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Research paper

# Development and validation of Attitudes Towards Vaccinations Scale (ATVS) – part 1



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## ABSTRACT

**Background:** Since infectious diseases can lead to serious consequences among older people, clinicians should be able to motivate older patients effectively to uptake vaccination. However, there are few instruments assisting them in this challenge. This article is the first part of a series of two articles proposing a scale facilitating assessment of perception of advantages and disadvantages of vaccination among older people.

**Methods:** This article describes the process of development and validation of the Attitudes Towards Vaccination Scale (ATVS). The development and validation phases were performed on two samples of patients aged 60 and older in outpatient geriatric clinic and family doctor's outpatient clinics ( $n = 103$  and  $n = 85$ , respectively). The statistical analysis of the material gathered in both phases involved exclusion of the overlapping items, based on analysis of correlation matrix, analysis of theoretical validity, including its factor structure and meaning of subscales, as well as reliability.

**Results:** The final version ATVS has a two-dimensional structure: it consists of two 4-item subscales, namely positive attitude (PA) subscale and negative attitude (NA) subscale. The correlation between subscales equalled  $-0.58$ . The reliability of PA-subscale equalled 0.83 and NA subscale equalled 0.70. Reliability of total ATVS score equalled 0.84.

**Conclusions:** We developed and validated a short tool which can be applied in a clinical practice to guide the assessment of older people's attitudes towards vaccination and their education about immunization. The second part of the series of articles provides an in-depth understanding of the theoretical relations of the construct measured by ATVS with psychological concepts.

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## 1. Introduction

Prevention of infectious diseases, such as flu, pneumonia and herpes zoster, is important for maintaining health in older age. Studies conducted in Japan in 2007–2008 revealed that the common factors contributing to resignation from vaccination is uncertainty of vaccine's safety and, especially for older adults, its possible complications [1]. Similar results were obtained in the study in New York conducted on asthmatic patients in 2004–2005. It revealed that individuals who were more afraid of complications, i.e. fever, pain or infection, relatively rarely wanted to have vaccination in comparison with the patients who had no fear of side effects [2]. Numerous studies confirmed that lower interest in vaccination among older adults relates to the

lack of knowledge about the vaccinations, the belief that vaccination is not sufficient, and the fear against side effects as well as possible complications after the vaccination. They also suggest that high self-assessment of health and own immunity may result in neglecting the potential danger associated with infections. The high cost of the vaccine was also reported as an important barrier [3–6].

For the clinical practice, it is important to understand the reasons for the decisions of older adults about accepting or not accepting vaccination. Therefore, the development of a simple tool to assess the patient's attitude towards vaccination would be helpful for clinicians. An analysis of a patients' intention based on their positive or negative attitudes towards vaccination may guide a physician in motivating the patient towards a positive decision. Thus, the aim of this study was to develop and validate the scale measuring positive and negative attitudes toward vaccinations in the age group above 60.

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## 2. Methods

### 2.1. Setting and sample

The study consisted of two phases. The first one was devoted to the development of the new scale, the second was focused on its validation. Phase one was conducted in spring 2013 in the outpatient geriatric clinic in a big city in Poland on the development sample consisting of 103 patients aged 60 years and older (mean = 68.6; SD = 5.5). The second phase was carried out in autumn 2013 on the validation sample consisting of 85 patients, out of whom 45 were recruited in a family doctor's outpatient clinic in a large Polish city, and 40 in another family doctor's outpatient clinic in a small rural community. All patients from the validation sample were of age 60 years and more (mean = 70.1; SD 7.5). In both study phases, inclusion criteria were all patients at age of 60 and older, who were appointed to outpatient clinic on the day of our study conducting and gave informed consent to be interviewed. A physician working in the outpatient clinic made pre-screening excluding patients with cognitive impairment based on his clinical diagnosis.

### 2.2. Study design

The recent systematic literature review showed that the most important factors related to vaccine uptake among older adults are their attitudes towards vaccination, recommendations of health-care workers, side effects and effectiveness of the vaccine, as well as perceived susceptibility [7]. We developed the Attitude Towards Vaccination Scale (ATVS) referring to these factors. The initial pool of 11 items, each with five possible answers on a Likert's scale, was surveyed in the development sample. Statistical analysis involved exclusion of the overlapping items, analysis of theoretical validity, including its factor structure and meaning of subscales, as well as reliability. The same scheme of analysis was repeated using the data from the validation sample to confirm theoretical validity of the scale. Before the start of the validation phase, the initial item pool had been extended by one additional item to provide possibility of obtaining two subscales with equal number of items and comparable reliability of both subscales.

### 2.3. Statistical analysis

#### 2.3.1. Theoretical validity

The correlation matrix was analysed for both development and validation phases separately, and items with salient correlations ( $\geq 0.7$  estimated using Pearson  $r$  correlation coefficient) were excluded from respective item pools to avoid including redundant items in the scale [8]. The factor structure of the scale was assessed using Principal Component Analysis (PCA) with the application of non-rotated and rotated (using Varimax rotation) solutions. The criteria for the number of extracted factors were an eigen value of greater than 1 and theoretical interpretation of the factors.

#### 2.3.2. Reliability

We applied the Cronbach alpha coefficient to assess the reliability of the ATVS and its subscales in terms of the Classical test theory in aspect of internal consistency. We assumed the value of the reliability coefficient equal to or higher than 0.7 as acceptable for group comparison, and the value of 0.9 or greater as desired for individual comparisons [9]. The discrimination power of the items was measured as the item-total correlation, after correction for the overlap i.e. after excluding a particular item from the total score of the subscale including that item, or from the total score respectively.

We conducted statistical analysis using IBM SPSS 22 for Windows.

## 3. Results

### 3.1. Study samples characteristics

We provided basic characteristics of study samples of patients participating in the development and validation phase in Table 1. Both samples (development and validation one) differed statistically significantly in terms of financial status ( $P < 0.010$ ). Moreover, in the validation sample there were significant differences in the education level of studied patients depending on rural or urban place of their residence ( $P < 0.001$ ). Yet, we did not find significant differences between the samples as concerns gender and age of the study participants.

### 3.2. Results of the development phase

The initial pool of items is presented in Table 2. The correlation matrix showed that there were no items with salient correlations. PCA extracted two factors with eigen values of greater than one, explaining together 58.8% of total variance of analysed set of items. The comparison of the amount of the variance explained by the extracted factors (49.7% and 9.1%, respectively) suggested an unidimensional structure of the scale. The non-rotated solution of PCA revealed that all items intended to measure patients' attitudes towards vaccinations correlated stronger than 0.5 with the first latent variable explaining its variance, and not stronger than 0.5 with the second one, supporting the interpretation of explained variance ratio. However, Varimax rotated PCA solution led to extracting two factors, explaining 32.4% and 26.4% of the total variance, respectively. They indicate two domains covered by the scale: the domain of positive attitudes (PA-subscale) towards vaccinations (6 items: A,B,C,D,E,F), and the domain of negative attitudes (NA-subscale) towards vaccinations (5 items: G,H,J,K,L). The former indicates the perceived advantages of vaccination and the latter scepticism toward taking vaccinations.

The internal consistency reliability equalled 0.87 for the PA-subscale, 0.77 for NA-subscale, and 0.89 for the total score. The discrimination power of the items measured as item-total correlation (after correction for overlap) ranged between 0.65 and 0.73 for the PA-subscale and between 0.54 and 0.64 for the NA-subscale, with the lowest one equal to 0.41 for the item L. The value of the Cronbach alpha coefficient for the scale

**Table 1**

Sociodemographic characteristics of groups of older people studied during development and validation phases.

Characteristics of the sample	Development phase		Validation phase	
	n = 103	%	n = 85	%
<i>Gender</i>				
Men	30	29.1	23	27.1
Women	73	70.9	62	72.9
<i>Education</i>				
Primary	14	13.6	20	23.5
Vocational	35	34.0	24	28.2
Secondary	44	42.7	30	35.3
University	10	9.7	11	12.9
<i>Place of residence</i>				
City	103	100.0	45	52.9
Rural area	0	0	40	47.1
<i>Self-assessment of financial status</i>				
Bad or very bad	10	9.7	18	21.2
Fair	70	68.0	40	47.1
Good and very good	23	22.3	27	31.8

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