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Parental preferences for rotavirus vaccination in young children: A discrete choice experiment

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ABSTRACT

Objective: This study aimed to identify characteristics that affect parental decisions about rotavirus vaccination, to determine the relative importance of those characteristics and subsequently to estimate vaccination coverage for different implementation strategies.
Methods: A Discrete choice experiment (DCE) questionnaire was sent to the parents of 1250 newborns aged 6 weeks (response rate 37.3%). Mixed-logit models were used to estimate the relative importance of the five included rotavirus vaccine and implementation characteristics; vaccine effectiveness, frequency of severe side effects, protection duration, the healthcare facility that administrates vaccination and out-of-pocket costs. Based on the utility functions of the mixed-logit model, the potential vaccination coverage was estimated for different vaccine scenarios and implementation strategies.
Results: All characteristics, except for healthcare facility that administrates vaccination, influenced parental willingness to vaccinate their newborn against rotavirus. Parents were willing to trade 20.2 percentage points vaccine effectiveness for the lowest frequency of severe side effects (i.e., 1 in 1,000,000) or 20.8 percentage points for a higher protection duration. Potential vaccination coverage ranged between 22.7 and 86.2%, depending on vaccine scenario (i.e., vaccine effectiveness and protection duration) and implementation strategy (i.e., out-of-pocket costs and healthcare facility that administrates vaccination).
Conclusions: When deciding about vaccination against rotavirus, parents are mostly driven by the out-of-pocket costs, vaccine effectiveness, protection duration, and frequency of severe side effects. The highest vaccination coverage is expected for a vaccine with high effectiveness and protection duration that is implemented within the current National Immunization Program context. Implementation of the same rotavirus vaccine in the free market will result in lowest coverage.

1. Introduction

Although two rotavirus vaccines, RotaTeq and Rotarix, have been readily available since 2006, vaccination of newborns against rotavirus is not common practice in many countries, including the Netherlands. Rotavirus is a highly contagious pathogen that is the leading cause of gastroenteritis worldwide [1]. Especially in young children (under the age of two), rotavirus causes high morbidity [2,3]. Worldwide about 95% of all unvaccinated children will experience at least one infection before the age of five [4]. Peak incidence is reported in children aged 4–26 months [4,5]. Based in the results of a Dutch prospective cohort study it is estimated that one in every two unvaccinated Dutch children will suffer from a symptomatic rotavirus related gastroenteritis before the age of five [6,7]. The currently licensed live-attenuated oral vaccines confer up to 94–96% protection against severe rotavirus related complaints and up to 60–80% protection against rotavirus disease of any severity [8–11]. Both vaccines are recommended for use in infants by the WHO and have been implemented in several countries (e.g., US, Australia, Belgium, Finland, and recently the UK), where a substantial decrease in rotavirus related GP-visits and hospitalizations was observed [12].

In several countries, among which the Netherlands [13], debate is ongoing whether to implement this vaccine in the National Immunization Program (NIP). This is partly because of inconsistent results of research studying the cost-effectiveness of introducing

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this vaccine [14–17]. In countries that have not yet decided to include rotavirus vaccination in the NIP, the vaccines are available on the private market. Countries that consider adding rotavirus vaccination to their NIP in the (near) future, will benefit from greater knowledge on parental preferences with regard to vaccine safety and efficacy profiles as well as different implementation strategies (i.e., how the vaccine will be administered to their child), and how these influence the willingness of parents to vaccinate their newborn against rotavirus. Such information can guide their decisions concerning the strategy they might use for the introduction of the vaccine, and may serve as a starting point for efficient communication when the vaccine is introduced. Moreover, in countries that already implemented rotavirus vaccination, this information might provide guidance for policy makers to optimize the vaccination regime.

The aim of this study was to determine parental preferences with regard to rotavirus vaccination for their newborn. A secondary aim was to determine the potential vaccination coverage for different vaccine scenarios (based on vaccine characteristics) and different ways to implement the vaccine (based on implementation characteristics such as vaccine costs).

2. Materials and methods

Discrete choice experiments (DCEs) are increasingly being used to determine the relative importance of different interventions or medical treatment characteristics. DCEs may also be used to estimate participants' willingness to pay as well as to estimate potential participation rates (e.g., potential vaccination coverage) [18–20]. The random utility theory is the basis of this method, which assumes that any intervention or treatment can be described by its characteristics or "attributes" (such as vaccine effectiveness). The individual's preference for an intervention or treatment is determined based on the levels (e.g., effectiveness of 50% versus 80% versus 95%) of those attributes [18–20]. Scenarios are constructed by varying the levels of the attributes. Respondents are provided with a series of "choice tasks" that consist of at least two scenarios. They have to choose the scenario they prefer most within every choice task.

2.1. Attributes, levels, and DCE design

To construct the current DCE, possible attributes and levels were identified from previously published literature [21–28], expert interviews (i.e., pediatrician with a specific interest in rotavirus infections and a scientist with a specific interest in vaccination behavior), and four group interviews with a total of 25 parents of newborns. These group interviews were conducted using the nominal group technique (NGT) [29], which entails a ranking system as opposed to regular focus group techniques. Finally, five attributes were selected for this DCE (Table 1).

Using Ngene 1.0 (Choice Metrics, 2011) software, a D-efficient design was developed [30,31], which minimizes the sample size and the number of choice tasks every respondent is asked to complete based on optimizing the variance–covariance matrix. The DCE consisted of 18 unique choice tasks. These were divided into two sets of nine choice tasks, and each set of nine choice tasks was randomly distributed among half of the study population. Before participants were asked to complete these choice tasks, they received detailed information on the meaning of all attributes and levels as well as an explanation on how to complete a choice task. Here it was explained very clearly to parents that protection against a rotavirus infection is of specific importance when children are younger than two years of age. An example of a choice task of the current study is displayed in Table 2.

The draft questionnaire was pilot tested among a convenience subgroup (n = 48) of our study population. Four of these pilot tests were "think aloud" tests, during which a researcher was present when the participant completed the questionnaire, reading out loud. This pilot test showed that correct wording was used, the target population understood the attributes, levels, and choice tasks and provided the attribute estimates that served as priors for the design of the final DCE questionnaire. Additionally, based on these pilot-test data, sample size calculations were performed to ensure that significant differences for each attribute could be detected at a 5% level.

2.2. Questionnaire

The questionnaire consisted of two parts. The first section of the questionnaire comprised of 30 questions on demographics such as gender, age, educational level, and ethnicity. Thereafter, questions pertained to information on children's siblings, health status, parental view on the Dutch NIP, but also to their attitude, social norm, self-efficacy, perceived severity of and perceived susceptibility for rotavirus infection (by presenting parents with different theorems). The second part of the questionnaire consisted of the actual DCE as explained above.

2.3. Study population

It is advised to administer the first dose of the rotavirus vaccine when newborns 6 weeks of age, which is around the same age as during which parents have to decide whether to participate in the regular Dutch National Immunization Program (NIP). Since these parents are in the decision-making phase about vaccination according to the NIP, they were selected as the target population for this study. The target population was identified via Praeventis, which is a national vaccination register that registers the vaccination status of all Dutch newborns. A random sample of the parents of 1250 newborn babies aged 6 weeks was selected to receive a questionnaire. Due to confidentiality agreements with Praeventis, no reminder letters could be sent. For this reason no non-response information was available. The Institutional Review Board of the University Medical Center Utrecht advised that formal testing by a medical ethical committee was not necessary, as parents were only required to complete an anonymous questionnaire once, which is in accordance with the guidelines laid down in the Declaration of Helsinki.

2.4. Statistical analysis

Data were analyzed using Mixed-logit (MIXL) models to account for preference heterogeneity and to adjust for the multilevel structure of the data. Respondents with >10% missing answers on their choice tasks were excluded from the analysis ($n = 12$). All attributes were tested for linearity, afterwards non-linear attributes were recoded using effect codes [32], which resulted in Eq. (1).(1)

$$U = V + \varepsilon = \beta_{0i} + \beta_1 * \text{vaccine effectiveness} + \beta_2 * \text{frequency of severe side effects}_{1\text{ in }10{,}000} + \beta_3 * \text{frequency of severe side effects}_{1\text{ in }100{,}000} + \beta_4 * \text{protection duration}_{3\text{ years}} + \beta_5 * \text{protection duration}_{6\text{ years}} + \beta_6 \text{healthcare facilitychild welfare center} + \beta_{7_i} * \text{out} - \text{of} - \text{pocketcost}_{€30} + \beta_{8i} * \text{out} - \text{of} - \text{pocket cost}_{€140} + \varepsilon$$