynx (£100,447,997).
- Result were consistent across all four UK nations (Table 3).
- In a scenario of using GDP per capita rather than average wage, female PVFLP increased whilst decreasing for males. There was minimal change to the total UK PVFLP (£271,978,508, decrease of 2.84%).

Table 3. Total estimated PVFLP due to early mortality from HPV-related cancer

Cancer sub-type	UK	England	Scotland	Wales	Northern Ireland
Oral cavity and pharynx	£100,448,997	£80,612,467	£11,823,097	£4,920,685	£3,092,748
Larynx	£16,148,426	£13,089,450	£2,175,767	£500,693	£382,517
Cervix uteri	£125,353,865	£100,630,889	£14,535,396	£6,852,840	£3,334,740
Vulva	£4,965,644	£3,863,879	£907,681	£194,084	NR
Vagina	£2,139,478	£1,650,265	£353,257	£135,957	NR
Anus	£25,378,437	£21,771,900	£2,177,718	£1,428,819	NR
Penis	£5,473,355	£5,118,464	£228,004	£126,888	NR
Total	**£279,908,202**	**£226,737,313**	**£32,200,919**	**£14,159,966**	**£6,810,004**

Limitations

- For patient anonymity, mortality, was not widely reported for cancer types of lower incidence/mortality in Northern Ireland due to the small population size.

CONCLUSIONS

- There is a high disease burden in the UK for HPV-attributable cancers that results a large economic impact on both the healthcare system directly, but also the wider economy due to productivity losses.
- It is critical to implement and reinforce public health measures with the aim to reduce to incidence of HPV-related diseases, and the subsequent premature cancer deaths.
- Further research should explore total economic burden of all HPV-attributable diseases, including the productivity loss from disease morbidity.

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