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German travelers' preferences for travel vaccines assessed by a discrete choice experiment

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ABSTRACT

Background: Many travelers to regions with endemic infectious diseases do not follow health authorities' recommendations regarding vaccination against vaccine-preventable infectious diseases, before traveling. The determinants of individual travelers' decisions to vaccinate before traveling are largely unknown. This study aimed to provide this information using a discrete choice experiment (DCE) administered to four types of German travelers: (1) business travelers; (2) travelers visiting friends and relatives (VFR); (3) leisure travelers; and (4) backpackers.

Methods: A DCE survey was developed, pretested and administered online. It included a series of choice questions in which respondents chose between two hypothetical vaccines, each characterized by four disease attributes with varying levels describing the of risk, health impact, curability and transmissibility of the disease they would prevent (described with four disease attributes with varying levels of risk, health impact, curability and transmissibility), and varying levels of four vaccine attributes (duration of protection, number of doses required, time required for vaccination, and vaccine cost). A random-parameters logit model was used to estimate the importance weights each traveler type placed on the various attribute levels. These weights were used to calculate mean monetary equivalents (MMEs) of changes in each attribute (holding all others constant) and of hypothetical disease-vaccine combinations.

Results: All traveler types' choices indicated that they attached the greatest importance to the risk and health impact of disease and to the vaccine cost whereas the other disease and vaccine attributes were less important for their decisions about travel vaccines. An option of not choosing any of the vaccine-pairs presented was rarely selected indicating that travelers' generally prefer to be vaccinated rather than not. The MMEs of changes in vaccine attributes indicated a very high variability between the individual travelers within each type.

Conclusions: The travelers' responses indicated strong preferences for selecting vaccination rather than opting out of vaccination, and disease risk, health impact and vaccine cost were the most important features for vaccine choice.

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1. Introduction

International travel has increased markedly over recent years reaching a maximum of 1.2 billion arrivals in 2015 with an annual increase of 4.4% since 2014 [1]. Travelers face the risk of exposure to infectious agents they are not immune to. The risk of exposure varies considerably across regions but is generally highest in developing countries with endemic infectious diseases of varying severity. Susceptible travelers exposed to infectious diseases may become ill themselves and may, in case of diseases transmittable from person-to-person and vector-borne diseases, also contribute to the disease spread, both while still traveling and upon returning home [2–6].

Health authorities around the world issue recommendations for preventive actions to take before traveling to particular regions of the world, including vaccination against vaccine-preventable infectious diseases [7,8]. Previous studies of travelers' attitudes

Abbreviations: CI, confidence interval; DCE, discrete choice experiment; MME, mean monetary equivalent (or willingness-to-pay); OR, odds ratio; RPL, random parameter logit; SM, supplementary material; VFR, visiting friends and relatives.

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and actual practice with regard to getting recommended travel vaccines (e.g., [9–16]) showed that relatively few travelers sought travel health advice, had correct information about travel health, and had adequate protection against the risks of infectious diseases. However, there is limited understanding of the factors that actually determine individual travelers' decisions to vaccinate before traveling.

The present study aimed to improve the understanding of the importance of selected determinants of travelers' vaccination choices by performing a discrete choice experiment (DCE). While DCE methods are recognized as well suited to identify and assess the relative importance of various dimensions of health outcomes and healthcare interventions and also have been used to study preferences for vaccination [17–21], this is the first DCE study of travelers' preferences for travel vaccines. The study is founded on several maintained assumptions. In particular, we assume that choosing to vaccinate against a particular infectious disease is determined by attributes both of the disease (such as its severity and curability) and the vaccine (such as the durability of protection and cost). It is further assumed that travelers are willing to make trade-offs among these disease and vaccine attributes like being willing to pay more for a vaccine protecting against a severe disease than for one against a minor, self-limiting ailment.

Another aim was to examine preferences for travel vaccines among different types of travelers as there is evidence that attitudes toward vaccines and actual vaccination behavior vary across traveler types [22–25]. The study was also designed to examine whether vaccine preferences and trade-offs differ systematically between four distinct types: (1) business travelers; (2) travelers visiting friends and relatives (VFR); (3) leisure travelers; and (4) backpackers.

Germany was selected as the study location because of its central position in Europe and because it is the most populous European country with a large pool of international travelers [26].

2. Materials and methods

In DCE studies, respondents are posed a series of choice questions, each consisting of two alternative options and asked to indicate their preferred option. The options are described in terms of attributes with different levels and analysis of the stated choices yields estimates of the relative importance of each attribute level. We followed good research practice [27,28] to develop a DCE survey.

2.1. Survey development

The attributes and levels selected were based on the characteristics of disease risks facing international travelers and travel vaccines. The four disease attributes were the risk of getting the disease without vaccination, its severity, transmission mechanism and curability. The four vaccine attributes were the duration of protection, the number of doses, the time span needed for vaccination and its cost. Table 1 presents the attributes and levels.

The respondents were asked to imagine that they would soon be traveling to an area with an endemic infectious disease and that health authorities recommended travelers following the planned itinerary to vaccinate. They were then posed a series of choice questions, each presenting two hypothetical disease-vaccine profiles combining different levels of the disease and vaccine attributes. For each choice question, the respondents were asked to choose one option. After each choice question, the respondent was asked an "opt-out" question - i.e., whether they preferred the selected vaccine or no vaccine - in order to explore their willingness to get travel vaccines. An example choice question is shown in Fig. 1.

Table 1
Disease and vaccine attributes and levels.

Variable	Attribute	Attribute levels	
Disease	Chance of contracting the disease without vaccination	Low (up to 1 person out of 100,000 people who visit a country for one month will get the disease)	
		Medium (2 to 99 persons out of 100,000 people who visit a country for one month will get the disease)	
		High (at least 100 persons out of 100,000 people who visit a country for one month will get the disease)	
	Health impacts of the disease	Full recovery after 1–2 weeks of symptoms	
		Chance of long-term health problems	
		Chance of death	
	How disease is spread	Not transmissible	
		Person-to-person	
	Availability of curative treatment	Available	
		Not available	
Vaccine	Duration of protection	30 years	
		10 years	
		2 years	
	Number of doses	1 dose	
		2 doses	
		4 doses	
	Number of months required for vaccine	Less than 1 month	
		2 months	
		6 months	
	Cost for all doses	Narrow cost range	Wide cost range
		€0	€0
		€50	€50
		€200	€500 or €625[a]

[a] The respondents were divided into two groups presented with a different range of vaccine costs to perform the scope test which seeks to determine if respondents pay attention to the absolute amounts or rather perceive the costs in qualitative terms, such as low versus high. Based on the responses of the first 34 responders, the highest cost level in the wide cost range was changed from €500 to €625 in order to improve the quality of the estimates of the monetary equivalents.

The choice questions were pretested during semi-structured in-person interviews with a convenience sample of 15 individuals with previous or planned international travel, to (1) ensure that the attributes were understood, were of concern, and that important dimensions had not been omitted; (2) assess respondents' acceptance of the attributes and levels; (3) assess respondents' willingness to make trade-offs between the disease-vaccine profiles; and (4) test the wording of the questions and their perceived difficulty.

The final survey instrument was revised according to the findings of the pretest and included the following: screening questions, questions about previous and planned travel vaccination, discrete choice experiment questions, and questions about travel health, demographic and socioeconomic characteristics. The respondents were asked to assume that the hypothetical vaccines had been demonstrated to be equally safe and effective.

2.2. The experimental design of the choice sets

The experimental design serves to develop a set of choice questions that generates a maximum of information on trade-offs between attributes and levels to obtain a unique set of preference

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