

1 **Additional file 1: Supplementary Text**

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3 **Literature review: Cost-benefit analysis (CBA) on vaccination**

4 We searched PubMed for articles on cost-benefit analysis of vaccines using the following search
5 query: (“cost-benefit analysis” OR “benefit-cost analysis”) AND (“vaccine” OR “vaccination”).

6 The search yielded a total of 269 articles. We narrowed it down to 151 studies by excluding all
7 studies published before January 1, 2000 and further to 135 by excluding articles not written in
8 English. At the initial screening, we reviewed titles and abstracts to exclude (i) cost-effectiveness
9 analysis or any other forms of economic evaluations (i.e. not using monetized benefits), (ii)
10 studies on zoonotic diseases, and (iii) systematic review or comments. At the final stage of
11 screening, we reviewed the full text of 21 remaining articles that conducted a full CBA on
12 vaccination, which includes indirect benefits to see what type of monetization approach was used
13 in the analysis. Only two methods for cost-benefit analysis (CBA) were used in the identified
14 articles, namely the human capital and the value of statistical life approaches. We also found
15 substantial methodological differences among these studies, with the scope of benefits ranging
16 from medical cost savings only, to productivity gains from avoiding disease, to individual or
17 societal willingness to pay to avert premature death. None of these studies examined the
18 implications of varying the approach used to estimate benefits.

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20 **Selection of value of statistical life (VSL) estimates from the published literature**

21 To select representative VSL estimates for our analysis, we searched PubMed for articles on a
22 VSL using the following search query: (“value of a statistical life” OR “value of statistical life”),
23 (“revealed preference” OR “stated preference”), (“willingness-to-pay” OR “WTP” AND

24 “cervical cancer”), and (“hedonic” AND “cancer”). As the stated preference approach using the
25 contingent valuation method is context-specific (i.e. surveys given under the specific
26 hypothetical scenario), we limited our search for WTP studies to that related to cervical cancer
27 only. The search yielded a total of 590 journal articles. After excluding 14 duplicate studies, a
28 total of 576 titles and abstracts were reviewed for relevance based on the following inclusion
29 criteria: (1) the article is written in English; (2) the study reports VSL estimate(s) based on
30 empirical evidences or a systematic review; and (3) the study was conducted in developed
31 countries (comparable to the UK). After the initial screening, we further narrowed it down to
32 include 19 studies that report VSL estimate(s) for cancer, in particular. A full text of the 19
33 articles that meet the selection criteria were reviewed and the three most relevant studies that
34 provide VSL estimates for cancer were selected to be included in our study. We further added
35 three more VSL estimates from the recent UK and US government reports and OECD’s
36 guidelines (based on a systematic review) to see how VSL estimates are applied in practice. A
37 total of 7 VSL estimates including four from relevant studies and three from the national or
38 international normative guidelines were included in the analysis, as shown below. All VSL
39 estimates were converted to the 2015 UK currency using benefit transfer method following the
40 OECD guideline [7].

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42 **Estimation of the threshold vaccine cost (TVC)**

43 We defined the TVC as the maximum vaccine cost per person (including the administration cost)
44 at which HPV vaccination has a benefit-to-cost ratio above one (i.e. the vaccination program is
45 cost-beneficial). The TVC estimates presented in Table S4 were computed by dividing the total

46 benefits (including both the direct and indirect benefits) obtained from each of different CBA
47 methods by the total number of girls to be vaccinated.

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51 **References**

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53 Valuation in Environment, Health and Transport Policies. 2012. [http://www.oecd-
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