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## Poor knowledge of vaccination recommendations and negative attitudes towards vaccinations are independently associated with poor vaccination uptake among adults – Findings of a population-based panel study in Lower Saxony, Germany

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## ABSTRACT

**Objectives:** The aims of this study were to (a) assess knowledge of official vaccination recommendations and attitudes towards vaccinations among adults and (b) examine their association with vaccination uptake among adults.

**Methods:** This study was part of the HaBIDS study (Hygiene and Behaviour Infectious Diseases Survey), which is an online panel established in March 2014 in Lower Saxony, Germany with males and females aged between 15 and 69 years ( $n = 2379$ ). Every few months, participants completed questionnaires on different aspects of infectious diseases. In September 2014, knowledge of vaccination recommendations, attitudes towards vaccinations and information on uptake of vaccinations in the last 10 years (practice) were collected using a knowledge-attitude-practice (KAP) questionnaire. Multiple correspondence analysis was applied to identify underlying structures in each KAP domain and fractional polynomial regression analysis to examine the associations of knowledge and attitudes with vaccination uptake.

**Results:** Of the 2379 panel members, 1698 (71%) completed the KAP questionnaire on vaccinations. The majority of participants (80%) knew that the vaccine against diphtheria and tetanus should be administered every 10 years. Regarding other recommendations, the proportion of correct answers varied between 35% and 60%. 82% of participants agreed that adult vaccinations should be mandatory for selected groups such as health care workers and 40% stated that vaccinations should be mandatory for all adults. For the different vaccines, the odds of being unvaccinated were 1.5- to 5-times higher among participants with poor knowledge of vaccination recommendations compared to participants with good knowledge. Participants with negative attitudes towards vaccinations were also more likely to be unvaccinated.

**Conclusions:** Efforts should be undertaken to improve knowledge of official vaccination recommendations in the general population and reduce common misconceptions about vaccinations. This information can be provided during general practitioner visits or through media campaigns.

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**Abbreviations:** HaBIDS, hygiene and behaviour infectious diseases survey; KAP, knowledge-attitudes-practice; MCA, multiple correspondence analysis; RKI, Robert Koch Institute; STIKO, standing committee on vaccination.

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### 1. Introduction

Adult vaccinations recommended by the German Standing Committee on Vaccination (STIKO) of the Robert Koch Institute (RKI) can be divided into two broad groups; (1) those for the general population and (2) those for specific risk groups such as individuals with underlying chronic diseases (e.g. pneumococcal vaccination for individuals with diabetes mellitus, chronic heart

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or lung disease or immune compromised individuals), individuals with occupational risks (e.g. varicella vaccination for health care workers) or travellers in high endemic regions (e.g. vaccination against meningococcal infection for Hajj travellers) [1]. In addition to general recommendations, there are specific recommendations regarding booster vaccination and catch up programs. Regular booster doses against diphtheria and tetanus are recommended every 10 years for adults in the general population [1]. A single booster dose of pertussis vaccination is recommended since 2009 for all adults and should be administered with the next diphtheria and tetanus vaccination. There is a recommendation for measles, mumps and rubella vaccination for individuals born after 1970 and not vaccinated previously. There is also a recommendation for administering inactivated polio vaccine for adults who were previously not vaccinated or vaccinated incompletely. The STIKO recommends annual vaccinations against seasonal influenza infection and vaccination against pneumococcal infection for individuals over 60 years of age.

Available estimates of vaccination coverage among adults show that they are lower than coverage estimates among children in Germany [2,3]; the highest coverage was reported for tetanus vaccination (70–75%) and the lowest for pertussis vaccination (8%). In contrast, the coverage of tetanus and pertussis vaccinations for German children is >90% [4]. It is not well known which factors lead to a poor vaccination status of German adults. Decision to be vaccinated is a complex process influenced by many factors: contextual influences, individual and group influences as well as vaccine/vaccination-specific influences [5]. Understanding these influences may help to develop tailored interventions to improve vaccination coverage in the general adult population. Nichter has differentiated active demand for vaccinations (adherence by an informed public) from passive acceptance of vaccinations (compliance by a public which yields to recommendations and social pressure) [6]. Jarrett et al. reported in a systematic review that the interventions with the largest observed increases (>25%) in vaccine uptake were those that aimed to increase vaccination knowledge and awareness [7]. In studies of parents' choice to get their children vaccinated, this choice was often based on conformity or following what is recommended [8]. Knowledge of current vaccination recommendations is, thus, important in increasing vaccine uptake. This association has already been shown for influenza vaccination in Austria and the United States [9,10]. Betsch et al. found out that knowledge seems to be an indirect driver of vaccination intentions [11].

A few available studies in Germany examined the effect of socioeconomic factors on selected vaccinations among adults. For example, Bödicker et al. demonstrated age-, sex- and regional differences in coverage of tetanus, pertussis and influenza vaccinations [2]. In addition, Böhmer et al. showed that individuals with a lower socioeconomic status, those with a migration history and those not caring about personal health were less likely to be vaccinated against tetanus and influenza [12]. Recently, Klett-Tammen et al. showed that uptake of influenza vaccination among older German individuals was associated with attitudes towards vaccinations (perceived importance of the influenza vaccination, vaccination due to recommendation by physician or family member), whereas pneumococcal vaccination was associated with the knowledge of vaccination recommendation [13]. In this study, attitudes towards one vaccine did not influence uptake of other vaccines. In contrast to other studies in Germany, which dealt with single or a few vaccinations and included only specific population groups such as the elderly, the present study provides a more complete picture including a broad range of vaccinations recommended for the general adult population. The study focuses on influences arising from personal perception of vaccines, particu-

larly knowledge and attitudes. Thus, the aims of the study were to (a) assess knowledge of official vaccination recommendations and attitudes towards vaccinations among adults and (b) examine their association with adult's vaccination uptake.

## 2. Materials and methods

### 2.1. Study design and sampling

This study was part of the HaBIDS study (**H**ygien**e** and **B**ehav**i**our **I**nfectious **D**iseases **S**urvey), which is a longitudinal online panel aiming to assess hygiene practices and behaviour regarding various infectious diseases in the federal state of Lower Saxony, Germany. The detailed description of the applied methodology is presented elsewhere [14,15]. In brief, around 27,000 males and females between 15 and 69 years of age were invited to participate in the panel. Potential participants were randomly selected from the population registries in urban (Braunschweig, Salzgitter and Wolfenbüttel) and rural areas (Vechta) and invited to participate in the panel between January and April 2014. Each month, participants completed questionnaires on different aspects of infectious diseases. Individuals were given an opportunity to select between two modes of participation (web- or paper-based) in Braunschweig and Vechta while in Wolfenbüttel and Salzgitter only a web-based participation was offered. The participants who selected web-based approach received monthly a total of nine questionnaires on different topics between March and November 2014. The participants of the paper-based approach received two longer questionnaires covering the themes of the nine online questionnaires. The 2379 individuals who had consented to participate in the panel (8.9% initial response rate) received the questionnaire on adult vaccinations in September 2014. Seventy-one percent of the panel members (n = 1698) returned this questionnaire.

### 2.2. KAP questionnaire on adult vaccinations

The questionnaire on adult vaccinations was designed as a knowledge-attitude-practice (KAP) survey. The questions were developed for the study aims or adapted from the literature [16]. Knowledge of official recommendations on adult vaccinations was assessed by six statements (true as well as false statements) with three answer options: 'true', 'untrue' and 'don't know'. We used different questions to assess the attitudes towards vaccinations. First we asked about attitudes towards tetanus and influenza vaccination because these two vaccines are known to be perceived differently [17]. The following three questions were used: 'What is your general attitude towards vaccinations?', 'What is your attitude towards vaccination against tetanus?' and 'What is your attitude towards vaccination against influenza?' with five response options: 'supportive', 'slightly supportive', 'slightly negative', 'negative' and 'don't know'. In addition, eight items were used to assess various attitude aspects with five categories ('strongly agree', 'agree', 'disagree', 'strongly disagree', and 'don't know'). Uptake of vaccinations (practice domain) was assessed for each of the following vaccinations: diphtheria, tetanus, pertussis, poliomyelitis, hepatitis B and pneumococcus by the question 'Were you vaccinated against the following infectious diseases in the last 10 years?' with three answer possibilities for each vaccination ('yes', 'no' and 'don't know').

### 2.3. Socio-demographic and health-related data

Basic socio-demographic data (e.g. sex, age, education level, and country of birth) and health-related data (e.g. perceived health

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