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RESEARCH ARTICLE

Principles of Forming a Strategy for Reducing the Psychological Tension of Social Network Users

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Abstract:

Aims:

The purpose of the study was to develop principles of a strategy for influencing the psychological state of social network users using the example of the Russian-language segment of Twitter, one of the reasons for which is the lack of awareness about aspects of the coronavirus infection.

Background:

In contrast to the existing works on mood management and Emotion Regulation Strategies, there are principles based not on emotional regulation (cognitive reappraisal and expressive suppression), but on information processing of the content of social media messages and forums.

Objective:

The objective of the study was to develop principles of a strategy for reducing the psychological tension of social network users (further – Strategy) based on the Russian-language segment of Twitter.

Methods:

The proposed research methodology includes a study of the discussion field in the active forum of the Runet (the qualitative aspect of emotionality as a reflection of psychological tension) and the Russian-language segment of Twitter (the quantitative aspect of terminology frequency). The qualitative research consisted in isolating the sensitive words used by vaccine opponents to describe their beliefs. A multi-stage methodology has been developed for the meaningful analysis of Twitter users' messages.

Results:

The result of the study is a methodology for developing principles of the Strategy. Based on this methodology, the following aspects of the problem have been developed: 1) the principle of clarifying the definition of psychological tension; 2) the principle of comparing the user and scientific meanings of terms, taking into account the contexts of their use; 3) the principle of contextual comparison of the user's and scientific meanings of the term; 4) the principle of visual popularization of scientific knowledge.

Conclusion:

An original methodology was created for developing principles of the Strategy. In contrast to the existing works on mood management and Emotion Regulation Strategies, there are principles based not on emotional regulation (cognitive reappraisal and expressive suppression [1]), but on information processing of the content of social media messages and forums.

Other:

A new approach to reducing the psychological tension of social media users can contribute to sharing timely, accurate and positive information about COVID-19, and reduce excessive discussions about COVID-19, which can positively affect the psychological well-being of the general public.

Keywords: Twitter, Anti-vaxxers, Vaccine, Vaccination, COVID-19, PCR testing, Emotional regulation.

Article History

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1. INTRODUCTION

The world took damage from the COVID-19 pandemic. Vaccines are one of the most important preventive measures to protect the population from diseases and infections. The development of vaccines is considered one of the greatest advances made in medicine.

Anti-vaccination sentiments in society have been known for a long time. In 1722, English minister Edmund Massey delivered a sermon “A sermon against the dangerous and sinful practice of inoculation”. Massey stated: “Let us not sinfully endeavour to alter the Course of Nature...”. He denounced these vaccines as an attempt to resist God's punishment of man for his sins [2]. Despite the development of science, the measures used to prevent infectious diseases still cause controversy and concern [3].

Access to the medical information on the Internet has changed the discussion landscape of social communication on health issues. At the same time, the dissemination of false and misleading information found on the Internet can lead to negative consequences, for example: refusal of parents to vaccinate their children, and refusal to vaccinate against strains of coronavirus [4]. Anti-vaccination Internet writers use a range of tactics to achieve their goals, including distorting scientific data, changing hypotheses, censoring opposition, and attacking critics [5].

The rise of movements against coronavirus vaccination poses a serious threat to human health and herd immunity. People of all ages are falling victim to the coronavirus disease, which has not only placed a huge strain on national health systems but is causing massive deaths.

The majority of the population does not have specialized education in order to confidently judge such topics as the composition of vaccines, the principles of their action, the effect on the human body, and limitations in their use. People do not understand what a virus is, how it works, how it enters the body, and what antibodies are. Such people have a reduced criticality of perception in relation to rumors. Therefore, the population succumbs to rhetorically convincing speeches and statements of media persons. In addition, people who have the highest need for knowledge about vaccination are the most vulnerable to this information [6]. Several studies have shown that older people, women, people with higher incomes, and people with higher levels of education are more likely to take the vaccine [7].

The main source of information from which people get information about COVID-19 vaccines is TV. The second source of information is the Internet, social networks, and close circle (relatives, friends, acquaintances, colleagues).

Yaqub *et al.* found that distrust of doctors, government sources and pharmaceutical companies is the cause of the hesitant attitude of citizens of different countries towards vaccination, including anxiety or doubts about the value or safety of vaccination [8].

A European study found that more than 40% of respondents experienced some degree of negative attitudes towards vaccine safety [9]. A study conducted in October 2020 in the United States showed a further decline in the readiness of people to be vaccinated against COVID-19, with only 51% of respondents expressing their intention to get vaccinated [10]. The lack of reliable and understandable information is expressed in the level of confidence in the coronavirus vaccines developed. “Vaccines cannot be trusted” – this is the opinion of 33.6% of respondents from Pakistan, 32.9% from Kazakhstan, 17.2% from Kyrgyzstan, 14.3% from Tajikistan, 12.5% from Georgia, 9.5% from Uzbekistan, 5.1% from Mongolia [11]. A recently published global survey of 19 countries conducted in June 2020 showed that the vaccination acceptance rate (consent to get vaccinated) ranges from 54.95% to 88.6% (the lowest in Russia and the highest in China [12]).

The vaccination campaign against coronavirus in Russia is going on with difficulty. Officials impose restrictions on the unvaccinated amid the development of a black market for vaccination certificates and fake PCR. The main problem of the authorities is the large-scale distrust of vaccines in the country [13]. A huge number of fake messages about the virus and vaccination on the Internet is already presented as an information war that Russia's healthcare is losing [14]. Philologists have studied the neo-language of Russian-speaking anti-vaxxers, assessing it as meager, unexpressive but at the same time alarming in its hostility to the rest of the world. Anti-vaxxers call medical masks “muzzles”, and vaccinated people - “pricked”, “zombie” and “biorobots” [15].

Twitter has revolutionized the way people communicate. In just 280 characters, users instantly participate in public discussions of current events. As social media continues to grow, it is reasonable to expect anti-vaxxers to continue spreading their beliefs on these platforms.

The aim of this paper is to develop and implement approaches to create a strategy for reducing the psychological tension of social network users during the COVID-19 pandemic based on the attitudes towards PCR testing.

It is proposed to solve the following tasks: 1) development of a methodology for the semantic analysis of forum messages; 2) preparation of an experimental array of tweets as an example; 3) semantic analysis of an array of messages to study the discussion field on the example of the active discussion forums of Runet; 4) analysis of the geographical distribution of Russian-speaking users based on an experimental array of tweets; 5) analysis of the topics of discussion and formation of thematic collections of tweets based on the hashtags #coronavirus, #PCR; 6) classification of sub-topics and selection of characteristic messages for each sub-topic; 7) formulation of principles of the Strategy; 8) an illustration of the implementation of the principles formulated during the previous step.

The main result was the formulation of principles for developing a strategy for reducing the psychological tension of social networks users based on a scientific understanding of the issues of PCR testing to detect infection of people with SARS-

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CoV-2 coronavirus.

The popularity and ubiquity of social media make it a valuable source for stress detection compared to traditional survey-based methods. Social media data provides valuable insight into the physical and mental health of users. Social media has been used to determine the trajectory of disease outbreaks [16, 17]. Several studies have identified markers in social media messages to identify a range of mental health problems, including drug addiction [18], depression [19], post-traumatic stress disorder (PTSD) [20], and suicidal thoughts [21]. Automatic suicidality detection modes use algorithms to detect variables such as keyword frequency, time of posting, and message tone [22].

Social networks are important sources of information [23]. Social media language is now a useful tool for identifying markers of mental health [24].

The expression of emotions by people seeking support is a widely used way of emotion regulation [25]. Online expression of emotions is widespread on social networks such as Facebook and Twitter, as well as other online resources such as blogs and forums [26]. Social support through interpersonal emotion regulation is used to reduce stress [27]. The concise nature of posts encourages more updates per day than traditional blogs [28]. This makes Twitter a suitable object for studying mental reactions to concrete situations.

Our work studied aspects that have not yet been considered in previous papers by other authors.

(1) Analysis of the manifestations of subjective opinions in relation to PCR testing, causing the formation of psychological tension in Russian-language tweets.

(2) The use of topic modeling to select themes that meet predefined criteria.

(3) Identification of erroneous information, misunderstandings or lies in tweets based on comparison with scientific information.

2. MATERIALS AND METHODS

The proposed original research methodology includes 2 main stages. The first stage includes the study of the discussion field on the example of one of the active discussion forums of the Runet. The first stage is the qualitative aspect of the study. The second stage includes the analysis of an experimental array of tweets. Based on the results, principles of the Strategy are proposed. The second stage is the quantitative aspect of the study.

2.1. The First Stage

Step 1 included the study of the discussion field of the active discussion forum of the Runet. The qualitative aspect of the developed methodology included the study of the discussion field of the active discussion forum of the Runet Sevpolitforum.info (Sevastopol Politforum) in the topic of the Politics section “Coronavirus, who are you, goodbye!”. 328 pages of the topic were viewed from October 1 to December 5, 2021, which amounted to more than 8,000 posts.

Qualitative research consisted in detecting current topics of discussion between supporters and opponents of vaccination as well as highlighting the terminology used by anti-vaxxers to describe their beliefs. The topics were selected by an expert method based on the activity of discussing objects/processes in the field of vaccination [29]. Several topics were highlighted in this area which were most actively discussed in the period from October 1 to December 5, 2021. In those topics, the choice of terms was carried out based on their emotional intensity. For a qualitative assessment of emotional tension, we used a resource developed by us earlier which includes the dictionaries of tonal vocabulary extracted from various Internet sources [30].

The criteria for choosing a topic for Phase 2 of our study were as follows: a) insufficient awareness of the population about the discussion object; b) non-political nature of the discussion.

Step 2 included the analysis of the generated experimental array of tweets to develop principles of a strategy for reducing the psychological tension of users. When developing a methodology for analyzing tweets as an example of the social network, we proceeded from the following hypotheses, which were tested experimentally: 1) Twitter threads are the mixture of “long” threads existing weekly or monthly and “short” threads that pop up and then quickly disappear; 2) high-profile events will generate many tweets; 3) the authors of Russian-language tweets are mostly Russians.

2.2. The Second Stage

The content aspect of our methodology included the following 6 steps.

Step 1 included the formation of a representative array of experimental data. A collection of tweets was formed. Data for research was downloaded from Twitter in November-December 2021 (from 29/11/2021 to 05/12/2021). The download was carried out using the analytical mechanisms of Twitter (Vicinitas) [31] which allows downloading Tweet Id, Tweet Type, hashtags, User Id, Name, location, *etc.* The whole procedure takes place in real time. This research contains 4161 Russian tweets (translated into English).

Step 2 included the analysis of the geographical distribution of Russian-speaking users. We analyzed the geographical distribution of Russian-speaking users who expressed their opinion on topics of interest. Not all users have a location, however it should be noted that users come from different countries: Russia, Post-Soviet states, Germany, Serbia, the USA, Israel, the Czech Republic, Cyprus, Greece, France, Japan, *etc.*

Step 3 included the analysis of the discussion topics and the formation of thematic collections of tweets [32]. A collection of tweets was analyzed to highlight topics of discussion using an expert method and forming mini-collections of tweets by topic. Each topic was divided into sub-topics.

The criteria for the formation of an experimental array to develop principles for the strategy were as follows: 1) insufficient awareness of Twitter users about the object of discussion; 2) a relatively high number of messages

contradicting each other; 3) “long” period of discussion of the topic [33]; 4) non-political character of the discussion.

Twitter users’ awareness was assessed according to the following criteria: 1) use of terms related to the molecular and biochemical aspects of coronavirus disease and testing for coronavirus (for example, professional terms such as replication, RNA polymerase, primer); 2) use of decoding abbreviations (ribonucleic acid instead of RNA, polymerase chain reaction instead of PCR).

Step 4 included breaking topics into subtopics and selecting characteristic messages. The resulting experimental array on the selected topic was analyzed as follows: a) dividing the messages into subtopics; b) highlighting the messages in the subtopic to chosen directions.

Step 5 included the development of the strategic principles of influencing users’ moods/beliefs. The principles of developing a strategy for reducing the users’ moods are formulated.

Step 6 included the implementation of the principles of the influence strategy. From messages related to the chosen directions, the users’ usual opinions were identified. Relevant scientific papers were considered, and we formulated and posted tweets to popularize scientific understanding of the issues and aspects of PCR testing.

3. RESULTS

3.1. Studying the Terminology used by Opponents of Vaccination (Anti-vaxxers)

The study of the terminology used by opponents of vaccination (anti-vaxxers) was carried out in order to select a topic for the subsequent formation of an experimental array to develop principles of the Strategy.

The search for anti-vaxxer terminology was carried out on the Sevpolitforum.info forum (Sevastopol Politforum) in the topic “Coronavirus, who are you, goodbye!” in messages from October 1 to December 5, 2021. The search was carried out by terms in the posts with a pronounced position of anti-vaxxers. Here are some examples of messages from anti-vaxxers.

“I am definitely for vaccination with proven and valid vaccines. When the vaccine is not tested and does not work very well, it should be a conscious choice, and not a consequence of fraud. And even more so, not an order from the bastards who imagine themselves to be the elite. ... Can a vaccinated person get infected, infect other people and even die? This is a fact that has already been established purely empirically and repeatedly [34].”

“And every post of such propagandists who are agitating for vaccination with no one knows what, which has not passed all the tests, is a corpse. Or a cripple. Or disabled. These are unfortunate children who have lost their father, mother, even if they did not die, but became disabled. This is lost childhood happiness. And you will be judged as the German Nazis who were judged by an international court... [35].”

In the array of messages from opponents of vaccination, we expertly identified the following topics: “vaccine”, “vaccination”, “virus”, “media”, “society (population)”, “authority”. These topics were identified based on the pronounced emotional coloring of the vocabulary. Then we selected the main language units (terms and phrases) that were used to criticize the official positions of the authorities on the pandemic. As expressions of the extreme manifestations of the anti-vaxxers’ positions, we have identified such terms as “Conspiracy against humanity”, “Vaccine fascism”, “Medical holocaust”, “Vaccine apartheid”. The main terms are presented in the form of a two-dimensional terminological map, which is a visualization of the study area (Fig. 1).

According to the proposed methodology (Materials and Methods), the principles for choosing a topic for further research were as follows: 1) insufficient awareness of the population about the object of discussion; 2) the non-political character of the discussion. Most people have little understanding of the essence of the PCR test, doubt the reliability of its results. Further presentation refers to the topic “PCR test”. This topic was chosen to form an experimental array of tweets.

3.2. Analysis of tweets related to the PCR tests

At this stage of the study, the following tasks were performed: 1) preparation of an experimental array of tweets; 2) analysis of the geographical distribution of Russian-speaking users; 3) analysis of the topics of discussion and the formation of thematic collections of tweets; 4) division of topics into subtopics and selection of characteristic messages; 5) development and implementation of the principles of the strategy for reducing the psychological tension of Twitter users. The tasks can be solved by using a combination of automatic and expert methods.

An experimental array of tweets was formed, consisting of 4161 messages for the period from 29/11/21 to 5/12/21. Russian-language tweets were selected based on the presence of the keyword “PCR”. The array included 1428 original tweets, 1517 retweets, 1216 replies.

3.2.1. Geographic distribution of Russian-speaking Twitter users expressing their attitude towards PCR tests

The location was specified for 2073 out of 4161 tweets. Users from Algeria, the Netherlands, Denmark, Argentina, Cambodia, Mongolia, Cabo Verde, Abkhazia, LNR, San Juan y Martinez, Singapore, Bosnia and Herzegovina, Sweden, Uzbekistan left 1 tweet each. Users from Ecuador, Belgium, Greece, Bulgaria, Armenia, Lithuania, Bermudes, Portugal, and the Slovak Republic left 2 tweets each. Users from Spain, Italy, Thailand, Canada, and Switzerland left 3 tweets each. Users from Austria, Turkey, Moldova left 4 tweets each; from Fiji, Syria – 5 tweets each; from Cyprus, Estonia, France, Australia, Latvia, and the Republic of Korea – 6 tweets each; from Poland, Serbia – 8 tweets; from Finland – 9 tweets; from Donetsk, Israel, Japan – 10 tweets. The countries with highest number of tweets are shown in Table 1.

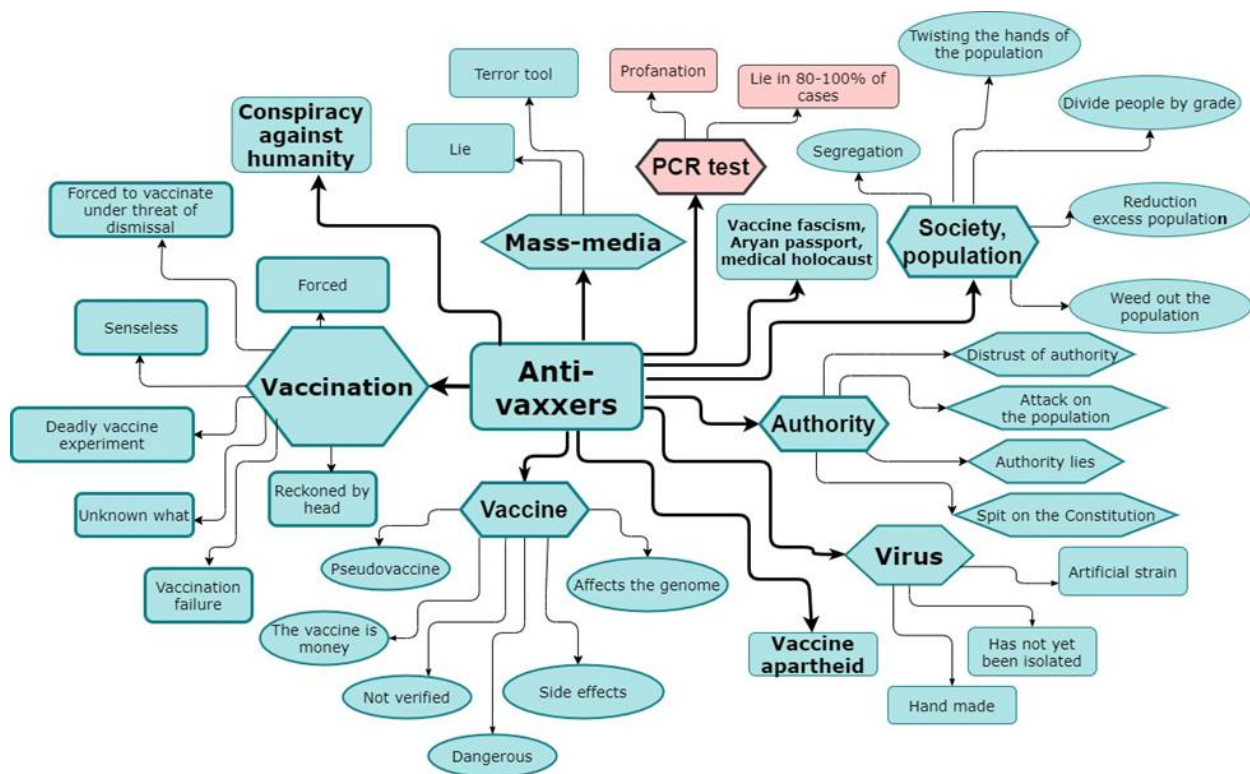


Fig. (1). Terminological map of the ideology of anti-vaxxers (based on materials from the Sevpolitforum.info forum).

Most users are Russians. 35.56% of Russian users' tweets are from Moscow and 10.88% are from St. Petersburg. So 46.44% are from two Russian capitals (almost half of all Russian users' tweets). The share of all post-Soviet republics was 12.01%. The expressed earlier hypothesis that the authors of Russian-language tweets are mainly Russians was confirmed.

3.2.2. Analysis of Topics for PCR Tests Discussion and the Formation of Thematic Collections of Tweets

The tweets were analyzed by topic. Expert analysis of the texts (Methods and Materials) revealed nine central sub-topics related to attitudes towards PCR tests and PCR testing: 1) Test expiration date; 2) Passing the test; 3) Test result; 4) Test cost; 5) Border control (using a test to control people crossing the border); 6) Control inside the country; 7) Test reliability; 8) Conspiracy theory; 9) Fake tests. Tweets that had not been included in the listed above sub-topics made up the

Miscellaneous group.

Tweets were analyzed statistically in each sub-topic (theme). The analysis included counting the total number of tweets (including retweets) and the number of original tweets. Fig. (2) shows the ratio of the total number of tweets (including retweets) with the PCR keyword by sub-topic as a percentage of the total number of tweets.

The prevalence of tweets on the sub-topic “Test expiration date” is due to the fact that in order to combat the omicron strain, Rospotrebnadzor decided to limit the validity of the PCR test from 72 to 48 hours [36]. So, many tweets include retweets of official announcements about the reduction in test validity with user comments. The number of original tweets on the sub-topic “Test expiration date” was only 18.67 percent. Therefore, the sub-topic “Test expiration date” is “short” and not suitable for long-term consideration. Thus, the hypothesis about the presence of “short” topics in the discussion is confirmed.

Table 1. The countries with the highest number of Russian tweets related to PCR test.

Country	Number of Tweets	Percentage of Total
China	11	0,53
Czech Republic	11	0,53
Republic of Macedonia	15	0,72
Kyrgyzstan	19	0,92
United Kingdom	29	1,40
Germany	30	1,45
USA	35	1,69

(Table 1) contd....

Country	Number of Tweets	Percentage of Total
Kazakhstan	41	1,98
Belarus	45	2,17
Ukraine	123	5,93
Russia, out of Moscow Saint Petersburg	1572 559 171	75,83

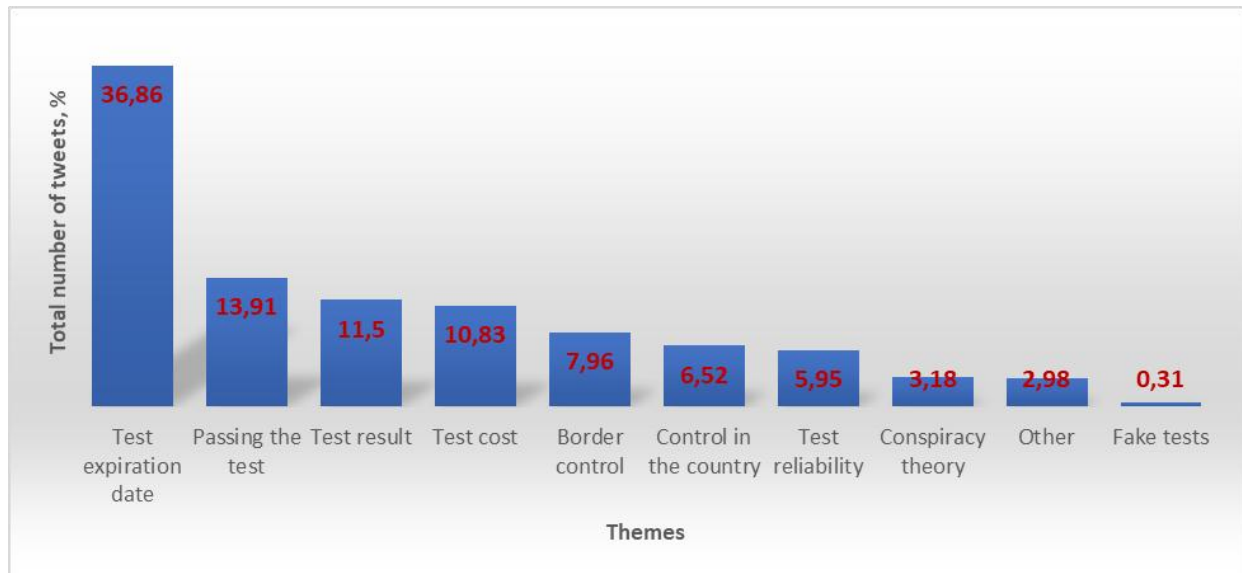


Fig. (2). Total number of tweets (including retweets) with the PCR keyword by sub-topic as a percentage of total tweets.

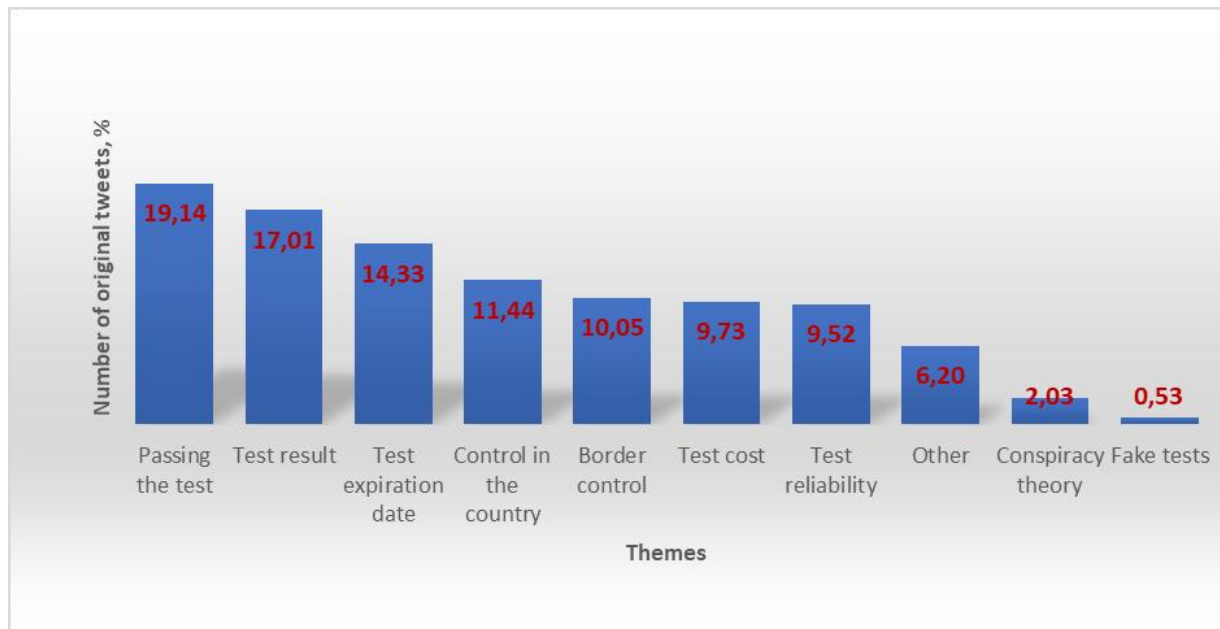


Fig. (3). Number of original tweets (excluding retweets) with PCR keyword by sub-topic in percent of the total number of original tweets.

Fig. (3) shows the ratio of the number of original tweets (excluding retweets) with the PCR keyword by sub-topic in percent of the total number of original tweets. The discussion

of passing the test and test results dominated in the original tweets.

3.2.3. Splitting Topics Into Sub-topics and Selecting Characteristic Messages

Many tweets in the sub-topic “Test expiration date” were related to the fact that Rospotrebnadzor, in order to combat the highly infectious omicron strain, reduced the validity of the PCR test [37]. It has raised the concerns that people who take the test could receive its results after the expiration date.

People discuss the conditions for taking the test in the sub-topic “Passing the test”. They report about passing the test and the anxiety before taking the test. Users share information about their test results (positive or negative), often conveying their emotional state in the sub-topic “Test result”.

There are significant number of tweets in the “Test cost” sub-topic related to the high cost of PCR tests, including suggestions that the high cost is associated with profit. Proposals to reduce the cost of the test are being discussed.

Users discuss the conditions for passing the test when crossing the border in the “Border control” sub-topic. Users discuss the restrictions inside the country in the “Control in the country” sub-topic.

Users discuss incorrect test results in the “Test reliability” sub-topic. Some users try to explain the reasons for the inaccuracy of PCR testing. Some users have a negative attitude towards the reliability of PCR testing. Based on references to authoritative sources and scientific terminology, some users try to convince the audience that the tests are wrong.

Users have raised concerns that many commercial companies are benefiting from PCR testing in the sub-topic “Conspiracy theory”. Some users believe that PCR testing is an attempt to collect genetic material or a way to infect people with the coronavirus. They even think that raw materials are used to produce new strains. They discuss the sale of fake PCR certificates in a small sub-topic “Fake tests”.

Examples of tweets reflecting the mood of users in the discussion of PCR testing for selected topics and sub-topics are shown in Table S1.

To develop and implement approaches for creating principles of the Strategy, the sub-topics “Test reliability” and “Passing the test” were chosen. The criteria for selecting sub-topics were as follows: 1) insufficient awareness of the population about the discussion object (PCR testing); 2) non-political nature of the discussion; 3) a relatively high number of messages that contradict each other (PCR results are correct or incorrect); 4) the “long” nature of the topic (the topic is not due to some short-term event).

3.3. Development and Implementation of the Principles of the Strategy for Reducing the Psychological Tension of Social Network users during the COVID-19 Pandemic

3.3.1. Definition Clarification Principle

As the first principle, we propose an explanation of the scientific meaning of the terms that people use often without understanding their semantic content. Sometimes users do not understand the terms’ ambiguity. While the contexts determine one or another meaning of the term (“Definition clarification principle”).

To illustrate and further implement this principle, the sub-topic “Test reliability” has been chosen. As can be judged from the content of tweets devoted to PCR testing, Russian-speaking Twitter users often do not even know the decoding of the term. The meaning of the term is clear only to specialists. Only 2 out of 140 tweets contain a transcript of the abbreviation PCR (1.42%), for example: “PCR is polymerase chain reaction testing”.

Sometimes people express a desire to know what a PCR test is:

“...explain to me what PCR is in human words”;

“I thought PCR showed whether the microbes on the plate multiplied in a day, or in the machine in less than a day. Nothing is clear, but very interesting, thanks for telling”.

To clarify the scientific meaning of the term it is necessary to refer to scientific sources. Here is an example of explaining the essence of PCR testing:

“PCR testing makes millions of copies of a specific sequence or sequences in the genetic material present in the sample allowing for detection of a much lower initial viral load. These copied sequences can then be used to diagnose a patient, either by their presence (positive) or absence (negative). In the case of COVID-19, the genetic material is comprised of Ribonucleic Acid (RNA), which is relatively fragile, as opposed to Deoxyribonucleic Acid (DNA), which is far more stable” [38].

The dictionary by Merriam-Webster contains the following definition for polymerase chain reaction: «an in vitro technique for rapidly synthesizing large quantities of a given DNA segment that involves separating the DNA into its two complementary strands, using DNA polymerase to synthesize two-stranded DNA from each single strand, and repeating the process — abbreviation PCR [39].

We tagged a post on Twitter with an attempt to explain the essence of PCR (we used sources [40 - 42] for the formulation):

“What is PCR? The nose sample contains an extremely small amount of coronavirus RNA. With the help of PCR (polymerase chain reaction), this RNA grows by multiple doubling with the help of the polymerase enzyme so that the device can understand whether there is a virus or not”.

“What is #PCR? Nose sample has #coronavirus RNA if it's already there. This RNA is extremely scarce. With the help of PCR (polymerase chain reaction), this RNA is multiplied by multiple doubling with the help of the polymerase enzyme so that the device can understand whether there is a virus or not”.

3.3.2. The Principle of Matching the Term Meanings

We have developed the second principle of comparing user and scientific meanings of terms considering the contexts of their use (“The principle of matching the term meanings”). On the example of the chosen sub-topic “Passing the test”, we will try to find out the everyday understanding of the term “primer”. There are few tweets containing this term without understanding its meaning.

“Okay, thanks for the fact that at least on modern methods of genetics we calculate all sorts of PCR and write primers, at least something useful”.

“PCR shows the presence of a “primer”. Short section of DNA. How to find a nut, to assert that there is a whole Mercedes around the corner. The latest model, serviceable, with a full tank, a running engine and a driver behind the wheel. Not even a detail. Just a nut. Almost anything”.

Primers are involved in the polymerase chain reaction, which proceeds under the action of polymerase enzymes. DNA and RNA polymerases synthesize DNA and RNA molecules, respectively, mainly by complementary copying of parent DNA or RNA strands [43].

For the polymerase to multiply the available nucleic acids incompletely, scientists point out the enzymes which fragment has to be reproduced using primers. These are small sequences (pieces) of DNA that stick to a site chosen by researchers on a copied strand. Two primers on both sides limit the area to be propagated. A primer is an artificially synthesized sequence of nucleotides.

The site for copying during PCR testing for coronavirus is chosen so that it: 1) is present only in the genome of coronavirus; 2) was conservative enough not to mutate constantly; 3) differed from similar places in the genomes of related viruses [44].

The Merriam-Webster Dictionary includes the following definition of a primer: “a molecule (such as a short strand of RNA or DNA) whose presence is required for the formation of another molecule (such as a longer chain of DNA)” [45].

The MeSH Thesaurus (PubMed) has Subject Heading “DNA Primers”: “Short sequences (generally about 10 base pairs) of DNA that are complementary to sequences of messenger RNA and allow reverse transcriptases to start copying the adjacent sequences of mRNA. Primers are used extensively in genetic and molecular biology techniques”. Year introduced: 1994 [46].

Therefore, statements that PCR shows the presence of a primer as a fragment of the genome of a coronavirus (or another virus) are fundamentally wrong. We formulated the following tweet:

“Some say that the #PCR test detects a primer, a piece of DNA out of nowhere. Nonsense. Primers tell the polymerase which piece of #coronavirus RNA to replicate. And this fragment is chosen wisely, so that it is “unique””.

3.3.3. The Principle of Judgments’ Comparison

We proposed the principle of contextual comparison of the

widespread mass user and scientific meanings of a term as the third one (“The principle of judgments’ comparison”). To implement this principle, the sub-topic “Test reliability” was chosen.

There were analyzed 164 tweets in this sub-topic to highlight the terms presenting the conflicting opinions. The judgment about the falsity of PCR tests was the most common (44.51%, 73 tweets). Here are some of the most characteristic phrases from the tweets:

“PCR tests are completely deceptive and designed to detect the common cold”.

“PCR tests give more than 50% false results, do not detect the virus even in people with obvious signs of the disease and detect it ... in plants!”.

“PCR tests do not distinguish covid from flu!”.

“PCR false positive rate is almost 80% because PCR is not a diagnostic tool (as its inventor said)”.

However, some tweets reported inconsistencies between the test result and the condition or diagnosis:

“I went hunting with a friend, he and his wife had symptoms, they passed the PCR and showed negative. And now have handed over on antibodies long and short. He is still sick, but his wife has already recovered”.

“There are antibodies. PCR showed nothing”.

A number of tweets gave an explanation for the inaccuracy of the tests, indicating that the accuracy of PCR depends on the procedure itself and time (23 tweets). Here are some of the most characteristic phrases from the tweets:

“... regarding PCR tests, they work exclusively in the early days of infection”

“... PCR is informative to take in the early 3-5 days. Then the virus goes down. From the pharynx, a smear will not show anything. And it is forbidden to take a deeper swab”

“... Although the PCR was negative, most likely the smear was taken late, when the virus went down into the lungs.”

“The PCR test gives false negative results, because if the virus multiplies just 1 cm lower than the cotton swab touched, its DNA will not be in the sample ...”

Some messages contain information about the reliability of test: “Will #PCR tests detect new strains of coronavirus?”

We gave the answer: “Because those parts of the #coronavirus that mutate the least are chosen for the reaction. These areas are not on the spikes, but between them. And it is the spikes that mutate quickly”.

3.3.4. The Principle of Visual Promotion

We proposed “The principle of visual promotion” of scientific knowledge (as the fourth principle). The illustrations explaining the principles of DNA replication are very complex (Fig. 4).

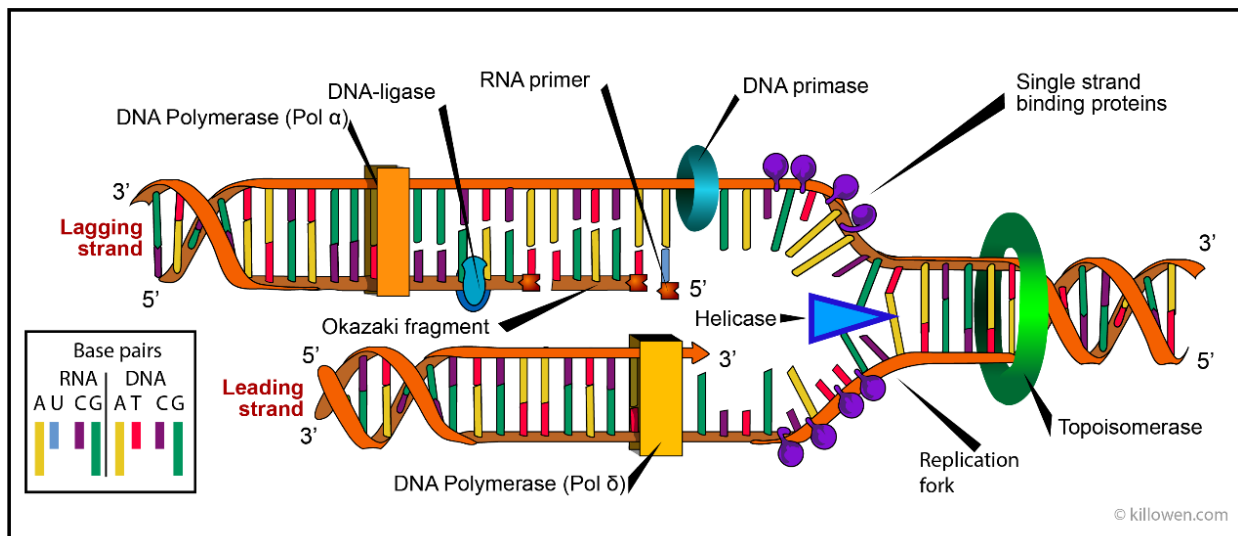


Fig. (4). The replication of DNA. Replication occurs by means of the partial unwinding of the two strands accompanied by the synthesis of a new strand complementary to each of the originals [47].

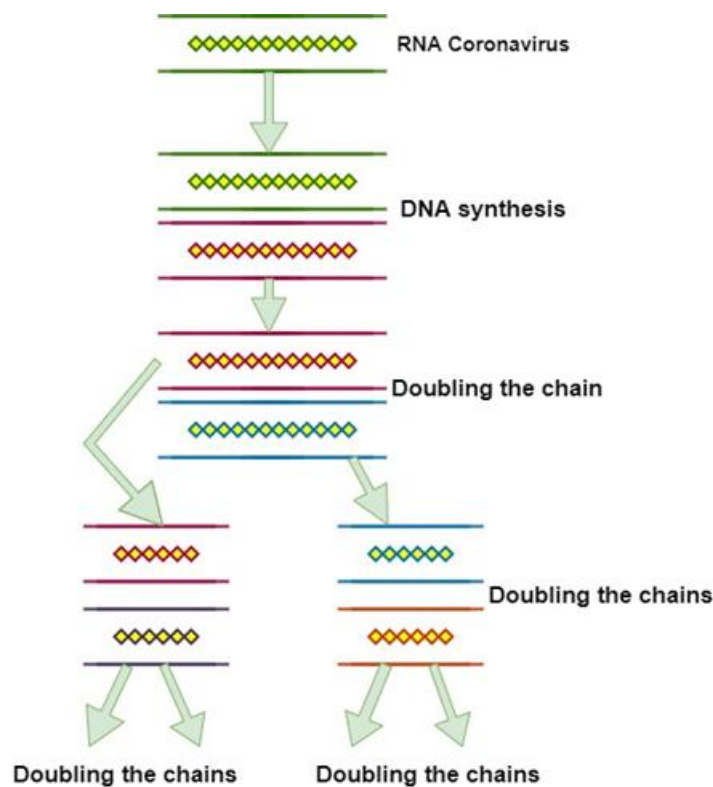


Fig. (5). The replication of DNA.

We posted a tweet (“#PCR test creates conditions for the multiplication of #coronavirus RNA so that the device can detect it”) for which we made the following picture Fig. (5) based on the work of Safiabadi *et al.* [48].

4. DISCUSSION

Vaccination uncertainty poses a serious threat to national health systems. The World Health Organization has named

non-vaccination as one of the top 10 threats to global health in 2019 [49]. Anti-vaccination statements are widely represented in social media [50].

To counteract anti-vaccination movements in social networks, it is necessary to debunk the myths propagated by anti-vaccination movements using relevant scientific knowledge [49].

New theoretical aspects have been developed. The principles for the formation of a strategy for reducing the psychological tension of users of social networks have been proposed. The strategy is based on the timely and regular extraction and processing of relevant information about COVID-19 discussed in social networks and forums, followed by its meaningful processing to bring it into an accurate and positive form.

The distribution of tweets by Russian-speaking users by countries showed that 75.83% of tweets were posted by Russian users. So, we conclude that the array of tweets can be used to judge the mood of Twitter users in Russia. In total with the former Soviet republics, the share of tweets was 87.84%.

An expert thematic analysis of the discussion about PCR tests made it possible to identify nine central sub-topics related to moods regarding PCR tests and PCR testing: 1) "Test expiration date"; 2) "Passing the test"; 3) "Test result"; 4) "Test cost"; 5) "Border control"; 6) "Control in the country"; 7) "Test reliability"; 8) "Conspiracy theory"; 9) "Fake tests". The topics "Test reliability" and "Passing the test" were chosen to develop and implement approaches to creating principles of the strategy for reducing the psychological tension of social network users.

As the first principle of the strategy, we consider it necessary to clarify the scientific meaning of the term (Definition clarification principle). As a second principle, we propose to compare the user and scientific meaning of the term (The principle of matching the term meanings). We believe that logical continuation of the second principle is the third principle - the comparison of a widespread mass user and scientific judgments about a certain term representing the object of judgment (The principle of judgments' comparison). As the fourth principle, we propose the principle of visual popularization of scientific knowledge (The principle of visual promotion).

CONCLUSION

The relationship between activity in social networks and psychological well-being is known [51, 52]. Our research results can be used as a means of popularizing current scientific knowledge and increasing user awareness as one of the factors for reducing psychological tension. The implementation of the principles of forming a strategy for reducing the psychological tension of users can mitigate unfavorable relationships between users in social networks.

Reducing excessive discussion about COVID-19 and encouraging caring online interaction rather than judgment can have a positive effect on the psychological well-being of the general public. In addition, the relationship between social media activity and psychological well-being differed at different levels of emotion regulation strategy. Adopting a cognitive reappraisal strategy can mitigate adverse relationships between certain social media user activities and mental health outcomes.

During the COVID-19 pandemic, people with lower levels of education have been shown to be more prone to depression and anxiety [53]. Raising awareness among such users about

aspects of the pandemic could improve mental health outcomes.

In further work, we plan to use the principles of the strategy of reducing the psychological state of social network users in practice. It is possible to create chatbots as a tool to increase users' awareness of certain aspects of the COVID-19 pandemic. It is planned to develop a model for reducing psychological tension and design information technology based on chatbots.

The feasibility of the proposed principles was tested on the Russian-language segment of Twitter. In the future, it is planned to expand the language base of the experimental array (move to multilingualism), test the application of the principles on other topics related to the pandemic considering the degree of their relevance and actuality.

We only reviewed comments from users of Twitter and one political forum, so they may not reflect the views of users of other social networks. In addition, only comments in Russian were analyzed, so they may not be representative of global assessment.

ABBREVIATIONS

PTSD	=	Posttraumatic Stress Disorder
PCR	=	Polymerase Chain Reaction

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

All the humans used were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013 (<http://ethics.iit.edu/ecodes/node/3931>).

CONSENT FOR PUBLICATION

Written informed consent was obtained from all individual participants included in the study.

STANDARDS OF REPORTING

COREQ guidelines and methodology were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIALS

Supplementary material is available on the Publisher's website.

REFERENCES

- [1] Yang Y, Liu K, Li S, Shu M. Social media activities, emotion regulation strategies, and their interactions on people's mental health in COVID-19 pandemic. *Int J Environ Res Public Health* 2020; 17(23): 8931. [http://dx.doi.org/10.3390/ijerph17238931] [PMID: 33271779]
- [2] A sermon against the dangerous and sinful practice of inoculation Preach'd at St Andrew's Holborn, on Sunday 1722; 1690-765. <https://quod.lib.umich.edu/e/evans/N02782.0001.001?rgn=main;view=fulltext>
- [3] Bazin H. The ethics of vaccine usage in society: Lessons from the past. *Curr Opin Immunol* 2001; 13(4): 505-10. [http://dx.doi.org/10.1016/S0952-7915(00)00248-X] [PMID: 11498309]
- [4] Galanis P, Vraika I, Siskou O, Konstantakopoulou O, Katsiroumpa A, Kaitelidou D. Willingness, refusal and influential factors of parents to vaccinate their children against the COVID-19: A systematic review and meta-analysis. *Prev Med* 2022; 157:106994 [http://dx.doi.org/10.1016/j.ypmed.2022.106994] [PMID: 35183597]
- [5] Kata A. Anti-vaccine activists, Web 2.0, and the postmodern paradigm – An overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine* 2012; 30(25): 3778-89. [http://dx.doi.org/10.1016/j.vaccine.2011.11.112] [PMID: 22172504]
- [6] H. Azhar, A. Syed, A. Madiha, H. Sheharyar. The anti-vaccination movement: A regression in modern medicine *Cureus j med sci* 2018; 10(7): e2919. [http://dx.doi.org/10.7759/cureus.2919]
- [7] Soares P, Rocha JV, Moniz M, *et al.* Factors associated with COVID-19 vaccine hesitancy. *Vaccines (Basel)* 2021; 9(3): 300. [http://dx.doi.org/10.3390/vaccines9030300] [PMID: 33810131]
- [8] Yaqub O, Castle-Clarke S, Sevdalis N, Chataway J. Attitudes to vaccination: A critical review. *Soc Sci Med* 2014; 112: 1-11. [http://dx.doi.org/10.1016/j.socscimed.2014.04.018] [PMID: 24788111]
- [9] Larson HJ, de Figueiredo A, Xiaohong Z, *et al.* The state of vaccine confidence 2016: Global insights through a 67-country survey. *EBioMedicine* 2016; 12: 295-301. [http://dx.doi.org/10.1016/j.ebiom.2016.08.042] [PMID: 27658738]
- [10] Lewis JR. What Is Driving the Decline in People's Willingness to Take the COVID-19 Vaccine in the United States? https://jamanetwork.com/channels/health-forum/fullarticle/2773320?utm_source=silverchair&utm_campaign=jama_network&utm_content=covid_weekly_highlights&utm_medium=email [http://dx.doi.org/10.1001/jamahealthforum.2020.1393]
- [11] Report A. Analysis of public attitudes towards COVID-19 vaccination in selected CAREC countries: (Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, and Uzbekistan) 2021 (in Russian) CARES Institute 2021. <https://www.carecinstitute.org/wp-content/uploads/2021/04/CAREC-Institute-vaccination-attitudes-report-RUS-22-Apr-2021.pdf>
- [12] Lazarus JV, Ratzan SC, Palayew A, *et al.* A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021; 27(2): 225-8. [http://dx.doi.org/10.1038/s41591-020-1124-9] [PMID: 33082575]
- [13] Focht E. Conspiracy theories are always more profitable than science (in Russian) RANEPА anthropologist on why people believe vaccine fake 2021. <https://www.bbc.com/russian/features-57681007>
- [14] No, lockdown rehearsal: Volgograd citizen about anti-vaxxers and fake information about COVID-19 (in Russian) <https://v1.ru/text/health/2021/10/26/70216094/>
- [15] Zavadsкая S. Zhizha", "shmurdyak", "QRab", or the Philological aspect in the movement of anti-vaxxers (in Russian) 2021. <http://vsevesti.ru/download/2021/261121.pdf>
- [16] Li J, Cardie C. Early Stage Influenza Detection from Twitter In: arXiv. 2013; pp. 1309-7340.
- [17] Schmidt CW. Trending now: using social media to predict and track disease outbreaks. *Environ Health Perspect* 2012; 120(1): A30-3. [http://dx.doi.org/10.1289/ehp.120-a30] [PMID: 22214548]
- [18] Moreno MA, Christakis DA, Egan KG, Brockman LN, Becker T. Associations between displayed alcohol references on Facebook and problem drinking among college students. *Arch Pediatr Adolesc Med* 2012; 166(2): 157-63. [http://dx.doi.org/10.1001/archpediatrics.2011.180] [PMID: 21969360]
- [19] Moreno MA, Jelenchick LA, Egan KG, *et al.* Feeling bad on Facebook: Depression disclosures by college students on a social networking site. *Depress Anxiety* 2011; 28(6): 447-55. [http://dx.doi.org/10.1002/da.20805] [PMID: 21400639]
- [20] Nadeem M, Horn M, Coppersmith G. Identifying depression on Twitter. 2016.
- [21] De Choudhury M, Kiciman E, Dredze M, Coppersmith G, Kumar M. Discovering shifts to suicidal ideation from mental health content in social media. Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. 2098-110. [http://dx.doi.org/10.1145/2858036.2858207]
- [22] Guntuku SC, Yaden DB, Kern ML, Ungar LH, Eichstaedt JC. Detecting depression and mental illness on social media: an integrative review. *Curr Opin Behav Sci* 2017; 18: 43-9. [http://dx.doi.org/10.1016/j.cobeha.2017.07.005]
- [23] Shearer E, Gottfried J. News use across social media platforms. Pew Research Center 2017. <https://www.journalism.org/2017/09/07/news-use-across-social-media-platforms-2017/>
- [24] Gopalakrishna Pillai R. Expressions of psychological stress on twitter: detection and characterization 2021. <https://wlv.openrepository.com/handle/2436/624536>
- [25] Brans K, Van Mechelen I, Rimé B, Verduyn P. To share, or not to share? Examining the emotional consequences of social sharing in the case of anger and sadness. *Emotion* 2014; 14(6): 1062-71. [http://dx.doi.org/10.1037/a0037604] [PMID: 25151517]
- [26] Rodríguez Hidalgo CT, Tan ESH, Verlegh PWJ. The social sharing of emotion (SSE) in online social networks: A case study in Live Journal. *Comput Human Behav* 2015; 52: 364-72. [http://dx.doi.org/10.1016/j.chb.2015.05.009]
- [27] Zhang R. The stress-buffering effect of self-disclosure on Facebook: An examination of stressful life events, social support, and mental health among college students. *Comput Human Behav* 2017; 75: 527-37. [http://dx.doi.org/10.1016/j.chb.2017.05.043]
- [28] McCormick T H, Lee H, Cesare N, Shojaie A. Using twitter for demographic and social science research: Tools for data collection and processing. *Sociological Methods & Research* 2017.
- [29] Rahim F, Khakimova A, Ebrahimi A, Zolotarev O, Rafiei Nasab F. Global scientific research on SARS-CoV-2 vaccines: A bibliometric analysis. *Cell J* 2021; 23(5): 523-31. [http://dx.doi.org/10.22074/cellj.2021.7794] [PMID: 34837679]
- [30] Dictionary T. Available at: <http://bigwer.ru/zol2/index.html> (accessed on 28 November 2021)
- [31] Available at: <https://www.vicinitas.io/> (accessed on 29 November 2021)
- [32] Khakimova A, Yang X, Zolotarev O, Berberova M, Charnine M. Tracking knowledge evolution based on the terminology dynamics in 4P-medicine. *Int J Environ Res Public Health* 2020; 17(20): 7444. [http://dx.doi.org/10.3390/ijerph17207444] [PMID: 33066086]
- [33] Indra Winarko. Trending topics detection of Indonesian tweets using BN-grams and Doc-p. *J King Saud Uni - Comp Inform Sci* 2019; 31(2): 266-74. [http://dx.doi.org/10.1016/j.jksuci.2018.01.005]
- [34] Sevpolitforum.info. Coronavirus, who are you, goodbye Available at: <https://sevpolitforum.ru/viewtopic.php?f=11&t=802052&hilit=%D0%BA%D0%BE%D1%80%D0%BE%D0%BD%D0%B0%D0%B2%D0%B8%D1%80%D1%83%D1%81&start=51700> (accessed on 29 November 2021)
- [35] Sevpolitforum.info. "Coronavirus, who are you, goodbye Available at: <https://sevpolitforum.ru/viewtopic.php?f=11&t=802052&hilit=%D0%BA%D0%BE%D1%80%D0%BE%D0%BD%D0%B0%D0%B2%D0%B8%D1%80%D1%83%D1%81&start=51775> (accessed on 29 November 2021)
- [36] Rospotrebnadzor reduced the validity of the PCR test from 72 to 48 hours (in Russian) 2021. Available at: <https://www.kommersant.ru/doc/5100523> (accessed on 30 November 2021)
- [37] Russia I. In Russia, the validity of the PCR test will be reduced to 48 hours due to Omicron (in Russian) 2021. Available at:

- <https://www.bbc.com/russian/news-59481183> (accessed on 30 November 2021)
- [38] What is PCR Testing? Zak M June 2021. Available at: <https://norgenbiotek.com/blog/what-pcr-testing> (accessed on 29 November 2021)
- [39] Polymerase chain reaction <https://www.merriam-webster.com/dictionary/polymerase%20chain%20reaction>
- [40] What is a PCR test? Methodology, advantages and disadvantages of the analysis (in Russian) 2021. Available at: <https://ria.ru/20210707/ptsr-test-1740292804.html> (accessed on 29 December 2021)
- [41] About coronavirus testing (in Russian) 2020. <https://mosgorzdrav.ru/ru-RU/news/default/card/4011.html> (accessed on 29 September 2021)
- [42] COVID-19 and PCR Testing. <https://my.clevelandclinic.org/health/diagnostics/21462-covid-19-and-pcr-testing> (accessed on 29 November 2021)
- [43] Mercadante AA, Dimri M, Mohiuddin SS. Biochemistry, Replication and Transcription. StatPearls. Treasure Island, FL: StatPearls Publishing 2022. <https://www.ncbi.nlm.nih.gov/books/NBK540152/> Updated 2021 Aug 27 Internet (accessed on 12 May 2022)
- [44] Tests for COVID-19: what are they, why are they needed and why do they work so poorly <https://iq.hse.ru/news/442788258.html> (accessed on 13 December 2021)
- [45] <https://www.merriam-webster.com/dictionary/primer> (accessed on 10 December 2021)
- [46] MeSH. DNA Primers <https://www.ncbi.nlm.nih.gov/mesh/?term=dna+primer> (accessed on 12 December 2021)
- [47] DNA Replication <https://www.killowen.com/genetics1D.html> (accessed on 13 May 2021)
- [48] Safiabadi Tali SH, LeBlanc JJ, Sadiq Z, *et al.* Tools and techniques for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)/COVID-19 detection. *Clin Microbiol Rev* 2021; 34(3): e00228-20. [<http://dx.doi.org/10.1128/CMR.00228-20>]
- [49] WHO Ten Threats to Global Health in 2019. <https://www.who.int/vietnam/news/feature-stories/detail/ten-threats-to-global-health-in-2019>
- [50] Stolle LB, Nalamasu R, Pergolizzi JV Jr, *et al.* The NEMA Research Group Fact vs fallacy: The anti-vaccine discussion reloaded. *Adv Ther* 2020; 37(11): 4481-90. [<http://dx.doi.org/10.1007/s12325-020-01502-y>] [PMID: 32965654]
- [51] Brindha MD, Jayaseelan R, Kadeswara S. Social media reigned by information or misinformation about COVID-19: A phenomenological study. *Alochana Chakra J* 2020; 9(5): 585-602.
- [52] Berryman C, Ferguson CJ, Negy C. Social media use and mental health among young adults. *Psychiatr Q* 2018; 89(2): 307-14. [<http://dx.doi.org/10.1007/s11126-017-9535-6>] [PMID: 29090428]
- [53] Wang Y, Di Y, Ye J, Wei W. Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. *Psychol Health Med* 2020; 26(1): 13-22. [<http://dx.doi.org/10.1080/13548506.2020.1746817>] [PMID: 32223317]

