ON THE NEW SPREADING MODEL OF THE SARS-COV-2 VIRUS AND SECURITY MANAGEMENT ISSUES

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Abstract. New mathematical and computer models for the spread of the SARS-Cov-2 virus have been proposed, based on the epidemic control protocol adopted by the Georgian authorities. The task is to control the fight against the epidemic taking into account vaccination with temporary immunity.

Keywords: *Mathematical, computer model, SARS-CoV-2, management, epidemic.*

1. Introduction. Modeling the processes of the COVID19 pandemic caused by the SARS-CoV-2 virus is of great interest. And this is natural, the pandemic claimed many lives, increased the number of people with various diseases, worsened the well-being of people, and more. At the first stage of the fight against COVID19, the main means were organizational restrictions, medical masks, etc. Sometimes it was necessary to announce a complete lockdown in the state. This gave a positive result - the minimum number of cases and deaths of the new corona virus. However, lockdown turned out to be too expensive and the budget of the countries suffered greatly. Replenishments to the treasury fell catastrophically and funds for social needs, including the treatment of those infected with the new virus, were not enough. To improve the economy, the lockdown was lifted, but as a result, the number of people killed and infected increased. In this case, patients are also treated at public expense. Thus, financial costs are high even in the absence of a lockdown.

Thus, the task is to make a decision and it is necessary to determine to what extent and how quarantine measures should be applied so that there is no sharp peak in morbidity and the country's economy avoids a crisis. It is necessary to solve the problem of managing the safety of life of the population and the economy of the state. After the possibility of vaccination of people appeared, the task of managing the safety of life of the population and the economy of the state did not become less urgent. Partly because there were not enough vaccines, partly because of the anti-vaxxer movement, partly because the vaccines were less effective than expected.

The task of managing the safety of life of the population and the economy has been improved as new funds and knowledge in the fight against the pandemic were obtained. The safety management problem without vaccination has been addressed in [1], with vaccination in [2]. However, in [2], it was assumed that the vaccinated people did not get infected with the virus, but in reality, as recent studies show, this is not the case, the number of infected vaccinated people is considerable. Therefore, in this work we will try to pose and improve the task of managing the safety of life of the population and the economy, taking into account the vulnerability of vaccinated persons.

As a basis for constructing a mathematical model for the spread of SARS-Cov-2, a protocol developed by the Georgian health care system was adopted, which are binding on all authorities of the country. When constructing the model, the ideas outlined in [3-6] were used.

2. Business logic of the epidemic control process. Let the number $N(t)$ of citizens be in the country at a given time$t$. At the same time, a number $N_e(t)$ of citizens are entering the country. According to the protocol, all of them should be sent to places designated for quarantine - hotels, sanatoriums, rest homes, etc. However, let's say that not all arriving citizens are transferred to quarantine; some managed to somehow avoid this. That is, $\alpha_{e1}(t)N_e(t)$ of the citizens $N_e(t)$, they were quarantined, but $\alpha_{e2}(t)N_e(t)$ quarantine was avoided. We have $N_e(t) = \alpha_{e1}(t)N_e(t) + \alpha_{e2}(t)N_e(t)$. Or $1 = \alpha_{e1}(t) + \alpha_{e2}(t)$. Note that there is a group of people entering the country - E, a group that is in quarantine - Q. Let $N_q(t)$ the number of citizens be in quarantine at the moment$t$. After some time, a certain number of people whose test-in-law will show a positive result for the presence of the SARS-Cov-2 virus is transferred to a hospital for treatment - they are infected, and there is documentary evidence of this, we will designate this group of people by I. Let the number of citizens $N_{qi}(t)$ be sent from quarantine for treatment at t the moment, and the number of citizens $N_{qh}(t)$ is released from quarantine and they replenish the group of citizens - HS specifically, into groups of healthy people without immunity H - their number is $N_{hs}(t)$. After treatment from the group I of recovered patients, I replenish the group of healthy HI - people with immunity, their number is $N_{hi}(t)$, unfortunately, a certain number of patients $N_{di}(t)$ cannot be saved. The group of those who died from the virus will be denoted by D. Note that in addition to knowingly infected people, in society there is a group S of sick people carrying the virus, but there is no documentary evidence of this, the number of these people will be denoted by $N_s(t)$. It is the members of the group $N_s(t)$ who are the main distributors of the virus, they freely contact with members of the group of healthy people without immunity - H, in which $N_h(t)$ citizens infecting them. The complexity of the situation is that the relevant authorities do not know exactly the number of these people, but also the distributors of the infection themselves. Note that a group HS is a union of groups H and$S$, $N_{hs}(t) = N_h(t) + N_s(t)$.

Epidemiological services identify infected people $N_{si}(t)$ from the group S and transfer them to hospitals for treatment, thereby replenishing the group$I$. At the same time, the circle of their contacts is determined, even in the number of people $N_c(t)$ from the group HS and they are transferred to quarantine, replenishing the group Q, respectively, $N_{qh}(t)$ from the group H, and $N_{qs}(t)$ from the group S, $N_q(t) = N_{qh}(t) + N_{qs}(t)$. Unfortunately, the group S also has a case of death from a virus, let us designate their number through $N_{ds}(t)$, which replenish the group D. We will assume that people who have recovered from the new corona virus acquire immunity but can become infected again. When vaccinated, people from group H go to HI. Those. in the process of vaccination of people from the group of healthy people without immunity, the vaccinated people from H go to the group of healthy people with immunity HI. then we denote their number at the moment t of time by $N_{hi}(t)$.

According to recent reports, despite vaccination, some members of the HI group, communicating with members of the S group, may be infected. Therefore, some of them are sent for treatment I, and some in quarantine Q. Note that the number of members of groups E, Q,I, HI, D, HS is known at any given time. However, the exact number of members of groups H and S, respectively, is not known. Meanwhile, contacts of members of groups H, HI and S can worsen the epidemiological situation, as patients from S can infect healthy people from $H$and HI. Let's build a scheme for fighting the epidemic and its business logic in the form of a directed graph:

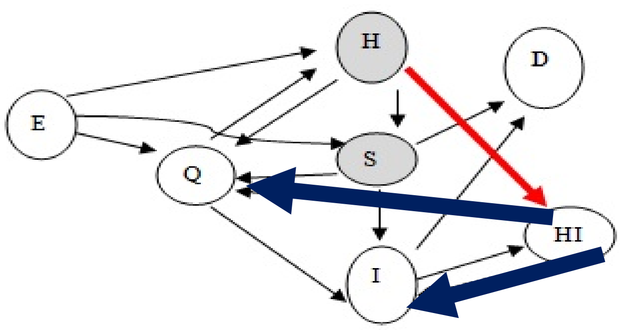

Fig. 1 Directed graph of the fight against the epidemic

3. Building the model. In the oriented graph in Fig. 1, the arc EH has $\alpha_{e21}(t)N_e(t)$ weight and the arc ES has $\alpha_{e22}(t)N_e(t)$ weight. The fact is that some citizens who have entered the country and who have not been quarantined can be both healthy and infected - sick. Their exact number is not known, but it is known that $\alpha_{e21}(t)+\alpha_{e22}(t)=\alpha_{e2}(t)$. But together they make up the $HS=H\cup S$group, an amalgamation of the H and S groups.

The rate of change in the number of a group of healthy people without immunity - $N_h(t)$ from a group Hdepends on the intensity of: contacts between group members $H$and S; replenishment of a group Q from a group H of people $N_{ch}(t)$; replenishment of a group H from a group Q of people $N_{hc}(t)$, replenishment of a group H from a group E of people $N_e(t)$. The indices of the coefficients and the number of transitions from one group to another are indicated in the order - the receiving group, and then the decreasing group. For the quarantine group Q, in this case, the symbol c is used, in other cases - q. Therefore, we have:

$$\frac{dN_h(t)}{dt}=\alpha_{hc}N_{hc}(t)+\alpha_{heh}(t)\alpha_{e21}(t)N_e(t)-\alpha_{ch}(t)N_{ch}(t)-\alpha_{hs}(t)N_h(t)N_s(t)-\alpha_{vac}(t)N_h(t) \quad (1)$$

where $\alpha_{ch}(t)$, $\alpha_{he}(t)$, $\alpha_{e21}(t)$, $\alpha_{hc}(t)$, $\alpha_{hs}(t)$, $\alpha_{vac}(t)$ the corresponding coefficients. The rate of change in the number of a group of healthy people with immunity - $N_{hi}(t)$ from the group HIdepends on the intensity: recovery of patients from the group I (increases), vaccination in the group H (increase), contacts between group members HI and S (decreases) - while part of the group HI goes into the group Q, and part into group I. As a result, we get:

$$\frac{dN_{hi}(t)}{dt}=\alpha_{ihi}(t)N_i(t)+\alpha_{vac}(t)N_h(t)-\alpha_{qshi}N_s(t)N_{hi}(t)-\alpha_{ishi}N_s(t)N_{hi}(t).$$

In a similar way, one can write out relations similar to (1) and for the rate of change in the number of groups Q,I,S. As a result, we get a system of ordinary differential equations:

$$
\left\{
\begin{aligned}
&\frac{dN_h(t)}{dt} = \alpha_{hq}(t)N_q(t) + \alpha_{he}(t)\alpha_{e21}(t)N_e(t) - \alpha_{qh}(t)N_h(t) - \\
&\qquad - \alpha_{hs}(t)N_h(t)N_s(t) - \alpha_{vac}(t)N_h(t), \\
&\frac{dN_q(t)}{dt} = \alpha_{qh}(t)N_h(t) + \alpha_{qe}(t)\alpha_{e1}(t)N_e(t) + \alpha_{sq}(t)N_s(t) - \\
&\qquad - \alpha_{hq}(t)N_q(t) - \alpha_{iq}(t)N_q(t) + \alpha_{qshi}N_s(t)N_{hi}(t), \\
&\frac{dN_s(t)}{dt} = \alpha_{sh}(t)N_h(t)N_s(t) + \alpha_{se}(t)\alpha_{e22}(t)N_e(t) - \\
&\qquad - \alpha_{is}(t)N_s(t) - \alpha_{qs}(t)N_s(t) - \alpha_{ds}(t)N_s(t), \\
&\frac{dN_i(t)}{dt} = \alpha_{is}(t)N_s(t) + \alpha_{iq}(t)N_q(t) - \alpha_{hii}(t)N_i(t) - \alpha_{di}(t)N_i(t) + \\
&\qquad + \alpha_{ishi}(t)N_s(t)N_{hi}(t), \\
&\frac{dN_d(t)}{dt} = \alpha_{di}(t)N_i(t) + \alpha_{ds}(t)N_s(t), \\
&\frac{dN_{hi}(t)}{dt} = \alpha_{hii}(t)N_i(t) + \alpha_{vac}(t)N_h(t) - \alpha_{qshi}(t)N_s(t)N_{hi}(t) - \\
&\qquad - \alpha_{ishi}(t)N_s(t)N_{hi}(t).
\end{aligned}
\right. \tag{2}
$$

where, the coefficients in the system are non-negative, the epidemic is observed over a period of time $[t_0; T]$. In (2), the function $N_e(t)$ is known in principle - the number of arriving citizens. At the initial moment of time t_0, the following are known:

$$N_q(t_0) = N_{q0}, \quad N_i(t_0) = N_{i0}, \quad N_d(t_0) = N_{d0}, \quad N_h(t_0) + N_s(t_0) = N_{00}. \tag{3}$$

System (2) with initial conditions (3) constitutes a complementally mathematical model of the SARS-Cov-2 virus epidemic.

4. The problem of managing the epidemic. Analyzing the protocol for fighting the epidemic and its mathematical model, it should be noted that the control of the spread of infections has special control levers. For example, by improving control over the arriving citizens, it is possible to practically exclude the penetration of sick citizens into society, bypassing quarantine. In the model, for example, the values of the coefficients $\alpha_{e21}(t), \alpha_{e22}(t)$ should be reduced. Also, by choosing the values of the coefficient$\alpha_{hs}(t)$, you can actually achieve a hard lockdown, or a liberal policy of containing the epidemic. Suppose that when selecting $\alpha_{e21}(t)$ - the impact on budgetary costs is $B: \alpha_{e21}(t) \to R$, and the costs of treating the infected can be expressed through$W: \int_{t_0}^{T} N_i(\tau)\, d\tau X \alpha_{hs}(t) \to R$, then the total costs of identifying the infected and their treatment, taking into account their minimization, can be expressed as follows:

$$J(\alpha_{e21}(t), \alpha_{hs}(t)) = B(\alpha_{e21}(t)) + W\left(\int_{t_0}^{T} N_i(\tau)d\tau, \alpha_{hs}(t)\right) \to \inf. \tag{4}$$

Functional (4) must be minimized under conditions (2), (3) and the constraint:

$$B\left(\alpha_{e21}\left(t\right)\right) \geq L > 0. \tag{5}$$

Constraint (5) means that budgetary expenditures for these activities cannot be less than a certain amount. It is clear that we have restrictions from above - budgetary funds are limited!

Note that the functional $W(*)$ also takes into account the fact that by choosing the values of the coefficient $\alpha_{hs}(t)$ (thereby determining the level of lockdown), we actually change financial receipts - specifically, we reduce them. Therefore, we need to minimize this value as well.

To manage the safety of life of the population and the economy of the state, an extreme problem of the type (4), (5), (2), (3) is considered.

In this case, another limitation appears, the purpose of which is to achieve herd immunity:

$$N_{hi}\left(T\right) = N_{hit}\left(T\right) + N_{hiv}\left(T\right) \geq 0{,}7N\left(T\right).$$

The computer implementation of the model (2), (3) and the extreme problem (4), (5) was carried out in the MatLab environment for various values of constant coefficients of system (2), initial conditions (3) and specific B, W functional.

5. Computer Experiment. For scientific calculations, we rewrite system (2) in the following form, and at the first stage, we will consider the coefficients as constants:

$$\begin{cases} \dfrac{dN_h(t)}{dt} = \left(-\alpha_{qh}(t) - \alpha_{vac}(t)\right)N_h(t) + \alpha_{hq}(t)N_q(t) - \\ \qquad - \alpha_{hs}(t)N_h(t)N_s(t) + \alpha_{he}(t)\alpha_{e21}(t)N_e(t), \\ \dfrac{dN_q(t)}{dt} = \alpha_{qh}(t)N_h(t) - \left(\alpha_{hq}(t) + \alpha_{iq}(t)\right)N_q(t) + \alpha_{sq}(t)N_s(t) + \\ \qquad + \alpha_{qshi}(t)N_s(t)N_{hi}(t) + \alpha_{qe}(t)\alpha_{e1}(t)N_e(t), \\ \dfrac{dN_s(t)}{dt} = \left(-\alpha_{is}(t) - \alpha_{qs}(t) - \alpha_{ds}(t)\right)N_s(t) + \alpha_{sh}(t)N_h(t)N_s(t) + \\ \qquad + \alpha_{se}(t)\alpha_{e22}(t)N_e(t), \\ \dfrac{dN_i(t)}{dt} = \alpha_{iq}(t)N_q(t) + \alpha_{is}(t)N_s(t) - \left(\alpha_{hii}(t) + \alpha_{di}(t)\right)N_i(t) + \\ \qquad + \alpha_{ishi}(t)N_s(t)N_{hi}(t), \\ \dfrac{dN_d(t)}{dt} = \alpha_{ds}(t)N_s(t) + \alpha_{di}(t)N_i(t), \\ \dfrac{dN_{hi}(t)}{dt} = \alpha_{vac}(t)N_h(t) + \alpha_{hii}(t)N_i(t) - \alpha_{qshi}(t)N_s(t)N_{hi}(t) - \\ \qquad - \alpha_{ishi}N_s(t)N_{hi}(t). \end{cases} \tag{6}$$

We have system (6) with initial conditions (3). Function $N_e(t)$ known and in the calculations we will assume that it is constant and equal to NE. We will take the same symbols as identifiers of the coefficients, but we will write them in one register, for example: we will write $\alpha_{qh}(t)$ as aqh. Note, that aqh is the measure of influence (increase) on the rate of change in the number of people in quarantine, and the measure of influence (decrease) on the rate of change in the number of healthy people without immunity. The interpretation of other coefficients is similar. Let's rewrite system (6) into a convenient one for scientific calculations in the MatLab package.

$$\begin{cases} \frac{dN_1(t)}{dt} = (-\alpha qh - \alpha vac)N_1(t) + \alpha hqN_2(t) - \\ \quad - \alpha hsN_1(t)N_3(t) + \alpha he \times \alpha e21NE, \\ \frac{dN_2(t)}{dt} = \alpha qhN_1(t) - (\alpha hq + \alpha iq)N_2(t) + \alpha sqN_3(t) + \\ \quad + \alpha qshiN_6(t) + \alpha qe \times \alpha e1NE, \\ \frac{dN_3(t)}{dt} = (-\alpha is - \alpha qs - \alpha ds)N_3(t) + \alpha shN_1(t)N_3(t) + \\ \quad + \alpha se \times \alpha e22NE, \\ \frac{dN_4(t)}{dt} = \alpha iqN_2(t) + \alpha isN_3(t) - (\alpha hii + \alpha di)N_4(t) + \\ \quad + \alpha ishiN_3(t)N_6(t), \\ \frac{dN_5(t)}{dt} = \alpha dsN_3(t) + \alpha diN_4(t), \\ \frac{dN_6(t)}{dt} = \alpha vacN_1(t) + \alpha hiiN_4(t) - \alpha qshiN_3(t)N_6(t) - \\ \quad - \alpha ishiN_3(t)N_6(t). \end{cases} \tag{7}$$

To assessment the stiffness of system (7), we write out the Jacobian matrix of the right side of this system - $\frac{\partial \frac{dN_i(t)}{dt}}{\partial N_j(t)}, i,j = \overline{1,6}$. As a result we have

$$\begin{pmatrix} -\alpha qh - \alpha vac - \alpha hsN_3(t) & \alpha hq & -\alpha hsN_1(t) & 0 & 0 & 0 \\ \alpha qh & -\alpha hq - \alpha iq & \alpha sq & 0 & 0 & \alpha qshi \\ \alpha shN_3(t) & 0 & \alpha shN_1(t) - \alpha is - \alpha qs - \alpha ds & 0 & 0 & 0 \\ 0 & \alpha iq & \alpha is + \alpha ishiN_6(t) & 0 & 0 & \alpha ishiN_3(t) \\ 0 & 0 & \alpha ds & \alpha di & 0 & 0 \\ \alpha vac & 0 & -\alpha qshiN_6(t) - \alpha ishiN_6(t) & \alpha hii & 0 & -(\alpha qshi + \alpha ishi)N_3(t) \end{pmatrix} \tag{8}$$

It is clear, that the determinant of the Jacobian matrix $\frac{\partial \frac{dN_i(t)}{dt}}{\partial N_j(t)}, i,j = \overline{1,6}$ - Jacobian is equal to zero, due to which we can conclude that the system (7) is rigid. Of course, it is possible to exclude the fifth equation from system (7), and calculate the function $N_5(t)$ of the number of deaths from the virus by integration of functions $N_3(t)$ and $N_4(t)$ that are simple found. However, in this case, we will adhere to the proposed complex method. To find numerical solutions to system (7) with initial values (3), we choose the ode15c solver from the MatLab application package. It is just designed for the solution of a rigid system of ordinary differential equations.

To find the numerical solutions of the nonlinear system (7), we will compose an auxiliary M-file. In it, the system (7) is presented in the MatLab M-code, while the values of the system coefficients and free members are also entered here. The code is presented in the listing 1:

Note, that we have notations in the listings and figures:$N1$ - healthy, without immunity $N_h(t)$; $N2$ - in quarantine $N_q(t)$; $N3$ - undetected infected $N_s(t)$; $N4$ - infected for hospital treatment $N_i(t)$; $N5$ - died from the virus $N_d(t)$; $N6$ - healthy with immunity$N_{hi}(t)$.

Listing 1. Right side of the system (7)

```
% sars-sistemis marjvena mxare
function dNdt=sars(t,N)
dNdt=zeros(6,1)
aqh=0.08; avac=0.5; ahq=0.2; ahs=0.4; ahe=0.2; ae21=0.4; ne=30;
aiq=0.34; asq=0.02; aqshi=0.3; aqe=0.02; ae1=0.1;
ais=0.2; aqs=0.02; ads=0.001; ash=0.2; ase=0.2; ae22=0.6;
ahii=0.02; adi=0.001; aishi=0.03;
k11=-aqh-avac; k12=ahq; c1=-ahs; b1=ahe*ae21*ne;
k21=aqh; k22=-ahq-aiq; k23=asq; k26=aqshi; b2=aqe*ae1*ne;
k33=-ais-aqs-ads; c3=ash; b3=ase*ae22*ne;
k42=aiq; k43=ais; k44=-ahii-adi; c4=aishi;
k53=ads; k54=adi;
k61=avac; k64=ahii; c6=-aqshi-aishi;
dNdt(1)=k11*N(1)+k12*N(2)+c1*N(1)*N(3)+b1;
dNdt(2)=k21*N(1)+k22*N(2)+k23*N(3)+k26*N(6)+b2;
dNdt(3)=k33*N(3)+c3*N(1)*N(3)+b3;
dNdt(4)=k42*N(2)+k43*N(3)+k44*N(4)+c4*N(3)*N(6);
dNdt(5)=k53*N(3)+k54*N(4);
dNdt(6)=k61*N(1)+k64*N(4)+c6*N(3)*N(6);
end
```

To run the code shown in Listing 1, we use the code shown in Listing 2.

Listing 2. Running the Solver and Visualizing Solutions

```
[T,Y]=ode15s('sars',[0 10],[600 100 20 10 5 40]);
plot (T, Y,'linewidth', 2)
title ('Spread of Sars-CoV-2')
xlabel ('Time')
ylabel ('Amount')
legend ('N1','N2','N3'.'N4','N5','N6')
```

The initial values of system (7) for $N1$, $N2$, $N3$, $N4$, $N5$, $N6$ are respectively equal to: 600, 100, 20, 10, 5, 40 units. We assume that 30 units of visitors enter the country at any given time. Note that infected people of whom the disease is reliably known are either in the hospital or are in quarantine. They do not spread the infection and do not exacerbate the epidemic. The main spreaders of the infection are those people who are infected, but this is not known for certain. Therefore, the intensity of contacts of these people with representatives of other groups determines the level of the epidemic. If a lockdown is introduced in a country to combat the epidemic, then its main task is to reduce the contact of members of the S group with representatives of other groups. In model (7), (3), lockdown can be displayed by selecting the values of those coefficients that are present in the contacts of the S group with other groups. For example, consider the contacts of the members of the groups S and H. If a strict lockdown is declared, then the coefficients $\alpha_{hs}(t)$ (ahs) and $\alpha_{sh}(t)$ (ash) have a minimum value. If the value of these coefficients is large, then it is natural that there is either no lockdown at all or it is not strict. Consider two modes of dealing with the epidemic. Mode A: non-strict lockdown - ahs=0.4, ash=0.2; Mode B: strict lockdown - ahs=0.2, ash=0.01; . Figure 2 shows the visualization of the calculation results for mode A, with the values of the coefficients indicated in lines 4-9 of Listing 1.

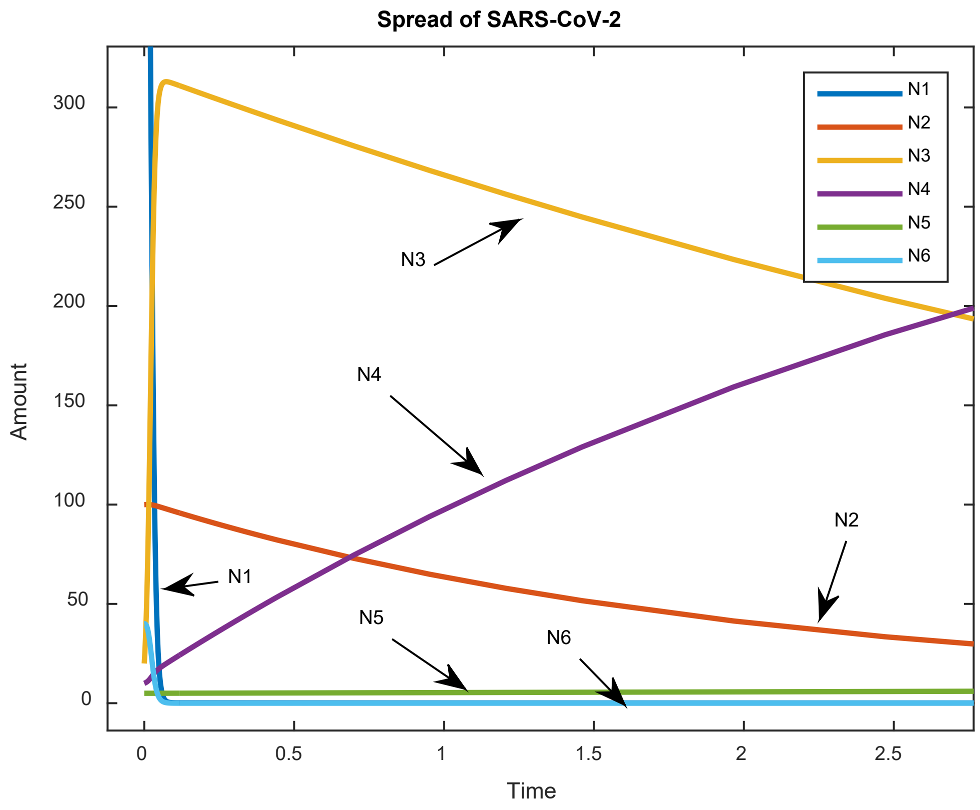

Fig.2. Significance of virus spread indicators during non-strict lockdown

Obviously, with a non-strict lockdown, the number of infected people in clinics is constantly growing and a collapse of the healthcare system may occur. Let's carry out scientific calculations for a strict lockdown. The values of all system coefficients (7) will be the same as in rows 4-9 of Listing 1, except for two: ahs=0,2 and ash=0,01. Figure 3 shows the visualization of the calculation results for mode B.

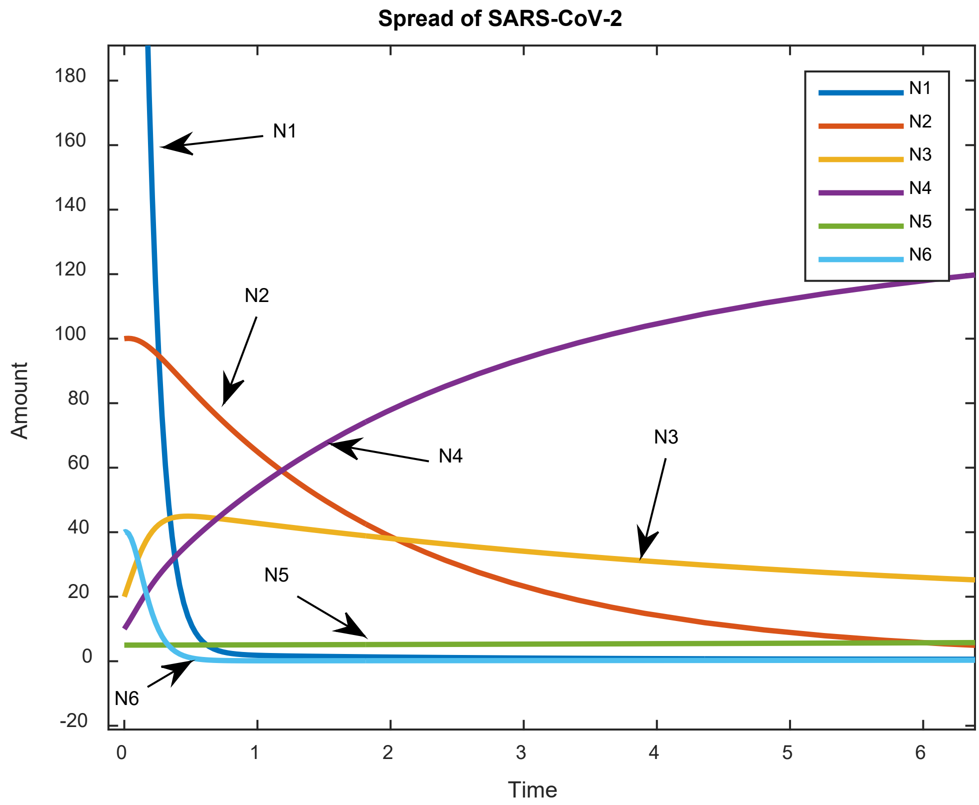

Fig.3. Significance of virus spread indicators during strict lockdown

As you can see, with a strict lockdown, the number of infected people in hospitals is almost constant and not high. The collapse of the health care system is expected. However, for complete objectivity, one should calculate the so-called, price for modes A and B. I.e. how much will the implementation of the models cost the country's budget. In the general case, it will solve the problem of optimal control (4), (5), (7), (3).

6. Conclusions. A computational experiment carried out on a computer model built on the basis of a mathematical model (2), (3) with constant coefficients allows us to conclude that by choosing the value of the parameters and, it is possible to select such a number of infected citizens, in which the economy does not need a lockdown, and the forecast recovery of those infected with the SARS-CoV-2 virus is favorable.

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SARS-CoV-2 ვირუსის გავრცელების ახალი მოდელისა და უსაფრთხოების მართვის საკითხების შესახებ

ნუგზარ კერესელიძე

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ცხუმ-აფხაზეთის მეცნიერებთა აკადემიის წევრ-კორესპონდენტი, ცხუმ-აფხაზეთის მეცნიერებათა აკადემიის კომპიუტერულ მეცნიერებათა ინსტიტუტის დირექტორი
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აბსტრაქტი. სტატიაში შემოთავაზებულია SARS-CoV-2 ვირუსის გავრცელების ახალი მათემატიკური და კომპიუტერული მოდელები, რომლებიც აგებულია საქართველოს ხელისუფლების მიერ მიღებული ეპიდემიასთან ბრძოლის პროტოკოლის გათვალისწინებით. მოდელებში გათვალისწინებულია რეინფიცირების შემთხვევები იმუნიზაციისა თუ გადატანილი დაავადების მიუხედავად. მიღებულია არაწრფივ, არაერთგვაროვან დიფერენციალურ განტოლებათა სისტემა ცვლადი კოეფიციენტებითა და საწყისი მნიშვნელობებით. შემოთავაზებულ მათემატიკურ მოდელში გამოყოფილია სამართავი პარამეტრები ქვეყანაში ლოკდაუნის წარმართვის ხარისხის გათვალისწინებით. დასმულია ოპტიმალური მართვის ამოცანა. მიზნის ფუნქცია აფასებს ფინანსურ დანახარჯებს ლოკდაუნისა და ეპიდემიის სხვადასხვა ხასიათის შემთხვევაში. ოპტიმალური ამოცანის ამოხსნის შედეგად შესაძლებელია შეირჩეს ლოკდაუნის ისეთი ვარიანტი, რომლის შედეგადაც არ ხდება სამედიცინო სისტემისა და სახელმწიფო ბიუჯეტის კოლაფსი, ამასთან, დაცულია მოსახლეობის უსაფრთხოება.

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