PERCEPTION OF TESTING FOR COVID-19 DURING THE FIRST WAVE OF THE PANDEMIC IN SLOVAKIA WITH EMPHASIS ON POPULATION AGE GROUPS

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SUMMARY

Objective: The aim of this study was to evaluate the perception of the respondents in selected areas of testing for COVID-19 during the first waves of this disease with an emphasis on the age categories.

Methods: The research sample consisted of 806 Slovak respondents and the collection of data took place in February 2021. The study examined six areas, of which five focused on the perception of testing and one area focused on examining the risk of population behaviour. All areas were examined in the first as well as in the last testing for COVID-19. In terms of age, we focused on 4 age categories: up to 24 years, 25–44 years, 45–59 years, and over 60 years. Data were obtained by online survey, using descriptive analysis and nonparametric analysis of differences.

Results: The results of the analysis show that age is a socioeconomic characteristic that is of great importance for the creation and implementation of epidemiological processes and programmes and therefore epidemiologists should pay increased attention to it when creating prevention programmes. Younger people perceived testing more positively than older ones, even though the course of the disease caused by COVID-19 is much more severe in older people. The difference in the perception of testing between age categories was confirmed in the first as well as in the last test study. Respondents perceived the last test more negatively and thus they showed slightly riskier behaviour compared to the first test.

Conclusions: We perceive testing as an efficient way in the fight against pandemics generally, but we point out that testing should be well accomplished in a managerial way, otherwise testing can have a negative impact on society's confidence.

Key words: SARS-CoV-2 pandemic, mass testing, social attitudes, testing experience, behaviour, age

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INTRODUCTION

The global pandemic caused by the SARS-CoV-2 infection has hit all the social and economic spheres of the countries in a considerable way and it has had a significant impact on public health and health policy processes at the global and national levels. The Slovak Republic (SR) has recorded a significant increase in the number of SARS-CoV-2 infections since the end of the 2020 summer. On 11 August 2020, the Pandemic Plan in the Slovak Republic prepared by the Public Health Office and approved by the Pandemic Commission was ratified. Not only the institutions of the Slovak health system, but also other ministries were thoroughly prepared for many activities and processes. Health policy has been strongly activated at the national as well as international level, and many experts have networked extensively in the different countries to exchange experiences, support and collaboration (1–4). During the 2020 autumn, thousands of infected patients were added daily, and hospitals were in danger of collapsing. This was the impetus for the decision of the Slovak government on mass testing in the conditions of the Slovak Republic. According to Holt (1), the decision of the Slovak government to test the entire adult population for SARS-CoV-2 infection has caused controversy in Slovakia. Many infectious disease experts in Slovakia have convinced the government that repeated nationwide testing of millions of people for SARS-CoV-2 will be a waste of resources and doubts have been expressed about its effectiveness. During the last weekend of October 2020, 3.6 million populations were tested with a positivity rate of 1.06%. Testing was repeated the following weekend in selected areas where a positivity rate greater than 0.7% was confirmed. SARS-CoV-2 infections decreased after the introduction of rapid population-wide testing, but it was difficult to estimate the extent to which the decrease was due to the test results, as additional measures were introduced at the same time. According to statistics from the study by Mahase, after three rounds of rapid testing the prevalence of detected SARS-CoV-2 infections decreased by 58% in one week in 45 districts of Slovakia that underwent two rounds of mass testing (2). This decrease grew to 61% after taking into account geographical parameters, traffic rates, epidemiological situation from the first round of testing, etc. The significance of these parameters was also confirmed by a study by Boďová and Kollár (5), who examined geographical epidemic scales and patterns and positivity trends of SARS-CoV-2 pandemics in mass antigen testing in Slovakia in 2020, as well as others (6–8). Many experts stated that this decrease in prevalence in Slovakia was also influenced by the isolation of people with a positive

test and quarantine measures for members of their households (3, 4). According to the statistics of the National Health Register of the Slovak Republic (9), at the beginning of January 2021 the proportion of SARS-CoV-2 infections was up to 35.04% and the daily mortality reached 204 individuals. Several expert groups have reported that while mass testing processes may contribute to reducing SARS-CoV-2 infections, it is very problematic to separate the effect of individual infection reduction measures from the impact of mass testing (10). This situation was complicated by the fact that it was not clear to what extent the testing was accurate. Although several research studies on the accuracy of the tests were conducted during this period, these were dependent on access to deeper structured data (7, 8, 11). Testing processes have been considered in many countries as an important tool for the successful and timely management of a global pandemic caused by SARS-CoV-2. In individual countries, these processes differed in the form, organisation and transfer of their results to other health policy processes of the country and government decisions. Each country faced a decision on what strategies to adopt to prevent the spread of SARS-CoV-2, not only choosing the right interventions but also combining them in a timely and effective manner (12, 13). The frequency and location of testing processes also play an important role in the success of mass testing. Kahanec et al. (14) examined the effects of mass antigen testing on the pandemic, using data from a uniquely designed nation-wide testing implemented in Slovakia in Autumn 2020. The results of the study show that mass testing of the population can be an effective tool to combat the spread of SARS-CoV-2. Many governments have pursued comprehensive economic and social policies, emphasizing the role of the state in guaranteeing the country's economic, health and social security. Strong political reactions by governments and the introduction of strong measures have also led to a change in attitudes to the role of government in the economy and redistribution. The success of mass population testing has largely depended on people's motivations, their belief that taking an active approach to testing will reduce the risk of the disease spreading and eliminate catastrophic effects on the health, economic and social systems. These facts were the motivation for us to carry out our study, the main aim of which was to examine and evaluate the perception of respondents in selected areas of testing on COVID-19 during the first waves of this disease with an emphasis on age categories.

MATERIALS AND METHODS

The achievement of the main goal of the study was conditioned by the implementation of research with the following research questions:

- Is there a difference between the age groups in the perception of selected areas of testing for COVID-19 in the first as well as in the last passed test?
- Are there differences in the perception of selected areas of COVID-19 testing between the first and the last test passed?

Table 1 demonstrates the questions for the respondents focused on the perception of the first and the last testing for COVID-19. The perception rates were examined on a scale from 1 (definitely no) to 4 (definitely yes). The questionnaire also identified the risk of behaviour after the first and after the last testing for COVID-19. The question "How did you spend the day after the first/last test in relation to other people?" had 4 categories: I went home; I met people and knew that everyone had a negative test; I met people and knew that one of them had a positive test; I met people who did not have information about the result of their test (in relation to their medical condition within the coronavirus). The respondents answered the questions related to the first testing and subsequently, the final one, while the respondent replied the questions related to his first testing and then, the same respondent replied the questions related to his last one.

The research sample consisted of 958 statistical units and 806 (84.13%) statistical units were included in the statistical processing. The statistical units were excluded due to disagreement with the processing of personal data, due to the non-participation of respondents in any testing, residence outside Slovakia, age limit of respondents under 18 years, and system errors in recording the response. The collection of data was completed in 10 days, namely from 12 February 2021 to 23 February 2021. The sample was secured by quota selection (by sex characteristics, age and social status) via Google Form. The structure of the sample consists of 314 (39%) women. From a point of view of social status,

Table 1. *Questions focused on perception of the first and the last testing for COVID-19*

	Question	Scale			
		Definitely no	Rather no	Rather yes	Definitely yes
QN 1	Did you feel that you were doing something right when you participated in the testing?	1	2	3	4
QN 2	When you participated in the testing, did you feel that the testing was beneficial?	1	2	3	4
QN 3	Did you feel that it helped the society when you participated in the testing?	1	2	3	4
QN 4	Did your participation in the testing make you feel safe (regardless of the test result)?	1	2	3	4
QN 5	Did the reasons for your participation in the testing also include responsibility for the people you meet?	1	2	3	4
QN 6	Have you participated in the testing to avoid the restrictions imposed by government regulations?	1	2	3	4

Source: own processing by the authors

full time students predominated (n = 364, 45.2%), followed by employed respondents 317 (39.3%), entrepreneurs 50 (6.2%), unemployed respondents 31 (3.8%), and pensioners 26 (3.2%), and the smallest part of the sample were respondents on maternity leave – 18 (2.2%). The structure of the sample shows the predominance of younger respondents (mean = 32 years, median: 26 years). In terms of age, 4 age limits were created: up to 24 years (n = 313, 38.8%), from 25–44 years (n = 359, 44.5%), from 45–59 years (n = 110, 13.6%), and above 60 years (n = 24, 3%). The mean number of tests passed per respondent was 5.65 (median: 5); 434 (53.8%) respondents passed less than 6 tests during the observed period and 366 (45.4%) respondents passed 6 or more completed tests (6 statistical units were not filled in). In terms of time between the first and the last testing, 68 (8.4%) respondents reported an interval of about a week, 17 (2.1%) respondents stated interval about two weeks, 29 (3.6%) respondents stated interval about a month, and most statistical units recorded more than one month (n = 659, 81.8%), 33 statistical units were not filled. The research was focused on population-wide testing on COVID-19 in Slovakia. The first testing took place mainly during the round of population-wide rapid antigen testing (76.7%) and the last participation was lower (52.4%). The tests used also correspond to these results. In the first test, the antigen test was predominantly used (79.7%), the molecular PCR test was used in 19.1% of samples and 1.2% of respondents reported an antibody test. In the last test, the use of the antigen test was reported by 85.7%, the molecular PCR test by 9.1%, and the antibody test by 1.1%.

Analytical processing of the obtained data was performed through the descriptive analysis and analysis of differences. Due to the type and frequency of observations, the nonparametric tests of differences were applied to assess differences. The Kruskal-Wallis H test was applied in order to assess differences between the age categories (4 categories). In evaluating the differences between the tests (the first test – the last test), due to the fact that the data was interrelated, the Wilcoxon Signed Ranks Test was applied for the two related samples (pairwise comparison). The Pearson's χ^2 test was applied to assess the differences in the distribution of the nominal variable. The analytical calculations were performed using SPSS v 26 (Armonk, NY: IBM Corp.).

RESULTS

The results of the analyses are categorised into two dimensions. The first dimension examined whether there was a difference in the perception of the first and the last COVID-19 test between age groups. In the second dimension, the perception of the first and the last passed test was examined. In this dimension, it was determined whether the frequency of testing (or the time between the first and the last test) is related to the change in attitude to testing.

Table 2 shows the results of the basic descriptive analysis and the tests of differences in the examined dimensions of testing perception between the age categories. Due to the structure of the scales used to measure the QN 1 to QN 6 areas in the first as well as in the last test, a higher value presents a more positive result. Significant differences were not confirmed only in the QN 6 area. It follows from the above that younger respondents in most cases presented more positive perceptions of testing at COVID-19 than older ones. The youngest age group (≤24) presents the highest level of perception in all significant cases, followed by the age group from 25–44 years. The lowest rate occurs alternately in the age group 45–59 years and in the category over 60 years. Here, it is necessary to point out the lower number of observations in the group of respondents older than 59 years. When comparing the outputs of the descriptive analysis from the first and the last testing, a lower rate is evident in the last testing.

Table 3 displays the results demonstrating that the differences between the first and the last testing are significant in all the areas of perception in the two youngest age groups. In the age category from 45–59 years, the difference at the level of $\alpha < 0.05$ did not manifest itself in only one case, namely in QN 6. The age category older than 59 years did not show any significant

Table 2. *Descriptive analysis and test of differences in COVID-19 testing perception dimensions*

		First COVID-19 testing						Last COVID-19 testing					
Age	**Stat.**	**QN 1**	**QN 2**	**QN 3**	**QN 4**	**QN 5**	**QN 6**	**QN 1**	**QN 2**	**QN 3**	**QN 4**	**QN 5**	**QN 6**
≤24	Mean	3.26	3.12	3.02	2.75	3.33	2.85	2.97	2.67	2.62	2.54	3.14	3.02
	Median	3	3	3	3	4	3	3	3	3	3	3	3
	SD	0.91	0.98	1.02	1.03	0.91	1.06	1.04	1.11	1.11	1.10	1.04	1.09
25–44	Mean	2.94	2.80	2.68	2.43	2.95	2.75	2.63	2.42	2.32	2.22	2.80	2.85
	Median	3	3	3	3	3	3	3	2	2	2	3	3
	SD	1.13	1.15	1.14	1.09	1.18	1.17	1.18	1.19	1.18	1.12	1.19	1.16
45–59	Mean	2.58	2.41	2.29	2.12	2.65	2.90	2.42	2.29	2.16	2.00	2.57	2.96
	Median	3	2	2	2	3	3	2	2	2	2	3	3
	SD	1.23	1.21	1.17	1.06	1.23	1.13	1.21	1.22	1.17	1.10	1.22	1.09
≥60	Mean	2.63	2.46	2.33	2.29	2.75	3.04	2.63	2.74	2.47	2.33	3.00	2.74
	Median	3	3	2	3	3	3.5	3	3	3	2	3	3
	SD	1.21	1.28	1.09	1.12	1.22	1.20	1.21	1.15	1.22	1.08	1.00	1.33
Kruskal-Wallis		30.071	33.286	38.675	32.053	33.123	2.709	21.369	12.424	17.283	23.494	22.135	3.592
p-value		< 0.001	< 0.002	< 0.003	< 0.004	< 0.005	0.439	< 0.001	0.006	0.001	< 0.001	< 0.001	0.309

Table 3. *Analysis of differences between perception of the first and the last testing*

Wilcoxon test	First COVID-19 testing vs. last COVID-19 testing – Z value (p-value)					
Age	QN 1	QN 2	QN 3	QN 4	QN 5	QN 6
≤24	−6.576 (<0.001)	−7.871 (<0.001)	−7.09 (<0.001)	−4.739 (<0.001)	−4.242 (<0.001)	−2.912 (0.004)
25–44	−6.931 (<0.001)	−7.486 (<0.001)	−7.267 (<0.001)	−4.91 (<0.001)	−3.806 (<0.001)	−2.092 (0.036)
45–59	−2.993 (0.003)	−2.063 (0.039)	−2.704 (0.007)	−2.786 (0.005)	−2.138 (0.032)	−1.075 (0.282)
≥60	−1.406 (0.160)	−0.302 (0.763)	−0.447 (0.655)	−0.749 (0.454)	−0.447 (0.655)	−1.225 (0.221)

difference between the perception of the first and the last testing. When interpreting the differences, it is appropriate to start from Table 2, in which the results based on the mean values show that the first testing was in most cases perceived more positively than the last one.

Table 4 visualises the riskiness of behaviour in the classification of the age categories, as well as in the comparison of the first and the last test of respondents on COVID-19. A comparison of the first and last test showed a slightly increased risk behaviour. Less risky behaviour was slightly lower after the last test and riskier behaviour was slightly higher. The differences between the age categories were also assessed meaning there were significant differences in both cases.

DISCUSSION

The COVID-19 pandemic had a global impact, and the countries applied a variety of tools and procedures to tackle it. The Slovak Republic has chosen mass testing of the entire population as an important strategy in this process. This activity of the Slovak government met with different views that had an impact on people's attitudes and on shaping their awareness of intervention activities. Therefore, it is important to pay attention to the attitudes, but also to differences in the perception of testing in the different population structures, as well as in general, localities, and so forth. Some research studies confirm the fact that asymptomatic population testing was highly acceptable, especially in the critical stages of the COVID-19 pandemic (15, 16). The level of motivation and willingness of the population to test was influenced by many factors, especially trust in the institution, expectations regarding the quality and integrity of tests and their results, various obstacles, concerns about damage to health, etc. (17, 18).

The results of our study led to several conclusions. When comparing the perception of the first and the last testing, significant differences were identified in the five issues examined (except QN 6 "Have you participated in the testing to avoid the restrictions imposed by government regulations?"). A more positive perception of testing was identified in the younger groups of respondents. The young population also perceived the limitations of absenting in testing differently, so their attitude is partly influenced by this factor. The elderly population was more concerned about the adverse health effects of testing, also related to their comorbidities that are much more common in the elderly. The concerns about infection also increased during testing proc-

Table 4. *Analysis of differences in behaviour after the first and the last testing in relation to other persons (N = 806)*

Age	Category	First COVID-19 testing		Last COVID-19 testing	
		n	%	n	%
≤ 24 (n = 313)	I went home.	238	76.04	202	64.54
	I met people and I did not have information about the result of their test.	16	5.11	21	6.71
	I met people and I knew that one of them had a positive test.	0	0.00	1	0.32
	I met people and I knew that everyone had a negative test.	59	18.85	83	26.52
25–44 (n = 359)	I went home.	272	75.77	245	68.25
	I met people and I did not have information about the result of their test.	28	7.80	29	8.08
	I met people and I knew that one of them had a positive test.	0	0.00	1	0.28
	I met people and I knew that everyone had a negative test.	59	16.43	66	18.38
45–59 (n = 110)	I went home.	95	86.36	78	70.91
	I met people and I did not have information about the result of their test.	8	7.27	10	9.09
	I met people and I knew that one of them had a positive test.	0	0.00	1	0.91
	I met people and I knew that everyone had a negative test.	7	6.36	15	13.64
≥60 (n = 24)	I went home.	21	87.50	12	50.00
	I met people and I did not have information about the result of their test.	1	4.17	3	12.50
	I met people and I knew that one of them had a positive test.	0	0.00	0	0.00
	I met people and I knew that everyone had a negative test.	2	8.33	4	16.67

Age categories: first COVID-19 testing: $\chi^2 = 12.78$, p-value = 0.047; last COVID-19 testing: $\chi^2 = 32.89$, p-value = 0.001.

esses related to population localisation before testing at selected locations, association after testing, etc. These factors were also important in the decision-making processes about participating in testing or accepting the restrictions that were associated with absenting in testing.

When evaluating the differences in the perception of the first and the last testing, it was found that in most cases it is possible to speak of significant differences while the first testing was perceived more positively than the last one. From a social point of view, we consider these results unfavourable. This is also due to the fact that during the period of the pandemic, the numerous external incentives were implemented, represented by the government regulations and restrictions (in case of non-participation in the tests). Therefore, a more positive perception of testing was expected in the later stages of pandemic development. The positive perceptions of testing may also be supported in the future by self-testing processes that could motivate people to regularly and voluntarily monitor their health, and to be responsible towards their environment, which they live or work in (19, 20). Regular self-testing can help to significantly eliminate the risk of spreading a pandemic (10, 21, 22). In assessing the risk of behaviour, that is, as respondents spent time after the first test, but also after the last test, it was found that the respondents' behaviour was slightly riskier after the last test than the behaviour after the first test. As a result, the perceptions of the importance and caution of COVID-19 decreased over time and respondents behaved less responsibly. These results may also be related to the fact that during the period of testing, rapid antigen tests also provided information on the degree of inaccuracy of their results. This degree of inaccuracy also resulted from lower diagnostic sensitivity compared to RT-PCR tests, while both false positive and false negative results can appear (23, 24). Thus, incorrectly negative individuals may pose significant health risks to society (25, 26). Several factors influence the different perceptions of testing, as well as trends in the emergence and promotion of risky behaviour during and after testing. In this context, it is important to emphasise the significance of health literacy that is little proclaimed in the conditions of the Slovak Republic, and so far, health literacy systems absent with links to age structures, socioeconomic and demographic factors (education, status, employment), health aspects of the individual, etc. The COVID-19 pandemic highlighted the need to reconsiderate and to effectively define a number of educational processes that would be linked to quality prevention programmes. The results of the analyses show that it is necessary to approach the testing process and its settings (frequency, location, population size, etc.) very carefully and to sensibly examine and evaluate the perception of these processes by the population. According to the results of the analyses, we can assume that the rate of positive perception of testing tends to decrease. The competent institutions will help to improve this situation by providing timely, targeted and truthful information on the whole process and by choosing a suitable implementation regime as well as education. Early communication by government, building trust to eliminate fear and increasing motivation will be important aspects of public health policies in the various crisis regimes.

The limitation of the research was formed by the discrepancy in several categories of the identification variables, especially gender characteristics, where women slightly predominated. From a point of view of social status, students slightly prevailed. It can also be considered a certain limitation that the age categories were not fully balanced and the group of respondents at the age of 60 years had a significantly lower number than the other groups. Younger respondents represent the majority in the sample. However, these limitations do not fundamentally distort the research results.

CONCLUSION

The aim of the study was to examine and evaluate the perception of the respondents in selected areas of testing for COVID-19 during the first waves of the disease, with emphasis on the age groups of the population. The study examined six areas, of which five focused on the perception of testing and another area focused on examining the risk of population behaviour. All areas were examined in the first as well as in the last testing for COVID-19. The results of the analyses revealed that age is a socioeconomic characteristic of great importance for the construction and implementation of the epidemiological processes and programmes. This was also confirmed by the results of differences in the perception of testing. The respondents also showed slightly riskier behaviour compared to the last test with the first test examined. The differences in the perception of testing in the explored areas call for a deeper examination of determinants affecting the attitudes and perceptions of prevention and intervention programmes. It is also important from this point of view that any quality prevention and intervention programme can fail in case of distrust of the population in its positive results, sensuality, safety, and own health protection, as well as of others' protection. It was the COVID-19 pandemic that opened the way for research into many other issues related to the prevention and intervention programmes, crisis management, health policy quality, efficiency and sustainability of health systems, and the need for a deeper examination of population health literacy and construction of the education systems in the field of public health.

We perceive testing as an effective weapon in the fight against pandemics generally, but we point out that testing should be well accomplished in a managerial way, otherwise testing can have a negative impact on society's confidence. Communication is an important factor in preparing for testing. Explaining to a society why testing is important and what its benefits are should not be neglected. Weaknesses and risks of testing should also be communicated – and an extra attention should be drawn to the test errors. Test preparation should minimise errors by making the right choice of tests. As mentioned, we perceive testing positively, but if we were to take an opinion whether to test in a mass way, that is, the whole population, or to test in a targeted manner (in possible outbreaks), we would be in favour of targeted testing.

The results of the research benefit health policymakers, regional and national health strategies and development plans, prevention professionals and policymakers, as well as other public health professionals. The research results support the creation of a multidisciplinary research platform aimed at examining the socio-demographic aspects of intervention programmes.

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Conflict of Interests

None declared

Adherence to Ethical Standards

The research involving human participants was reviewed and approved by the Ethics Committee of the Clinical Trials Services, USP TECHNICOM, Technical University of Košice, Slovakia (Ref. 02/03/2021 IG Bioinformatics).

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