

NEW METHOD FOR THE RESEARCH OF THE EFFECTS OF SOCIAL ISOLATION DUE TO COVID-19 PANDEMIC ON STRESS

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Abstract The COVID-19 virus pandemic has caused numerous changes in people's lives and work. As an inevitable consequence of the application of various measures of physical distancing and isolation prescribed by state institutions, the health care system and companies, the development of social isolation of people has occurred. This social isolation caused mental stress. In order to assess the level of induced stress due to the existence of social isolation, a new method was developed in this paper, which involves the use of a new SICS questionnaire to assess this impact. The paper presents the advantages of applying this method. One of the main advantages of the mentioned method is the simplicity of application, because it does not require two questionnaires to assess the mentioned impact, but only one. In addition, this method does not require the use of complex tools for mathematical data processing. The SICS questionnaire also has certain advantages. It enables unambiguous measurement of stress, because here stress is viewed in its original form, as a phenomenon of mental stress, effort or load caused by a certain event or circumstance. In addition, the SICS covers a greater number of relevant determinants of social isolation as a result of a pandemic than other tools previously used for that purpose. Measurement accuracy has also been improved, as each question measures stress that is induced as a consequence of a precisely defined factor of social isolation. Other advantages of this questionnaire include the fact that the data obtained by its application are easy to interpret, without the need to assess stress before and during social isolation. SICS was formed with the aim to primarily measure the objective component of social isolation. The questionnaire was successfully tested on a sample of 500 citizens of Serbia.

Keywords: SARS-CoV-2 virus; COVID-19 pandemic; SICS questionnaire; social isolation; stress.

1. INTRODUCTION

The COVID-19 pandemic that has been initiated in November 2019 caused an unprecedented global public health crisis, which then has caused other crises, especially in social, work and economic areas. Almost all countries took certain measures, such as lockdown and social distance provisions, in reaction to the COVID-19 pandemic, in order to prevent the virus from spreading and to deal with the enormous load placed on the health system. In many cases, people are forced to separate themselves at home and cut off face-to-face gatherings and interactions with family members, partners, colleagues, friends, classmates, and others as a result of the lockdown and social distancing rules [1].

At all ages, high-quality social relationships are critical for our mental and physical health and well-being. It is already known that social isolation is a significant predictor of loneliness, which is also pointed out by certain recent research [1]. The COVID-19 pandemic has brought social isolation and loneliness, especially among older people to the forefront of public health and policy concerns [2]. Loneliness and social isolation are both detrimental. According to the World Health Organization (WHO), they can make people's lives shorter and harm their mental and physical health, as well as their quality of life. Such detrimental effects can be interpreted by stress-buffering. Social relationships may provide social support (emotional, instrumental, or informational) that improves neuroendocrine or adaptive behavioral responses to acute or chronic stressors (e.g. self-quarantine), according to the stress-buffering model. As a result of their lack of social connectedness, self-quarantined people may experience more stress than others [1]. All this can also affect the reduction of the working ability.

The term "social isolation" usually refers to a lack of social connections or relationships, whereas "loneliness" refers to the subjective feeling of social isolation [1]. Loneliness also has been seen as a biological consequence or a response to social isolation in the past period. However, according to [3], should be differed objective social isolation from perceived social isolation. Perceived social isolation is directly connected to feeling unsafe (which triggers implicit hypervigilance for extra social threats in the environment). People can live relatively solitary lives and not feel lonely, but also they can have apparently rich social lives yet feel lonely. According to [3], loneliness increases perceived stress. In addition, in [4] it has been concluded that loneliness is a psychological experience that can have negative consequences on biological stress mechanisms that are potentially harmful to one's health.

2. GOAL OF THE RESEARCH

The topic of this paper is the influence of forced social isolation caused by the SARS-CoV-2 virus pandemic on the occurrence of stress. From the introductory part, it could be seen that stress can occur as a consequence of feelings of loneliness, which arises as a consequence of social isolation (perceived social isolation). This effect is partly discussed in [1]. However, stress due to social isolation can occur even when there is no feeling of loneliness. This is exactly the case with the SARS-CoV-2 virus pandemic, because through quarantine and other types of physical isolation, people are forced into social isolation. In that case, the feeling of social isolation develops faster in people's consciousness, regardless of whether the feeling of loneliness has already developed or not. In that case, people become aware of the dangers posed by social isolation, which also produces stress. This component of stress is related to the awareness of the existence of objective social isolation. The main goal of this research is to determine the level of stress that is primarily caused by various types of objective social isolation, imposed by the SARS-CoV-2 virus pandemic.

3. METHOD

At the time when this study was conceived (in early 2020), we were unable to find any previous scientific research that addressed the impact of social isolation resulting from the existence of a pandemic on the occurrence of stress. The research presented in this paper lasted a relatively long time (completed in 2021). There were two reasons for this. The first reason was to provide a sufficient

number of respondents. Another reason was the break in the research due to health problems and the long-term recovery of the second author of this paper. However, in the meantime, papers have appeared that have partly dealt with the mentioned issue. It is interesting to consider what methodology was used in these papers in order to determine the impact of social isolation due to a pandemic on the occurrence of stress.

3.1. Review of Other Related Methods and Approaches

In [1], stress was estimated on the basis of a questionnaire formed on the basis of the questionnaires from [5] and [6]. This questionnaire has contained 5 items, two of which related to emotional reactions to stress, while three items related to behavioral reactions to stress. The stress assessment scales of [5] and [6] were not formed for the specific assessment of stress due to social isolation or quarantine caused by the Coronavirus. Social isolation in [1] was assessed on the basis of a questionnaire consisting of four items. Of these four items, three items related to the inability to make contact with different entities (family members, relatives, friends), while one item referred to the inability to participate in activities due to lockdown. Given the separate determination of social isolation and stress, the impact of social isolation due to the pandemic on the occurrence of stress was assessed indirectly, by applying correlation analysis and testing a model that included other components that are not the subject of this study (eg assessment of loneliness or life satisfaction).

In [7], various factors influencing the stress of the population during social isolation due to the outbreak of the Coronavirus were considered. Depression, Anxiety and Stress Scale-21 (DASS-21) was used to assess stress. This questionnaire is also not designed for a specific assessment of stress due to social isolation. Stress was calculated by summing the scores for the chosen items. Various factors that can affect stress levels have been considered, such as some demographic factors, the possibility of infection or infection with a virus, and others. However, it is not possible to find a result that indicates the extent to which social isolation as a separate factor affects the level of stress. In the mentioned article, social isolation due to the Coronavirus is primarily viewed as an ambient, ie an environment in which stress research was performed, as well as some other factors considered in this paper (such as depression).

In [8] it is pointed out that perceived social isolation during the COVID-19 pandemic has significant psychological consequences. However, this paper does not use a questionnaire or other tool to more accurately determine the impact of social isolation on people's stress. Effects of social isolation during the pandemic have also been considered in [9]. Items were selected from Measures of Social Isolation [10]. In the mentioned paper ([9]), the authors described five goals of the research. Four goals referred to social isolation as a subject. The fifth goal referred to a certain connection of stress and social isolation, but not to the examination of the direct influence of social isolation on the advent of stress. In [11], social isolation in the Covid-19 pandemic is also considered - the impact of loneliness. However, due to the nature of this paper (Editorial), no method has been mentioned for the purpose of researching the effects of social isolation on stress.

In [12], one of the goals of the research was to determine the impact of social isolation in the conditions of the COVID-19 pandemic on the occurrence of stress (observed from the work context). Also, a questionnaire specially formed to assess the impact of social isolation on stress was not used

here, but in accordance with the aim of the research, a questionnaire (created in [13]) was used to assess stress in the technological environment - Technostress. Social isolation was tested using a questionnaire from [14], which was created for the purpose of determining social isolation in teleworking operators. Given the separate testing of social isolation and stress, the assessment of the impact of social isolation due to the pandemic on the occurrence of stress was reached indirectly, by applying correlation analysis and model testing.

In [15] has been analyzed the association of social isolation with perceived stress among residents of two countries. For the purpose of determination of stress, Perceived Stress Scale PSS-10 has been used. This scale is not specifically designed for stress caused by the pandemic. Social isolation has been seen used as a notion for a style of living at that period. To describe the state of social isolation, a questionnaire has been used, containing questions about mobility patterns, attitude, propensity to adjust toward the implemented measures, and fears regarding health and economics. However, this article does not deal with the determination of the correlation between social isolation and stress, but primarily with the determination of differences in answers that exist between two national populations.

From the previous analysis of the methods used to determine the link between social isolation caused by a pandemic and the occurrence of stress, two basic approaches used in the research of this phenomenon can be observed. The first approach is based on the independent determination of the perceived level of social isolation and the perceived level of stress using separate questionnaires, in the general context of the presence of social isolation as an environment in which the life and work of people take place. The correlation between the results obtained by using separate questionnaires for social isolation and stress is not a subject of afterward calculation.

In the second approach, as in the first, two independent questionnaires are used, one of which is used to assess social isolation, while the other questionnaire is used to assess stress levels. Either both questionnaires, or at least one of those two questionnaires, were not designed to cover the specifics of the pandemic caused by the Coronavirus. This primarily refers to questionnaires for determining stress levels, which are of a general nature. In this second approach, after determining the perceived level of social isolation and perceived level of stress using separate instruments and scales, applying correlation analysis and forming a model, an attempt is made to assess the impact of social isolation on the occurrence of stress.

However, both mentioned approaches have certain shortcomings, in terms of reduced precision and unnecessary complexity. The disadvantage of the first approach is the lack of a correlation analysis that could quantify the impact of social isolation on the occurrence of stress. The second approach has two conditionally speaking disadvantages, which can be avoided. The first drawback is that the scales for assessing social isolation and stress levels are separate, often general and in some cases not covering precisely enough the specifics of social isolation caused by the COVID-19 pandemic. In other words, the individual variables that result from social isolation in a pandemic are in some cases not precisely defined. In addition, stress assessment scales date from the period before the onset of the pandemic and primarily measure certain behavioral and emotional responses to stress. However, the problem is that they measure the overall response to stress, where the reaction to stress may be a consequence of some other factors that are not a consequence of social isolation. One possible way to

improve this approach would be to determine the stress response before and after the pandemic, which could lead to a determination of a difference in the level of stress of people between these two periods. However, none of the aforementioned studies included an assessment of stress levels before and after the pandemic. It is understandable that such an approach would be quite complicated, and even practically very difficult to implement.

The second disadvantage of the second approach is that the impact of social isolation on the level of stress is assessed by applying correlation analysis and models, ie. mathematical procedures that are not perfect in themselves, whereby the interpretation of the results obtained in the mentioned papers is usually not performed by the authors (one of the reasons may be the complexity of the interpretation in some cases). The analysis is usually reduced to inserting the obtained results into statistical software, which generates certain output parameters (eg correlation coefficient). The application of these relatively complex statistical analyzes and models can also be avoided, whereby more precise results can be obtained that are very easy to interpret. There will be more words about that in the next chapter.

3.2. Development of a New Method for the Evaluation of Effects of Social Isolation on Advent of Stress

One of the basic requirements of the new method for assessing the impact of social isolation caused by the SARS-CoV-2 virus on stress is to circumvent the above-described shortcomings of the methods (approaches) previously used for this purpose. This goal can be achieved in a relatively simple way, which consists in developing a unique scale for assessing the impact of social isolation on stress levels. This means that instead of two separate scales, one of which is intended for social isolation and the other for stress, it is possible to use one scale. This scale should be formed in such a way that each individual question takes into account a certain variable of social isolation and directly assesses its effect on the level of induced stress.

Given the above, it is necessary to form such a scale that will simultaneously include the stimulus (in this case, social isolation) and the effect that produces that stimulus (in this case, stress). In addition, in order for the usability of the questionnaire to be as high as possible, it is necessary for the stimulus and its product to meet certain requirements. That in this case means that it is necessary to include the relevant segments of social isolation as variables in the questionnaire (individual questions). In addition, the questions need to be formulated in such a way as to unambiguously measure the stress that results from social isolation. In order to be able to determine the level of stress, questions should be formulated so that the respondent can assess the level of that induced load on a scale.

Given the above, it is necessary to form a new questionnaire so as to include as much as possible the objective component of social isolation, which had not been the focus of earlier studies. This is possible if the questions from the questionnaire take into account primarily objective factors that define social isolation, such as physical isolation, which is characteristic of the Coronavirus pandemic. So, if people are physically isolated, there is no doubt that they are also socially isolated to a certain extent. This differs from the subjective component of social isolation, which focuses on the perception of the subject and his/her understanding of whether he/she is socially isolated or not (primarily from the aspect of developing feelings of loneliness).

Taking into account the above, the factor of social isolation as a consequence of the Coronavirus pandemic should include the following influential variables:

- stay in home isolation as a result of various formal regulations prescribed by state authorities in cooperation with the health system, including local directives issued by companies regarding work from home
- inability to visit institutions of cultural and religious life
- impossibility to visit institutions and facilities intended for entertainment and recreation
- aggravated conditions for accepting new acquaintances, taking into account regulations related to maintaining physical distance
- aggravated conditions for initiating new acquaintances, taking into account regulations related to maintaining physical distance
- the likelihood of self-prescribed isolation measures applied by individuals on their own initiative in order to prevent the spread of infection (in addition to officially prescribed isolation measures)
- the likelihood that the person has already been in isolation as a result of Coronavirus infection
- the likelihood that the person has already been in isolation as a result of contact with a person infected with Coronavirus
- the likelihood that a person may be infected with the Coronavirus and consequently sent to isolation
- concern about the possible deterioration of the relationship with a family member or partner due to prolonged physical isolation as a result of Coronavirus infection
- concern about the possible deterioration of a relationship with a friend due to prolonged physical isolation as a result of Coronavirus infection
- inability to establish contacts with other persons due to difficult conditions for the realization of travel to other countries, as a consequence of the application of the locking rules prescribed by state authorities.

As is well known, social isolation has also effected changes in the performance of work activities. Changes in work activities are primarily reflected through work from home, based on regulations issued by the state or companies in order to prevent the spread of infection. This effect is included in the questionnaire through the first question, which refers to the coercion of home isolation, as well as a couple of other questions, if for an individual the job is a place where he/she makes contact with another person based on partnership ties, kinship, or previously established friendship relations.

As previously said, the stress assessment scale must be constructed in such a way that it can measure stress without any doubt. In previous research, stress assessment scales were used, which were based on subjective stress assessments by the respondents, ie. based on the reported behavioral and emotional reactions of the respondents. Although all these scales have passed a certain assessment of validity and reliability, their use cannot be based on simple questionnaire completion, because questionnaires completed in this way, if the questions were not brought into the context of the factors whose impact on stress is to be assessed, can only measure the total stress level of the person and nothing else. Therefore, in order for these questionnaires to be usable, the questions from the questionnaire for stress need to be modified and linked to the variable whose impact on stress is being examined. However, in many of the aforementioned studies, such modification of the questions from the questionnaires used to assess stress cannot be observed.

However, even if the stress assessment questionnaires as a whole are brought into connection with a particular factor when assessing its impact on stress, given the wording of questions from existing stress questionnaires, an accurate assessment of the impact of the observed factor is not possible unless it has not been assessed stress before the action of that factor, in addition to the assessment when there is an effect of that factor (for example Coronavirus). No mathematical apparatus, such as, for example, factor analysis, can increase the accuracy of the results if the aforementioned requirement is not met.

Having in mind the above, in order to avoid the shortcomings of the application of the previous questionnaires for stress assessment, it was necessary to form a new questionnaire. As previously mentioned, each individual question from that questionnaire should contain a selected variable from the domain of social isolation, as well as a part related to the respondents' assessment of the stress produced by the observed variable. However, when it comes to assessing stress levels, it was necessary to avoid the possibility that the scale could eventually include some additional behavioral or emotional response to stress. For this reason, for evaluation, behavioral or emotional responses were not used as quantifiers of stress. Instead, stress is viewed in its original form, as a phenomenon that determines some strain, pressure, or load to which a particular entity is exposed. In this regard, from different definitions for stress, descriptors have been selected that are used as an explanation of this phenomenon. Stress synonyms that are most commonly used as its descriptors in stress definitions are:

- strain
- load
- pressure
- burden
- hardship
- tenseness.

The mentioned stress descriptors were applied to form questions for stress assessment, and they were used depending on the context of the question (sentence). So, the essence was to determine what level of strain - stress is produced by a certain variable from the domain of social isolation. Taking into account all the mentioned factors, a new questionnaire was formed to assess the impact of social isolation caused by the Coronavirus pandemic on the level of stress. This questionnaire contains 12 questions and is given below. The assessment of stress levels is based on the Likert scale with five levels.

Questionnaire for Assessment of the Stress Level as a Consequence of Social Isolation Caused by the Coronavirus Pandemic (SICS)

1. On a scale from 1 to 5, assess to what extent the measures of home isolation prescribed by any directive (including curfew also) were a strain (burden, hardship, or overload) for you
2. On a scale of 1 to 5, assess the extent to which the inability to visit cultural institutions (theaters, museums, cinemas, galleries, operas, religious objects) was a strain for you

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3. On a scale of 1 to 5, assess the extent to which the inability to visit locations intended for entertainment and recreation (cafes, discos, amusement parks, playgrounds, fitness centers, etc.) was a strain for you
4. On a scale of 1 to 5, assess the extent to which it has been a strain (problem, hardship, or overload) for you to accept an offer for a new acquaintance having in mind the rules of physical distancing due to the existence of the Coronavirus
5. On a scale of 1 to 5, assess the extent to which it was a strain (problem, hardship, or overload) for you to initiate a new acquaintance having in mind the rules of physical distancing due to the existence of the Coronavirus
6. If you practiced self-prescribed additional isolation measures (independently of official measures), on a scale from 1 to 5 assess to what extent that additional isolation measures were a strain (burden, hardship, or overload) for you
7. If you were compelled to be physically isolated as a result of your Coronavirus infection, not taking into account the severity of the disease, rate on a scale of 1 to 5 to what extent this kind of mandatory isolation (in a hospital, special quarantine, etc.) was a strain (burden, hardship, or overload) for you
8. If you were in any kind of physical isolation due to being in contact with a person who has Coronavirus disease, assess on a scale of 1 to 5 to what extent this type of imposed isolation was a strain (burden, hardship, or overload) for you
9. On a scale of 1 to 5, assess the extent to which you are strained (worried) due to the possibility of being isolated in any type of isolation (quarantine, hospital, etc.) if you become infected with the Coronavirus
10. In case of necessity of mandatory physical isolation if you become infected with the Coronavirus, or in the case of prolonged isolation due to prescribed rules in connection with maintaining the physical isolation, on a scale of 1 to 5 assess how tense are you (concerned) due to the possibility that your relationship with your family (partner) could deteriorate in the meantime
11. In case of necessity of mandatory physical isolation if you become infected with the Coronavirus, or in the case of prolonged isolation due to prescribed rules in connection with maintaining the physical isolation, on a scale of 1 to 5 assess how tense are you (concerned) due to the possibility that your relationship with some of your friends could be disturbed in the meantime
12. On a scale of 1 to 5, assess the extent to which the measures to prohibit or restrict travel opportunities prescribed by states have been a load (problem, hardship, or overload) in terms of preventing physical contact with other persons (relatives, partners, friends, etc.)

In order to initially check the validity of the questionnaire, face validity was first determined. Seven people (who were not experts) assessed on a five-level Likert scale, whether individual questions from the questionnaire are measuring what they needed to measure, ie. stress as a consequence of social isolation. All respondents have declared positive about the questions from the questionnaire,

which received maximum marks. After that, the content validity check was continued. Five experts from the relevant fields checked whether each item was essential for testing. CVR was determined twice. It was first determined in 2020, when the questionnaire was formed. For the first 11 items from the questionnaire, the CVR was 1. For the question under ordinal number 12, the CVR was 0.6. As a result, question number 12 was initially omitted from the questionnaire. However, this assessment was made at a time when travel restrictions were minimal and people were able to travel across the border without difficulty in most cases. The CVR was determined for the second time in 2021, at the time of the locking of many countries and the application of significant restrictions in terms of travel possibilities. In this case, all values for CVR were 1, including for question number 12. For this reason, question number 12 was returned to the originally formed questionnaire after fulfilling the conditions for content validity and was included in the final version of the questionnaire which was shown above.

3.3. Application of the SICS Questionnaire to Determine the Occurrence of Stress Due to Social Isolation Caused by the Pandemic in a Sample of Serbian Citizens

In order to determine the existence of induced stress due to the existence of social isolation in the conditions of the SARS-CoV-2 virus pandemic, research was conducted on a sample of Serbian citizens. This research included 500 citizens, mostly from the capital Belgrade, as well as several other smaller urban and rural areas. The average age of the respondents was 44.6 years, while the standard deviation of the subjects was 19.1 years. The youngest participant in this research was 12 years old, and the oldest was 91 years old. The occupation profile of the respondents was very wide, from elementary school students to retirees.

Respondents were asked to complete the questionnaire that is given in the appendix on their own. This questionnaire contains questions from the SICS questionnaire. However, in order to gain a more complete picture of the sample of respondents and their behavior during the pandemic, some more questions have been added. These additional questions referred to the infection with the COVID-19 virus in the previous period, staying in isolation due to contact with an infected person, adherence to prescribed measures, etc. The ordinal numbers of the basic and additional questions can be seen in the appendix.

Data collection began in 2020 and research continued in 2021. The reasons for this circumstance were mentioned earlier. It should be noted that the questionnaire in the appendix does not contain the twelfth question from the SICS questionnaire. The reason has already been mentioned before (question 12 from the SICS questionnaire subsequently passed the content validity criterion in 2021, considering significantly changed circumstances or the complete impossibility of traveling outside state borders).

4. RESULTS

In accordance with the formulation of the questionnaire given in the Appendix, respondents gave answers by circling numbers on a scale from 1 to 5, by circling YES or NO answers, or by writing the answer on the line below the question. The numeration of the question that follows is in the agreement with the numeration from the Appendix. Below are the average values of the respondents' assessments on individual questions about the induced level of stress as a consequence of social

isolation. It should be noted that in some cases, not all 500 respondents gave answers to certain questions, because some of the questions did not refer to certain categories of respondents, or they did not previously meet the conditions for answering that question. To questions 1, 1a, 7, 8, 8a, 9 and 9a, respondents were not answering by rounding the number on the scale.

The average score of the respondents' answer to question number 1b, which referred to the assessment of stress levels as a consequence of the application of prescribed measures of home isolation, is 3.27 (SD = 1.276). The answer to this question was given by 447 respondents, since they had previously given a positive answer regarding compliance with home isolation measures.

The average score of the answers of all 500 respondents to question number 2, which refers to the assessment of compliance with the prescribed measure of keeping a distance of 2 m from the next person, is 2.568 (SD = 1.198).

The average score of the answers of all 500 respondents given to question number 3, which refers to the assessment of the levels of induced stress as a consequence of the inability to visit cultural life institutions, is 2.854 (SD = 1.322).

The average score of the answers of all 500 respondents given to question number 4, which refers to the assessment of the levels of induced stress as a consequence of the inability to visit places intended for entertainment and recreation is 2.834 (SD = 1.392).

The average score of the answers of all 500 respondents given to question number 5, which refers to the assessment of induced stress levels due to difficult conditions or inability to accept an offer for a new acquaintance as a result of physical distancing and isolation measures is 2.732 (SD = 1.198).

The average score of the answers of all 500 respondents given to question number 6, which refers to the assessment of induced stress levels due to difficult conditions or inability to initiate an offer for a new acquaintance as a result of physical distancing and isolation measures is 2.686 (SD = 1.297).

The average score of the answers of 206 respondents given to question number 7a, which refers to the assessment of the levels of induced stress due to the feeling of being forced to apply additional self-isolation measures in order to prevent the transmission of infection, is 3.344 (SD = 1.289). The answer to this question was given by 206 respondents, since they had previously given a positive answer regarding the practicing of additional isolation measures in addition to those already prescribed (seventh question).

The average score of the answers of 83 respondents given to question number 8b, which refers to the assessment of the levels of induced stress due to physical and social isolation during the duration of the disease, is 3.457 (SD = 1.161). The answer to this question was given by 83 respondents, since they had previously given a positive answer regarding the question of whether they had suffered from Coronavirus (eighth question).

The average score of the answers of 83 respondents given to question number 9b, which refers to the assessment of the level of induced stress due to physical and social isolation as a consequence of

contact with an infected person, is 3.5 (SD = 1.187). The answer to this question was given by 83 respondents, since they had previously given a positive answer regarding the question of whether they were in isolation due to contact with an infected person (ninth question).

The average score of the answers of all 500 respondents given to question number 10, which refers to the assessment of the levels of induced stress due to the possibility of isolation as a consequence of the real possibility of coronavirus infection, is 3.712 (SD = 1.186).

The average score of the answers of all 500 respondents given to question number 11, which refers to the assessment of the levels of induced stress due to concerns that relationships with family (partner) could deteriorate in isolation is 2.57 (SD = 1.383).

The average score of the answers of all 500 respondents given to question number 12, which refers to the assessment of the levels of induced stress due to concerns that relationships with some of the friends could be damaged due to isolation, is 2.502 (SD = 1.406).

5. CONCLUSION

In addition to the new tool in the form of the questionnaire SICS (Social - Isolation - Coronavirus - Stress), this paper presents a new methodological approach for determining the impact of social isolation due to the SARS-CoV-2 virus pandemic on the occurrence of mental stress. In 3.2. the advantages of applying this methodological approach are described, which are manifested through:

- its more simple application, because only one is used instead of two questionnaires
- simpler mathematical analysis, because data processing does not require complex mathematical procedures.

The SICS questionnaire presented in this paper enables the realization of both of the above-mentioned methodological advantages. In addition, the advantages of using the SICS questionnaire compared to other questionnaires previously used for this purpose are:

- stress is unequivocally measured by this questionnaire, because it is considered in its original form, as a certain type of load, effort or strain that arises as a result of a stimulus, in this case, social isolation
- it covers a larger number of determinants of social isolation caused by a pandemic than other tools
- the accuracy of the data obtained on the basis of this questionnaire has been increased, because each question measures the stress that is induced as a consequence of a certain precisely defined variable of social isolation
- the data obtained from the application of this questionnaire are easy to interpret
- does not require stress measurements before the onset of social isolation and during social isolation.

Research on the occurrence of stress as a consequence of social isolation due to the COVID-19 pandemic has shown that the SICS questionnaire can be successfully used to determine stress levels. The highest level of stress (av =3.712, on a scale from 1 to 5) among the population of Serbia was established as a result of the existence of an objective danger of isolation due to possible coronavirus

infection. The lowest level of stress (av = 2.502, on a scale of 1 to 5) was registered due to the existence of the possibility that relationships with some of the friends could deteriorate during the duration of isolation. Finally, another advantage of this questionnaire can be highlighted. The questions are formulated in such a way as to enable its application regardless of the location, which means that the questionnaire can be applied in any national environment.

References

- [1] Li J., Zhou L., Van Der Heijden B., Li S., Tao H. and Guo Z., 2021, Social Isolation, Loneliness and Well-Being: The Impact of WeChat Use Intensity During the COVID-19 Pandemic in China. *Front. Psychol.*, Vol. 12:707667.
- [2] World Health Organization, 2021, Social isolation and loneliness among older people: advocacy brief, WHO, Geneva.
- [3] Hawkey L. C., and Cacioppo J. T., 2010, Loneliness matters: a theoretical and empirical review of consequences and mechanisms, *Ann. Behav. Med.*, 40, pp. 218–227.
- [4] Steptoe A., Owen N., Kunz-Ebrecht S.R., and Brydon L., 2004, Loneliness and neuroendocrine, cardiovascular, and inflammatory stress responses in middle-aged men and women. *Psychoneuroendocrinology*, Vol. 29, pp. 593–611.
- [5] Lee E. H., Moon S. H., Cho M. S., Park E. S., Kim S. Y., Han J. S., et al., 2019, The 21-item and 12-item versions of the depression anxiety stress scales: psychometric evaluation in a Korean population. *Asian Nurs. Res.*, 13, pp. 30–37.
- [6] Antony M. W., Bieling P. J., Cox B. J., Enns M. W., and Swinson R. P., 1998, Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample, *Psychol. Assess.*, 10, pp. 176–181.
- [7] Mautong H., Gallardo-Rumbea J.A., Alvarado-Villa G.E. et al., 2021, Assessment of depression, anxiety and stress levels in the Ecuadorian general population during social isolation due to the COVID-19 outbreak: a cross-sectional study, *BMC Psychiatry* 21, 212.
- [8] Pietrabissa G., and Simpson S.G., 2020, Psychological Consequences of Social Isolation During COVID-19 Outbreak, *Front. Psychol.*, Vol. 11:2201.
- [9] Clair R., Gordon M., Kroon M. et al., 2021, The effects of social isolation on well-being and life satisfaction during pandemic, *Humanit Soc Sci Commun*, 8:28.
- [10] Zavaleta D., Samuel K., and Mills C.T., 2017, Measures of social isolation, *Soc Indic Res*, 131(1), pp. 367–391.
- [11] Banerjee D., and Rai M., 2020, Social isolation in Covid-19: The impact of loneliness, *International Journal of Social Psychiatry*, 66(6), pp.525-527.
- [12] Toscano F., and Zappalà S., 2020, Social Isolation and Stress as Predictors of Productivity Perception and Remote Work Satisfaction during the COVID-19 Pandemic: The Role of Concern about the Virus in a Moderated Double Mediation, *Sustainability*, 12(23):9804.
- [13] Ayyagari R., Grover V., and Purvis R., 2011, Technostress: Technological antecedents and implications, *MIS Q. Manag. Inf. Syst.*, Vol. 35 No. 4, pp. 831–858.
- [14] Golden T.D., Veiga J.F., and Dino R.N., 2008, The Impact of Professional Isolation on Teleworker Job Performance and Turnover Intentions: Does Time Spent Teleworking, Interacting Face-to-Face, or Having Access to Communication-Enhancing Technology Matter? *J. Appl. Psychol.*, Vol. 93 No. 6, pp. 1412–1421.
- [15] Grabowski J., Stepień J., Waszak P., Michalski T., Meloni R., Grabkowska M., Macul A., Rojek J., Loretta L., Sagan I. and Bidzan L., 2021, Social Isolation During COVID-19 Pandemic. Perceived Stress and Containment Measures Compliance Among Polish and Italian Residents, *Front. Psychol.*, 12:673514.

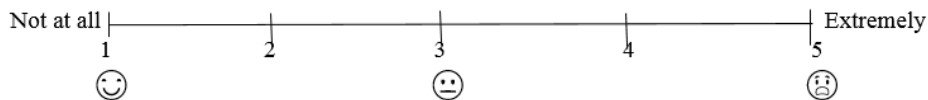
APPENDIX

1. Were you applying the measures of home isolation that were prescribed by any official directive (including curfew also)?

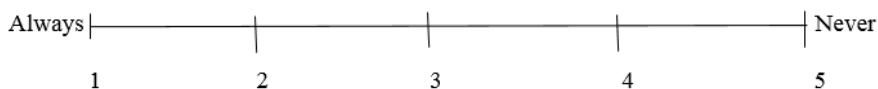
YES NO

1a. If the answer to the previous question is NO, enter the reason why were you not applying the isolation measures envisaged by the official directive (including curfew) on the line below

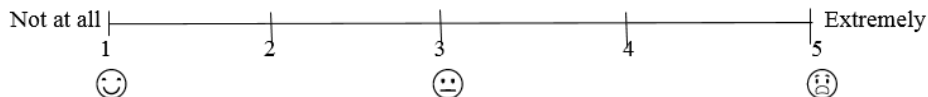
1b. If the answer to the previous question is YES, on a scale from 1 to 5, assess to what extent the measures of home isolation prescribed by any directive (including curfew also) were a strain (burden, hardship, or overload) for you



2. Assess to what extent (on average) did you adhere to the prescribed measures of keeping a distance of 2 m from the next person?



3. On a scale of 1 to 5, assess the extent to which the inability to visit cultural institutions (theaters, museums, cinemas, galleries, operas, religious objects) was a strain for you



4. On a scale of 1 to 5, assess the extent to which the inability to visit locations intended for entertainment and recreation (cafes, discos, amusement parks, playgrounds, fitness centers, etc.) was a strain for you

