

The Reliability and Validity of Turkish Version of the School-based Asthma and Allergy Screening Questionnaires

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Abstract

The reliability and validity of the Turkish version of the school-based asthma and allergy screening questionnaire

Background: Asthma is an important public health problem affecting children, causing school absenteeism and hospitalization. The aim of this study is to assess the validity and reliability for diagnostic accuracy of the Turkish version of the asthma and allergy screening questionnaire.

Methods: This study included primary and secondary school students from grades 2 to 7, and their parents or caregivers. For validity, 40 children with asthma and 39 children with allergy diagnosed by the questionnaire were used to determine the sensitivity, and specificity was calculated by using the data of 100 children without asthma and allergies. For reliability, the Spearman correlation was used for dependent groups, for validity, the Receiver Operating Characteristic (ROC) analysis was used.

Results: When the questionnaire cut-off point was 2/3 for asthma, according to the student and parent form, the sensitivity was 80.0% and 82.5%, and the specificity was 56.6% and 76.8%, respectively. When the questionnaire cut-off point was 0/1 for allergies, according to the student and parent questionnaire, the sensitivity was 74.4% and 84.6%, and the specificity was 66.3% and 54.2%, respectively. The reliability of the asthma and allergy questionnaires test-retest correlation values (≥ 0.68) of both questionnaires were found to be statistically significant.

Conclusion: According to the Turkish questionnaire of the students and their parents, questionnaire sensitivity for asthma and allergy was similar in proportion to the original questionnaire. The Turkish version of the questionnaire can be used for asthma and allergy screening in schools.

Introduction

Asthma is a chronic disease that is characterized by varying degrees of airway obstruction, airway inflammation, airway hypersensitivity, wheezing, shortness of breath and cough. Asthma causes a non-microbial inflammation of the airways. Therefore, the airway wall is swollen and edematous. This makes the lungs hypersensitive to stimuli (1). In recent years, the incidence of asthma has increased, especially in children. Asthma ranks third in the 5–9 age group in terms of Years Lost due to Disability (YLD) (2). Asthma symptoms are most common (> 20%) in children aged 13–14 in Australia, Europe, North America and some parts of Latin America. Asthma has the highest burden on people aged over 60 and on children who are aged between 5–14 y. (3). The median age in the diagnosis of asthma is 4 years. However, more than 20% of children diagnosed with asthma have symptoms of asthma in the first years of life (4).

Asthma is an important public health problem affecting children, causing school absenteeism and hospitalization. Kuyucu et al. (2006) indicated that the prevalence of allergic rhinitis in school children aged 9–11 was 36.3% and at least one allergen was found to be positive in 20.4% of patients with rhinitis. In a study conducted among children aged 7–12 in Edirne, Turkey, the prevalence of asthma

increased from 5.8% in 1994 to 12.1% in 2004, and allergic rhinitis increased from 4.7–7.2% in the same period. (5). In terms of children, loss of school days, decrease in academic success and severely restricted daily activities are the most important costs (6, 7).

In the literature, it is seen that many studies conducted in Turkey for asthma screening scales are not national. The prevalence of asthma in children and adolescents in Brazil was determined to be 22% by an asthma screening scale which was found to be valid and reliable (8). In another similar study, it was emphasized that the prevalence of asthma in children aged 5–15 was 18.8%, and that the scale was a valid tool for the detection of asthmatic children (9). In the school-based asthma screening study, the use of the scale was reported to be a good method to identify students who were not diagnosed with asthma before. The severity of asthma can be better understood if further studies are conducted. In Turkey, there is not enough statistical data revealing the prevalence of asthma in children. Therefore, there is a need for studies in this field.

A scale developed by the World Health Organization (WHO) and The International Study of Asthma and Allergies in Childhood (ISAAC) is used to detect asthmatic students (10). However, the application of the ISAAC scale needs video image evaluation, thus, it is a difficult scale to apply and evaluate. On the other hand, Redline et al. (2004) developed a School-Based Asthma and Allergy Screening Questionnaire in the United States. That is easy to implement and evaluate children aged 7–13 from different ethnic and socioeconomic groups. Within the scope of school health services, the use of a valid and reliable questionnaire by teachers and primary health care professionals can contribute to the early detection and timely treatment of children with asthma, while reducing direct and indirect costs. This study aimed to investigate the validity and reliability for diagnostic accuracy of the Turkish version of the ‘School-Based Asthma and Allergy Screening Questionnaire’.

Methods

This is a diagnostic accuracy study. Permission for this study was obtained from the Provincial Directorate of National Education, and ethics committee approval was obtained from Bozok University Faculty of Medicine Ethics Committee. Ethics committee decision date and number: 03 June 2014–12/9. The students and their parents or caregivers were informed about the research and their written consents were obtained. Permission for use of the School-Based Asthma and Allergy Screening Questionnaire was obtained from the journal (11). The research was conducted in accordance with the rules and ethic codes mentioned in the Helsinki Declaration.

Participants

This study was carried out among students from grades 2 to 7 of Primary and Secondary Schools in Yozgat between July 2014 and December 2015. Primary and secondary schools in the city center were divided into 3 groups according to the socio-economic level of the region, and one primary and one secondary school were selected by lot from each group. The sample consisted of students from grades 2,

3 and 4 of three primary schools and grades 5, 6 and 7 from three middle schools (around 50 students and their parents from each grade). Two classes from each grade were selected randomly and included in the study. The sample size was calculated for Receiver Operating Characteristic (ROC) analysis used in the diagnostic test. When area under curve (AUC) = 0.8, $1-\beta = 0.9$ for power analysis, sample size was calculated as $n = 26$ people (12).

Instruments

The school-based asthma and allergy screening questionnaire consist of two forms: the student questionnaire form (SQ) which consisted of 13 questions, and the parent or caregiver questionnaire form (PQ) (14 questions). In the SQ, questions 1–7 were related to asthma, and questions 8–9 were related to allergy. In the PQ, questions 1–8 were related to asthma, and questions 9–10 were allergy related. The answers given to these questions were scored as '0' for never, and '1' for occasionally and often. The last 4 questions in both forms were about the diagnosis of asthma and allergies, and the use of drugs was not scored (11). In addition, 4 questions were added to the SQ, and 7 questions to the PQ, that included their socio-demographic characteristics.

In the original validity study of the SQ, for asthma the sensitivity was 80%, and specificity was 70% for those who answered at least 3 of the 7 asthma-related questions as occasionally or often (cut-off point 2/3). According to the PQ, for asthma the sensitivity was 58%, and specificity was 69% for those who answered at least 2 of the 8 asthma related questions as occasionally or often (cut-off point 1/2). For allergy, the sensitivity of the SQ and PQ were 81% and 78%, and specificity were 42% and 53% respectively for those who answered one of two questions related to allergies as occasionally or often (cut-off point 0/1) (11).

Procedure

Turkish translation of the questionnaire

First, the questionnaire was translated from English to Turkish by two English lecturers. The questionnaire was then assessed by two experts, one chest disease specialist and one pediatric specialist, who then developed a Turkish version of the questionnaire. Then, the Turkish version was translated back to English by a bilingual person. The original and the translated questionnaire were compared to see if the translated version conveyed the same meaning as the original. The translated questionnaire was determined to be sufficient and 6 students and 6 parents (gender and age balanced) were interviewed separately for intelligibility of the Turkish version of the questionnaire. At last, the final Turkish version of the questionnaire was formed.

Data collection

The researchers explained the study's purpose to the students. The students took the Informed Consent Form and PQ form, and their parents/caregivers filled it out at home. On the following day, the Informed Consent Form and PQ were collected from the students. The SQ form was given to the students after an

explanation from the researchers. The students were instructed to mark the most suitable option. The study was completed with the participation of 704 students and parents.

Reliability of the questionnaire

For the test-retest reliability, one class was randomly selected from each grade, grades 2–7, participating in the research. These students and their parents/caregivers (200) were re-administered the same questionnaires one week later. The questionnaire was repeated with 154 students and 111 parents.

Validity of the questionnaire

The sensitivity and specificity of the questionnaire were examined to measure validity. To identify the sensitivity of the questionnaire, students who were previously diagnosed with asthma or allergy by a physician and according to the School-Based Asthma and Allergy Screening Questionnaire results, and students who have a risk for asthma or allergy were referred to the Child Health and Diseases policlinic of Bozok University Research and Application Hospital. Of the referred students, 40 were diagnosed with definite asthma by the anamnesis, clinical examination and pulmonary function test (PFT) results. The anamnesis, clinical examination, and prick skin test confirmed the definitive diagnosis of allergy in 39 students.

The Anamnesis, clinical examination and PFT results were reviewed by the pediatrician and asthma was ruled out in 99 students. The same physician confirmed that 83 students were free of allergy according to the anamnesis, clinical examination and prick skin test. The sensitivity of the questionnaire was determined according to the patients with a definite asthma or allergy diagnosis, and the specificity of the questionnaire was compared to those without a definite asthma or allergy diagnosis.

Data Analysis

The data was analyzed in IBM SPSS Statistics Standard Concurrent User V 25, Authorization Code: e31d836848b0a60e5756. The Cronbach's alpha coefficient for the internal consistency of the questionnaire and the test-retest results of the items for reliability were analyzed using the Spearman correlation test. Sensitivity and specificity cut-off scores of the questionnaire were analyzed by the ROC analysis. The size of the AUC is evaluating the accuracy of diagnostic tests.

Results

The validity of the asthma questionnaires was found to be $2/3$ (≥ 3 points) in the SQ and PQ. The Sensitivity of the SQ was 80% (true positive (32) / diagnosed with asthma (40) x 100), and the specificity was 56.6% (true negative (56) / robust (99) x 100). the sensitivity of the PQ was 82.5% (true positive (33) / diagnosed with asthma (40) x 100), and the specificity was 76.8% (true negative (76) / robust (99) x 100) (Table 1). The area under the ROC curve for asthma questionnaire was 0.793 in the SQ and 0.886 in the PQ (Fig. 1, Table 2). In the original questionnaire, the cut-off point for asthma was $1/2$ (sensitivity 95%, specificity 53.5%) while in the PQ, taking $2/3$ of the cut-off point in the ROC analysis was found to be more appropriate in increasing specificity (Table 3).

Table 1
Validity of asthma and allergy questionnaires

Asthma screening questionnaire	Asthma reference test (Physician-diagnosis + PFT)		
Asthma SQ (cut of point 2/3)	Asthma diagnosed	Not asthma	Total
Asthma suspect	True positive (32)	False positive (43)	84
Not asthma	False negative (8)	True negative (56)	55
Total	40	99	139
	Sensitivity 80.0%	Specificity 56.6%	
Asthma PQ (cut of point 2/3)			
Asthma suspect	True positive (33)	False positive (23)	84
Not asthma	False negative (7)	True negative (76)	55
Total	40	99	139 (100.0)
	Sensitivity 82.5%	Specificity 76.8%	
Allergy screening questionnaire	Allergy Reference test (Physician-diagnosis + Prick test)		
Allergy SQ	Allergy diagnosed	Not allergy	Total
Allergy suspect	True positive (29)	False positive (28)	57
Not allergy	False negative (10)	True negative (55)	65
Total	39	83	122
	Sensitivity 74.4%	Specificity 66.3%	
Allergy PQ			
Allergy suspect	True positive (33)	False positive (38)	71
Not allergy	False negative (6)	True negative (45)	51
Total	39	83	122
	Sensitivity 84.6%	Specificity 54.2%	
SQ: Student Questionnaire, PQ: Parent / Guardian Questionnaire			

Table 2
The area under the ROC curve for asthma and allergy questionnaires

Test result variables	Area	Std. Error	Sig. (2-sided)	95% Confidence Interval	
				Lower Bound	Upper Bound
Asthma					
Asthma SQ	0.793	0.045	0.000	0.705	0.881
Asthma PQ	0.886	0.030	0.000	0.828	0.944
Allergy					
Allergy SQ	0.711	0.051	0.000	0.612	0.810
Allergy PQ	0.740	0.048	0.000	0.646	0.834
SQ: Student Questionnaire, PQ: Parent / Guardian Questionnaire					

Table 3
ROC Coordinates of the curve for asthma and allergy questionnaires

Test Result Variable(s)	Cutoff Value	Sensitivity	1 – Specificity
Asthma questionnaires			
Asthma Student Questionnaire	-1.00	1.000	1.000
	0.50	0.975	0.778
	1.50	0.850	0.586
	2.50	0.800	0.434
	3.50	0.650	0.232
	4.50	0.550	0.091
Asthma Parent/Guardian Questionnaire	-1.00	1.000	1.000
	0.50	1.000	0.636
	1.50	0.950	0.465
	2.50	0.825	0.232
	3.50	0.700	0.131
	4.50	0.600	0.051
Allergy questionnaires			
Allergy Student Questionnaire	-1.00	1.000	1.000
	0.50	0.744	0.337
	1.50	0.205	0.072
	3.00	0.000	0.000
Allergy Parent/Guardian Questionnaire	-1.00	1.000	1.000
	0.50	0.846	0.458
	1.50	0.333	0.072
	3.00	0.000	0.000

When the cut-off point for the allergy questionnaires were taken as 0/1 according to the ROC analysis, the sensitivity of the SQ was 74.4% (true positive (29) / allergy diagnosed (39) x 100), and the specificity was 66.3% (true negative (55) / Intact (83) x 100); According to the PQ, the sensitivity of the questionnaire was calculated as 84.6% (true positive (33) / allergy diagnosed (39) x 100), and the specificity was 54.2% (true negative (45) / robust (83) x 100) (Table 1). The area of the allergy questionnaire under the ROC curve was 0.711 in the SQ and 0.740 in the PQ (Fig. 2, Table 2).

For the reliability of the asthma questionnaire, when the correlation between test-retest total scores was examined, it was found that $r = 0.68$ in the SQ and $r = 0.75$ in the PQ. The correlation of test-retest total scores of the allergy questionnaire was found to be $r = 0.68$ in both the SQ and PQ. Test-retest correlation values of both questionnaires were found to be statistically significant (Table 4). The internal consistency Cronbach α value of the asthma SQ and PQ were 0.72 and 0.80, respectively.

Table 4
The test-retest reliability, computed as an intra-class correlation coefficient.

Retests (Spearman's rho Correlation Coefficient)				
Tests	Asthma SQ	Asthma PQ	Allergy SQ	Allergy PQ
Asthma SQ (n = 154)	0.681**			
Asthma PQ (n = 111)		0.751**		
Allergy SQ (n = 154)			0.683**	
Allergy PQ (n = 111)				0.681**
**. Correlation is significant at the 0.01 level (2-tailed).				
SQ: Student Questionnaire, PQ: Parent / Guardian Questionnaire				

Discussion

In the study, the sensitivity of the Turkish version of the SQ for asthma (74.4%) was lower than the original questionnaire (81%), while the specificity (66.3%) was significantly higher than the original questionnaire (42%). The sensitivity of the Turkish version of the allergy parent/caregiver form (84.6%) was higher than the sensitivity of the original questionnaire (78%), and the specificity of the Turkish version (54.2%) and the specificity of the original questionnaire (53%) were similar (Table 1, 3) (11). For validity, in the Turkish version, the sensitivity of the allergy SQ was lower, and the specificity was higher than the original questionnaire. The sensitivity and specificity of the Turkish version of the allergy PQ were higher than the original questionnaire. In this study, using the International Childhood Asthma Allergy Questionnaire, the sensitivity was found to be 74% (13). In a study, where the questionnaire was translated into Turkish, the prevalence of asthma, wheezing and rhinitis was 14.1%, 22.4%, and 12.9%, respectively (14).

For asthma, the sensitivity of the Turkish version of the SQ (80%) and the sensitivity of the original SQ (80%) were the same, while the specificity was lower in the Turkish version (56.6%) compared to the original (70%). For asthma, the sensitivity of the Turkish version of the PQ (82.5%) and specificity (76.8%) were higher than the sensitivity (58%) and specificity (69%) of the original version of the PQ (Table 1). The cut-off point for asthma was taken as $1/2 (\geq 2)$ the same as the original PQ, the Turkish version of the PQ had very high sensitivity (95%) compared to the original (58%), and the specificity (53.5%) was

lower than the original (69%). Therefore, taking 2/3 of the cut-off point in the asthma PQ provides a more appropriate level of sensitivity and specificity (Table 3) (11). In the Turkish validity study, the sensitivity of the asthma SQ was at the same level as the original, but its specificity was lower than the original. The sensitivity and specificity levels of the asthma PQ were higher than the original questionnaire.

The validity and reliability studies of the questionnaires used for asthma in children can be found in the literature. In Turkey, for children aged 4–11, childhood asthma control test sensitivity was 74.8%, and specificity was determined to be 88.7% (15). The sensitivity of a questionnaire used to identify children and adolescents with asthma in Brazil was found to be 74% (8). The sensitivity of the questionnaire used in asthma screening in children aged 5–15 was found to be 70% (9). The sensitivity and specificity of the asthma questionnaire administered to preschool children in Latin America were found to be 93.1% (16). In the United States, the sensitivity and specificity of asthma questionnaires applied to children grades 3–5 of primary school were 90% and 49%, respectively (17). In a study in which primary school children were followed up with an asthma questionnaire for 2 years, the sensitivity and specificity of the questionnaire were 94% and 87% in the first year, and 96% in the second year (18). In a study using the European Respiratory Health Questionnaire, the sensitivity and specificity of the questionnaire were found to be 75.1% and 80.1% (19). In another study, the sensitivity and specificity of the asthma control questionnaire applied to asthma patients were 78% and 77.5%, respectively (20). In the asthma screening survey applied to children (aged 9–12) and their families admitted to a hospital in Argentina, it was detected that the sensitivity of the student version (cut-off point 1/2) was 53.4% and the specificity was 84.3%, the sensitivity of the parent version (cut-off point 2/3) was 92.3% and the specificity was 86.4% (21).

In this study, the internal consistency (0.72, 0.80) of the asthma student and parent/caregiver form was adequate. Turkey's childhood asthma control test's reliability (test-retest) was 0.71. The internal consistency Cronbach α value was found to be 0.69 for children, for the parents, the value was determined to be 0.78 (15). In the language validity and reliability study of the Asthma Screening Scale in Argentina, the internal consistency Cronbach α value of the 9–12 year-old student questionnaire was found to be 0.69, and the parental questionnaire value was 0.88 (21). Since there were only two allergy questions, internal consistency was not considered. The reliability of the Turkish version of the School-Based Asthma and Allergy Screening Questionnaire is satisfactory according to the test-retest result ($r = 0.68$). Therefore, the questionnaire has a reliable characteristic (Table 4). In Turkey, children benefit from health services free of charge. Every family has a family doctor. The family physicians are obliged to follow up their registered persons once a year. Therefore, examination of false positive cases by health institutions does not create a burden on the health system.

Conclusions

The Turkish version of the School-Based Asthma and Allergy Screening Questionnaire has a similar level of sensitivity and specificity with the original asthma and allergy screening questionnaires used in the literature. The reliability of the Turkish version of the questionnaire is acceptable. The Turkish version of questionnaire can be used for the screening of asthma and allergy in students grades 2–7 in Turkey.

Declarations

Ethics approval and consent to participate: The ethics committee approval was obtained from Bozok University Faculty of Medicine Ethics Committee. The students and their parents or caregivers were informed about the research and their written consents were obtained. The research was conducted in accordance with the rules and ethic codes mentioned in the Helsinki Declaration.

Consent for publication: The students and their parents or caregivers were informed about the research, and their informed written consents forms were obtained.

Availability of data and materials: The study data are stored. The data may be provided if desired. The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests. The authors alone are responsible for the content and writing of the paper.

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Authors' contributions:

MK. The research's planning, implementation, statistical analysis and writing

GE. To examine sick and healthy children for asthma and allergies

TU. Conducting surveys in schools, collecting data, conducting ethical permits for research

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Figures

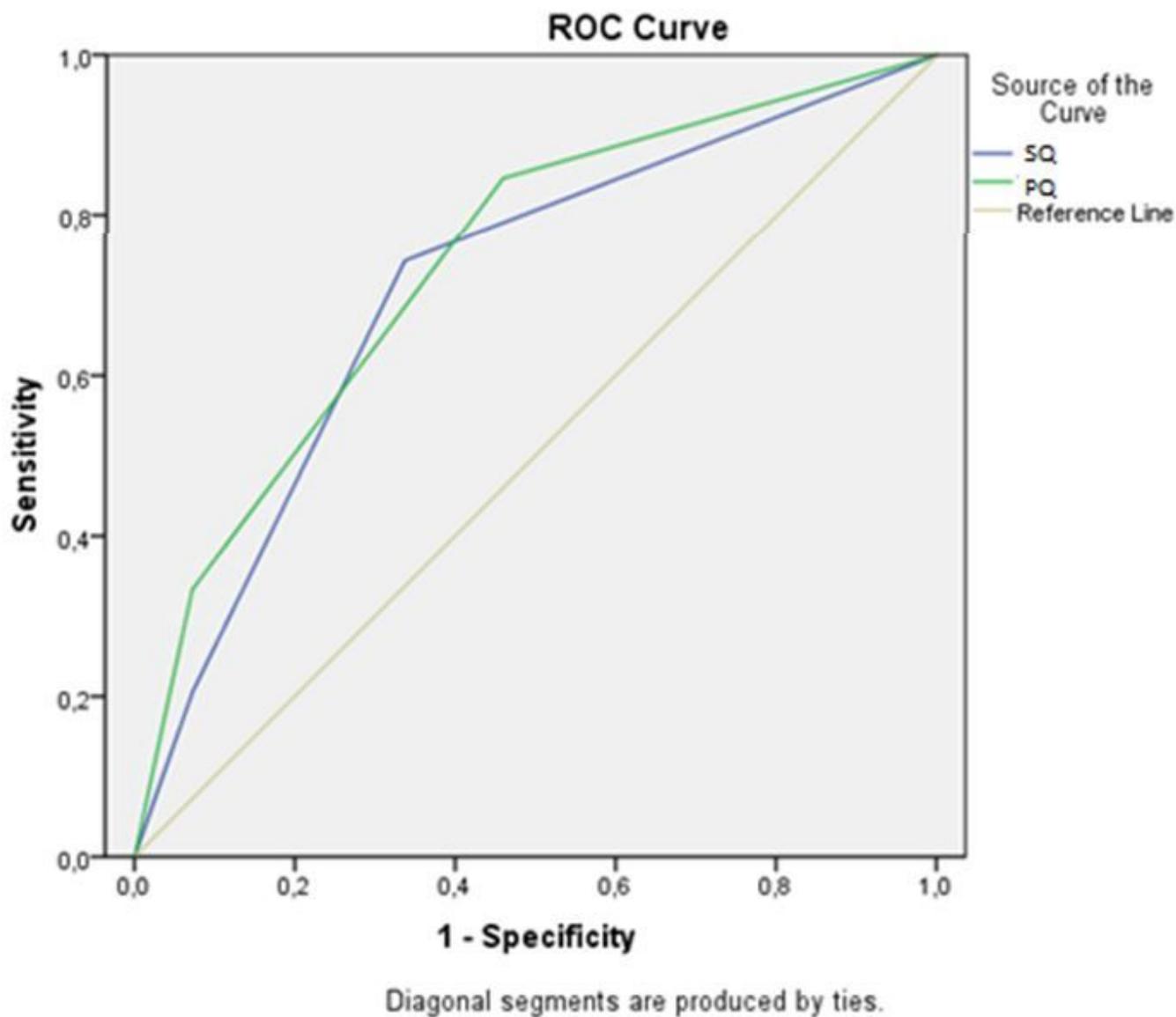


Figure 2

Area under the ROC curve for allergy questionnaires