Section: Estimating the healthcare-associated economic benefits of rotavirus vaccination introduction in England and Wales.

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**Methods**

**Healthcare outcomes averted**

*GP visits:* To generate a distribution for the annual GP consultations averted, we subtracted the 2013-4 observed number of GP consultations from the annual number of predicted GP consultations from the statistical model (section XX Methods). Consistent with the previously described statistical model, we assumed the annual incidence rate in each age group was log-normally distributed. Conservatively, we assumed that total number of consultations equals the total incident visits as previously discussed (Data cleaning Methods).

*Hospital visits:* We applied the same methodology as described in ‘GP Visits’, using previously published data (Aitchison et al. CID 2015) to calculate a distribution for the total hospital visits averted for the rotavirus year 2013/14.

*A&E visits: <*Jemma is probably best placed to fill this in>. We sampled the cases averted from the normal distribution previously parameterized.

**Healthcare costs averted**

*GP visits*: To calculate the cost of a GP consultation, we used the 2014 Unit Costs of Health and Social Care, assigning the modal value as a consultation lasting 11.7 minutes (£38), with the lower and upper bounds as consultations that last for 7.1 minutes (£23) and 17.2 minutes (£56) respectively (ref: Curtis et al). We also assigned an additional prescription cost to each GP visit with a modal value as the cost for scripts that are “routinely” and “can be” used for GE (£2.30). Lower bound cost consisted of those “routinely” used for GE (£1.38) and upper bound (£3.79) cost of the modal value in addition to the cost for scripts that are rarely used for GE. Prescription costs were inflated from 2004 prices to 2014 using annual Health Services Pay and Prices Index (ref: Curtis et al). Adding together the cost of a consultation visit and prescription, we used a Triangular distribution of total GP consultation costs (mode £40.30, lower bound £24.38 and upper bound £59.79).

*Hospital visits*: We calculated the modal cost of a hospital visit for paediatric cases (<15 years) using a weighted average using national 2013–4 unit costs for elective, non-elective, non-elective short stay, and day-use hospital costs for paediatric infectious or non-infectious gastroenteritis (codes PF21A-PF21B), with weights given by the admissions for each combination of code and type of admission. For non-paediatric cases (15 years or older) we used the same weighted average method using national average unit costs for only non-elective short stay, and day-use hospital costs for gastrointestinal infections (for no intervention or single intervention only, codes FZ36K,L,P,Q). Similarly, lower and upper bounds on costs were calculated using a weighted average of the lower quartile and upper quartiles for unit costs respectively. (ref: NHS Reference Costs) These methods provided a Triangular distribution of hospital costs as such: non-paediatric hospital visit cost: mode: £433.96, lower bound: £335.72, upper bound: £493.35; paediatric hospital visit cost: mode: £695.57, lower bound: £529.98, upper bound: £787.72.

Conservatively, we did not include excess bed days in hospital or non-paediatric hospital stays that were elective or non-elective that were not short-stay, as these are not likely to be RVGE-related.

*A&E visits:* To evaluate the cost of an Accident and Emergency visit, we calculated the average of all Emergency visits using national 2013-14 unit costs for Emergency visits, weighted by the number of attendances. We used all codes VB-XX-Z except VB-10-Z (dental care). This calculation provided: mean: £123.71; lower bound: £100.30; upper bound: £142.96.

*Sampled output*: All costs and cases averted were sampled 100,000 times over their respective distributions for each age group. The healthcare costs averted per year were calculated as the product of the healthcare visits averted and the cost of healthcare visit for each age group.

**Results**

Table: Averted healthcare outcomes and associated costs (Median values presented with 95% CIs from Monte Carlo sampling)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Age (years) | Annual visits averted 2013/14 | | | Annual costs averted (2014 £million) | | |
|  | GP | Hospital | A&E | GP | Hospital | A&E |
| <1 | 16240  (4619,29224) | 5306  (2849,8099) | 4579  (3284,5873) | 0.657  (0.181,1.317) | 3.542  (1.871,5.574) | 0.552  (0.377,0.760) |
| 1 | 18483  (7485,31092) | 4962  (-85,12565) | 5657  (2919,8397) | 0.749  (0.288,1.411) | 3.313  (-0.056,8.526) | 0.681  (0.344,1.069) |
| 2 | 5192  (1401,9377) | 1674  (-116,4185) | 0.210  (0.055,0.422) | 1.117  (-0.078,2.842) |
| 3 | 2995  (466,5814) | 700  (-143,1796) | 0.121  (0.018,0.260) | 0.467  (-0.096,1.220) |
| 4 | 2656  (720,4804) | 328  (-155,915) | 0.107  (0.028,0.216) | 0.219  (-0.104,0.621) |
| **All ages** | 45883  (28751,64407) | 13226  (6951,21533) | 10236  (7206,13267) | 1.869  (1.044,3.016) | 8.839  (4.561,14.759) | 1.234  (0.830,1.715) |
| **Total** | 69606  (50824,89834) | | | 12.002  (7.578,18.011) | | |

**Data sharing**

All code is available on https://github.com/katiito/rotaenglandcostcalculations

**Notes for Discussion:**

Percentage of UK population living in England = 84% [http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-uk--england-and-wales--scotland-and-northern-ireland/mid-2014/mid-year-population-estimates-for-the-uk-2014.html]

Vaccine-related costs:

Total annual live births in 2014 = 661,496

Total annual live births in 2013 = 664,517

Vaccine price (course) = £36.67 [using Jit et al. Vaccine 2010, with 1.46 euro-> sterling and Euro27.50]

Vaccine uptake (1 dose) in 2013 = 93%

Vaccine uptake (2 doses) in 2013 = 88%

Cost per course vaccine admin = £10.95 [using Jit et al. Vaccine 2010 with 1.46-> sterling and Euro8]

Total cost of vaccine purchase and admin (2013)

47.63\*664517\*(0.88 + (0.93-0.88)/2) = £ 28, 644, 000

Total cost of vaccine purchase and admin (2014)

47.63\*661496\*(0.88 + (0.93-0.88)/2) = £ 28, 514, 000

**Refs**

NHS Reference costs 2013-14 <https://www.gov.uk/government/publications/nhs-reference-costs-2013-to-2014> (accessed 6 November 2015**)**