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Quality of life impacts from rotavirus gastroenteritis on children and their families in the UK

Robin Marlow[a,b,*], Adam Finn[a,b], Caroline Trotter[c]

[a] Bristol Royal Hospital for Children, University Hospitals Bristol NHS Foundation Trust, Bristol, UK
[b] Schools of Clinical Sciences & Cellular & Molecular Medicine, University of Bristol, Bristol, UK
[c] Disease Dynamics Unit, Department of Veterinary Medicine, University of Cambridge, Cambridge, UK

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ABSTRACT

Aims: Rotavirus vaccines (RV) are safe and effective but demand significant investment of healthcare resource. In countries with low mortality due to rotavirus, a key component to assessing cost-effectiveness is quantifying the Health Related Quality of Life (HRQoL) lost due to rotavirus acute gastroenteritis (RVAGE).

Methods: Families with children less than six years old with gastroenteritis were recruited from attendees to Bristol Children's Hospital Emergency Department. Stools were tested for viral causes of gastroenteritis. Children's HRQoL was assessed at presentation using Health Utilities Index 2 (HUI2) with visual analogue scale (VAS). The effect of the child's illness on the HRQoL of up to two adult carers was assessed using EQ-5D-5L. Families completed a daily symptom diary to assess time to recovery and within-family transmission.

Results: 127 families consented to take part, 84(65%) had rotavirus as the cause of illness. At the time of attendance, mean paediatric HRQoL with RVAGE was 0.74(HUI2) and 0.42(VAS). Primary/secondary carer's HRQoL was 0.68/0.80 (EQ5D) or 0.70/0.79 (VAS). The mean number of QALYs lost due to RVAGE was 3.1–3.5 per thousand children and 7.7–8.7 per thousand family units.

In 52% of RVAGE families at least one other member developed a secondary case of gastroenteritis. For working parents, 69% missed work, for a mean of 2.8 days (95% CI 2.3–3.4).

Conclusions: We have found the HRQoL loss associated with RVAGE in children and their carers to be significantly higher than estimates used for all RV medical attendances in UK cost-effectiveness calculations.

1. Introduction

Rotavirus is the commonest cause of gastroenteritis in childhood and most children will have suffered from it at least once by the time they are five years old [1]. Although prevalent in all countries, the burden of rotavirus is far from equitable. In developing countries with limited access to healthcare, it is estimated to lead to the deaths of half a million children under the age of five per year [2]. In the early 1980s, vaccination was identified as the only feasible method of controlling rotavirus [3]. A worldwide concerted effort to develop a vaccine has culminated in the licensure of two safe and effective formulations in 2006. The WHO has recommended that all countries [4] introduce RV vaccine into their childhood vaccination schedules.

With the support of international agencies and discounted vaccine prices, in countries with high levels of mortality due to rotavirus, the justification for vaccination is clear. But in those countries where mortality is rare, such as in the United Kingdom (UK) [5], a more formal approach to assessing cost-effectiveness is required. In the UK new vaccines are assessed by the Joint Committee for Vaccination and immunisation (JCVI) using methods based upon the National Institute for health and Care Excellence (NICE) health technology assessment framework. Crucial to cost-effectiveness calculation is an assessment of how the disease affects health related quality of life (HRQoL). When expressed over time as Quality Adjusted Life Years (QALYs) this permits standardised comparisons between different healthcare interventions.

Cost effectiveness is often summarised by the incremental cost effectiveness ratio (ICER) which represents the cost implications per net change in QALYs. In the UK, NICE suggests that an ICER

* Corresponding author at: Bristol Royal Hospital for Children, Paediatric Infectious Diseases, Upper Maudlin Street, Bristol BS28BJ, UK. Tel.: +44 7989348023.
E-mail address: robin.marlow@bristol.ac.uk (R. Marlow).

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less than £20–30,000 per QALY is likely to be cost-effective. To fully capture the benefits of an intervention, NICE recommends that all direct health benefits (not just those for the patient) should be taken into account. Reviews have found that this is still a relatively uncommon practice, most often applied in health economic assessments of chronic diseases with informal but long term caring commitments such as dementia [6–8].

Although there have been many assessments of the clinical burden [9–11] and secondary economic costs to families [12,13], the effects of rotavirus on HRQoL have not been robustly assessed. The analyses of rotavirus vaccine cost effectiveness in the UK [14] as well as in other countries [15,16] are based on data from a single cohort of attendances to Canadian primary care [17]. All found the QALY loss of parents and children to be a major determining factor of vaccine cost effectiveness. As the severity of cases seen in primary care may not be representative of the whole spectrum of rotavirus disease, we sought to determine the effects of more severe rotavirus infection on the HRQoL of a cohort of children and their parents in the UK to help provide additional data to parameterise any future cost effectiveness analyses.

2. Methods

Children presenting with symptoms of gastroenteritis (>2 loose stools and/or >1 episode of forceful vomiting in the last 24 h) under six years of age were recruited from the paediatric emergency department of Bristol Royal Hospital for Children. After obtaining informed consent, a short questionnaire assessed childrens' and their carers' quality of life at the point of presentation to hospital and asked for how long symptoms had been present. The impact of the child's illness on the quality of life of the primary, and when present, secondary carer was assessed using the EQ5D-5L [18] using UK 3L–5L crosswalk valuation sets for valuation [19]. Children's HRQoL was assessed using the Health Utilities Index 2 (HUI2) [20] questionnaire with the addition of the EQ5D visual analogue scale (VAS) which is anchored at 0—"best health you can imagine" to 100—"worst health you can imagine". Clinical severity was assessed using the Vesikari [21] scoring system. This scale was developed for the assessment of rotavirus vaccines and combines the length and frequency of symptoms, degree of dehydration and level of treatment required to assign a score between 0 and 20. In its derivation community cohort of children with rotavirus gastroenteritis the mean score was 11 (standard deviation 3.7); conventionally severe gastroenteritis is defined as a score greater than 10. A stool sample was collected and tested for viral causes of gastroenteritis using routine clinical PCR. Families were asked to complete a daily diary card recording children's symptoms, days of missed work, childcare and healthcare use until they felt their child had returned to normal health (see appendix 1 for example page). At this point there was a final assessment of the whole family's HRQoL and the diary was returned by post.

As rotavirus is usually a transient self limiting illness with no long term effects, we assumed that a child's pre-morbid HRQoL would be the same as their HRQoL once they had recovered from the acute illness. To calculate HRQoL loss we estimated a constant linear decrease from the pre-morbid baseline at reported symptom start to a nadir at point of presentation to the emergency department and then constant improvement to return to baseline by the reported end date (Fig. 1).

Any incomplete domains were scored as perfect health. Non parametric distributions were compared using the Mann–Whitney *U* test. Confidence intervals for the mean were derived from 1000 bootstrap iterations. Statistical analyses were performed using R [22].

The study was approved by the South West Central Bristol NRES ethics committee (REC12/SW/0359) and funded through a University Hospitals Bristol NHS Foundation Trust Clinical PhD studentship.

3. Results

129 families consented to take part in the study, 118 (91%) completed the initial questionnaire and 59 (46%) returned the diary. Of the 84 (65%) found to be rotavirus positive, 77 completed the initial questionnaire and 48 returned the diary. Childrens' median age was 14 months (IQR 10–22 m) and 52% were male. Children had been ill for a mean 4 (95%CI 3.5–4.6)/median 4 (IQR 2–5) days before attending the emergency department. 41 (53%) children required hospital admission. The mean Vesikari score on attendance was 11.2 (SD 2.5 range 5–18) with 66% categorised as severe (score greater than 10).

Table 1 shows the mean HRQoL of children and carers at presentation and at final assessment in those who returned diaries. At time of presentation to the emergency department, the main domains reported to be affected in children were emotion and

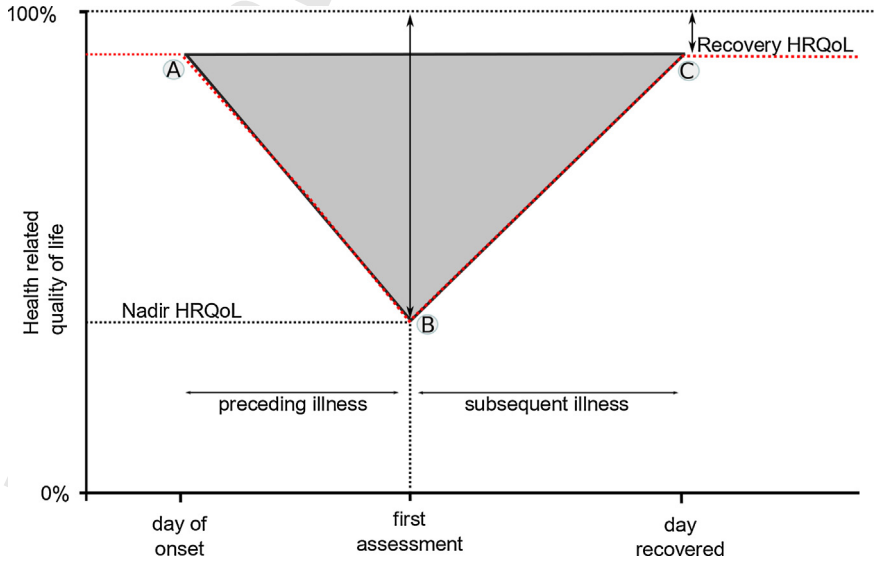

Fig. 1. Graphical representation of our method of estimating QALY loss. Point A represents disease onset, point B assessment in the emergency department at nadir HRQoL. Point C, recovery HRQoL—is assumed to represent pre-morbid baseline. Shaded area represents the QALY loss due to rotavirus gastroenteritis.

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