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ANALYSIS OF THE SHORT-TERM FORECAST OF COVID-19 RELATED CONFIRMED CASES, DEATHS CASES AND INFECTION RATES IN GEORGIA FROM SEPTEMBER 2020 TO OCTOBER 2021

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Summary: *Results of analysis of averaging ten day, two week and monthly interval prediction of daily data associated with such parameters of the new coronavirus covid-19 pandemic in Georgia, as infection cases (C), deaths cases (D) and infection rate (I) from September 2020 to October 2021 are presented. Comparison of real and calculated predictions data of C, D and I are carried out. It was found that in the study period the mean ten day, two-week and monthly real values of C, D and I practically fall into the 67% - 99.99% confidence interval of these predicted values.*

Key Words: *New Coronavirus COVID-19, statistical analysis, short-term prediction.*

Introduction

Almost two years have passed since the outbreak of the new coronavirus (COVID-19) in China, which was declared a pandemic on March 11, 2020 due to its rapid spread in the world [1]. During this period, despite the measures taken (including vaccination), the overall level of morbidity and mortality in many countries of the world, including Georgia, remains very high [https://www.soothsawyer.com/john-hopkins-time-series-data-with-us-state-and-county-city-detail-historical/; https://data.humdata.org/dataset/total-covid-19-tests-performed-by-country; https://stopcov.ge].

In our previous works, we present the results of a statistical analysis of daily data related to infection with the new coronavirus COVID-19 of confirmed (C), recovered, deaths (D) and infection rate (I) of the population of Georgia in the period from March 14, 2020 to August 31, 2021 [2-6]. The results of the analysis of a regular ten-day and two-week forecast of C, D and I values are also presented [3-6]. From September 2021, a regular monthly forecast of C, D and I values began. Information was regularly sent to the National Center for Disease Control and Public Health of Georgia and posted on the Facebook page https: // www.facebook.com/Avtandil1948/

In this work results of analysis of averaging ten day, two week and monthly interval prediction of daily values of confirmed, deaths and infection rate coronavirus-related cases from September 2020 to October 2021 are presented.

Study area, material and methods

The study area: Georgia. Data of John Hopkins COVID-19 Time Series Historical Data (with US State and County data) [https://www.soothsawyer.com/john-hopkins-time-series-data-with-us-state-and-county-city-detail-historical/; https://data.humdata.org/dataset/total-covid-19-tests-performed-by-country] and https://stopcov.ge about daily values of confirmed, deaths and infection rate coronavirus-related cases are used.

The calculation of the interval prognostic values of C, D and I taking into account the periodicity in the time-series of observations was carried out using Excel 16 (the calculate methodology was description in [3]). R^2 - coefficient of determination, α – the level of significance.

The regular ten day prediction values of C from September 23, 2020 to December 31, 2020 was carried out (10 cases); two week prediction – from January 1, 2021 to August 31, 2021 (16 cases); monthly prediction – from September 1, 2021 to October 31, 2021 (2 cases). In total - 28 cases of prediction.

The regular two week prediction values of D from January 1, 2021 to August 31, 2021 was carried out (16 cases); monthly prediction – from September 1, 2021 to October 31, 2021 (2 cases). In total - 18 cases of prediction.

The regular two week prediction values of I from February 1, 2021 to August 31, 2021 was carried out (14 cases); monthly prediction – from September 1, 2021 to October 31, 2021 (2 cases). In total - 16 cases of prediction.

67%...99.99%_Low - 67%...99.99% lower level of confidence interval of prediction values of C, D and I; 67%...99.99%_Upp - 67%...99.99% upper level of confidence interval of prediction values of C, D and I.

In the Table 1 [7] the scale of comparing real data with the predicted ones and assessing the stability of the time series of observations in the forecast period in relation to the pre-predicted one (period for prediction calculating) is presented.

Results and discussion

The results in fig. 1- 3 and tables 1 - 3 are presented.

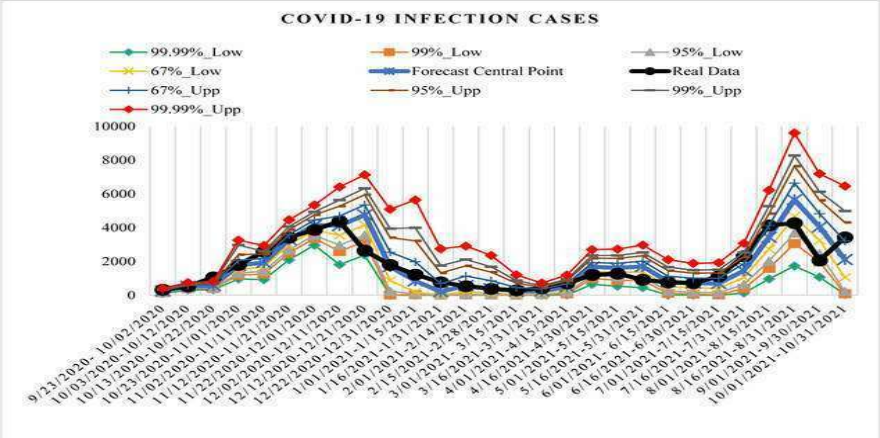

Fig. 1. Verification of the time-averaged forecast of interval prediction of Covid-19 infection cases in Georgia from 23.09.2020 to 31.10.2021.

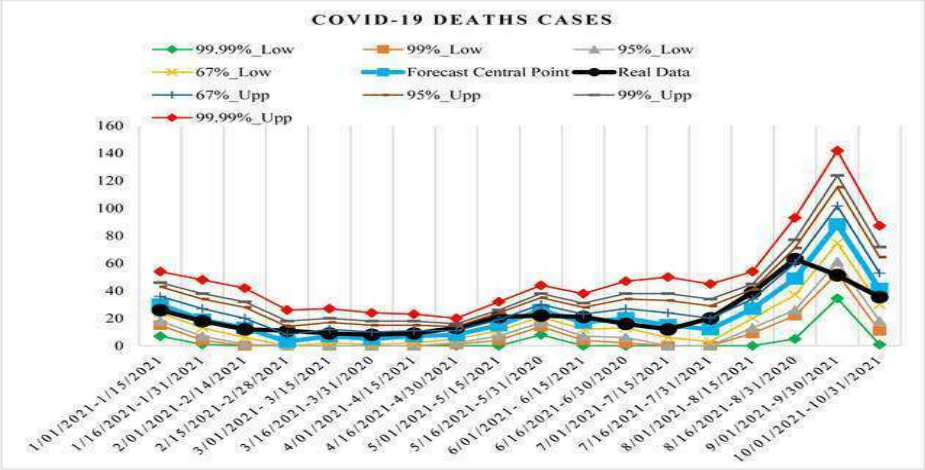

Fig. 2. Verification of the time-averaged forecast of interval prediction of Covid-19 deaths cases in Georgia from 01.01.2021 to 31.10.2021.

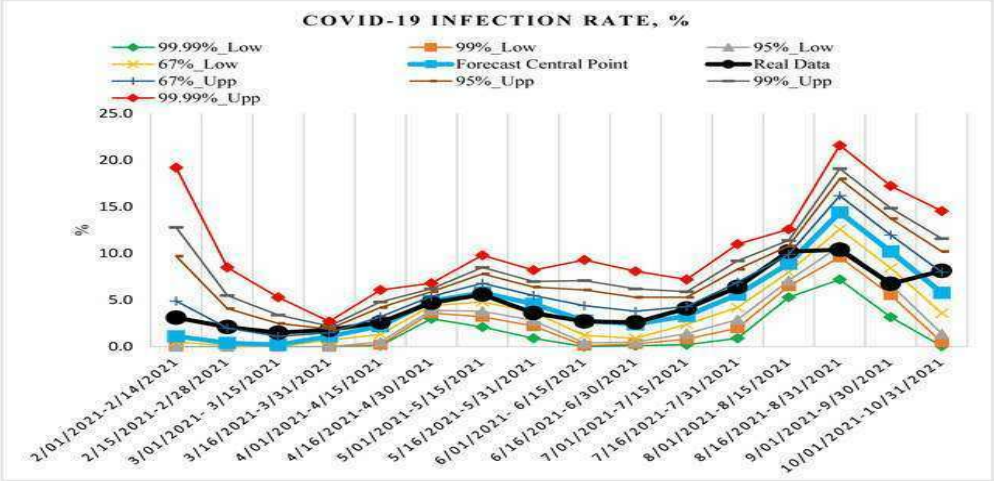

Fig. 3. Verification of the time-averaged forecast of interval prediction of Covid-19 infection rate in Georgia from 01.02.2021 to 31.10.2021.

In fig. 1-3 for clarity graphical information about of the time-averaged forecast of interval prediction of Covid-19 infection cases, deaths cases and infection rate in Georgia for investigation period are presented. In tables 1-3 data about comparing of mean real data of C, D and I with the predicted ones and assessing the stability of the time series of observations in the forecast period in relation to the pre-predicted one are presented.

Table 1. Comparing of mean real data of C with the predicted ones and assessing the stability of the time series of observations in the forecast period in relation to the pre-predicted one.

Change in the forecast state in relation to the pre-predicted one	**Date (period for averaging)**	**Range of Forecast Level**
COVID-19 Infection Cases		
Alarming deterioration, violation of the stability of a time-series of observations (1 case)	10/13/2020-10/22/2020	Real Data > 99.99% Upp
Significant deterioration, stability of a time-series of observations (2 cases)	11/02/2020-11/11/2020; 7/16/2021-7/31/2021	95% Upp <Real Data ≤99%Upp
Noticeable deterioration, stability of a time-series of observations (7 cases)	9/23/2020- 10/02/2020; 1/16/2021-1/31/2021; 3/16/2021-3/31/2021; 4/01/2021-4/15/2021; 7/01/2021-7/15/2021; 8/01/2021-8/15/2021; 10/01/2021-10/31/2021	67% Upp <Real Data ≤95% Upp
Preservation, stability of a time-series of observations (12 cases)	10/03/2020-10/12/2020; 10/23/2020-11/01/2020; 11/12/2020-11/21/2020; 11/22/2020-12/01/2020; 12/02/2020-12/11/2020; 12/22/2020-12/31/2020; 1/01/2021-1/15/2021; 2/01/2021-2/14/2021; 2/15/2021-2/28/2021; 3/01/2021- 3/15/2021; 6/01/2021- 6/15/2021; 6/16/2021-6/30/2021	67% Low ≤ Real Data ≤ 67% Upp
Noticeable improvement, stability of a time-series of observations (3 cases)	4/16/2021-4/30/2021; 5/01/2021-5/15/2021; 8/16/2021-8/31/2021	95% Low ≤Real Data < 67% Low
Significant improvement, stability of a time-series of observations (2 cases)	5/16/2021-5/31/2021; 9/01/2021-9/30/2021	99% Low ≤Real Data < 95% Low
Sharp improvement, stability of a time-series of observations (1 case)	12/12/2020-12/21/2020	99.99% Low ≤Real Data < 99% Low

Table 2. Comparing of mean real data of D with the predicted ones and assessing the stability of the time series of observations in the forecast period in relation to the pre-predicted one.

Change in the forecast state in relation to the pre-predicted one	**Date (period for averaging)**	**Range of Forecast Level**
COVID-19 Death Cases		
Noticeable deterioration, stability of a time-series of observations (5 cases)	2/15/2021-2/28/2021; 4/16/2021-4/30/2021; 5/01/2021-5/15/2021; 8/01/2021-8/15/2021; 8/16/2021-8/31/2021	67% Upp <Real Data ≤95% Upp
Preservation, stability of a time-series of observations (12 cases)	1/01/2021-1/15/2021; 1/16/2021-1/31/2021; 2/01/2021-2/14/2021; 3/01/2021- 3/15/2021; 3/16/2021-3/31/2021; 4/01/2021-4/15/2021; 5/16/2021-5/31/2021; 6/01/2021- 6/15/2021; 6/16/2021-6/30/2021; 7/01/2021-7/15/2021; 7/16/2021-7/31/2021; 10/01/2021-10/31/2021	67% Low ≤ Real Data ≤ 67% Upp
Sharp improvement, stability of a time-series of observations (1 case)	9/01/2021-9/30/2021	99.99% Low ≤Real Data < 99% Low

Table 3. Comparing of mean real data of I with the predicted ones and assessing the stability of the time series of observations in the forecast period in relation to the pre-predicted one.

Change in the forecast state in relation to the pre-predicted one	**Date (period for averaging)**	**Range of Forecast Level**
COVID-19 Infection Rate		
Noticeable deterioration, stability of a time-series of observations (5 cases)	2/15/2021-2/28/2021; 3/01/2021- 3/15/2021; 3/16/2021-3/31/2021; 8/01/2021-8/15/2021; 10/01/2021-10/31/2021;	67% Upp <Real Data ≤95% Upp
Preservation, stability of a time-series of observations (8 cases)	2/01/2021-2/14/2021; 4/01/2021-4/15/2021; 4/16/2021-4/30/2021; 5/01/2021-5/15/2021; 6/16/2021-6/30/2021; 7/01/2021-7/15/2021; 7/16/2021-7/31/2021; 6/01/2021- 6/15/2021	67% Low ≤ Real Data ≤ 67% Upp
Noticeable improvement, stability of a time-series of observations (2 cases)	5/16/2021-5/31/2021; 9/01/2021-9/30/2021	95% Low ≤Real Data < 67% Low
Significant improvement, stability of a time-series of observations (1 case)	8/16/2021-8/31/2020	99% Low ≤Real Data < 95% Low

As follows from Fig. 1 and table 1, except for the period from October 13 to October 22, 2020, all averaged real data of C coincide with their averaged predicted data within 67-99.99% of the forecast confidence interval. All averaged real data of D and I coincide with their averaged predicted data within indicated forecast confidence interval (fig. 2,3 and tables 2,3). Except the period from October 13 to October 22, 2020 the stability of all pre-forecast and forecast time-series of observations are observed.

Depending on the range of forecast level the following correspondence of real data with predicted is observed (tables 1-3).

67% Low ≤ Real Data ≤ 67% Upp, practically accurate forecast (preservation of the real situation in comparison with the pre-forecast): C - 42.9 %, D - 66.7 % and I – 50 % of all cases of corresponding predictions.

67% Upp <Real Data ≤95% Upp and 95% Low ≤Real Data < 67% Low, noticeable deterioration or improvement of real situation in comparison with the pre-prediction: C – 35.7 %, D – 27.8 % and I – 43.8 % of all cases of corresponding predictions.

95% Upp <Real Data ≤99%Upp and 99% Low ≤Real Data < 95% Low, significant deterioration or improvement of real situation in comparison with the pre-prediction: C – 14.3 %, D – 0 % and I – 6.3 % of all cases of corresponding predictions.

99.99% Low ≤Real Data < 99% Low, Sharp improvement of real situation in comparison with the pre-prediction: C – 3.6 %, D – 5.6 % and I – 0 % of all cases of corresponding predictions.

Real Data > 99.99% Upp, deterioration of real situation in comparison with the pre-prediction: C – 3.6 %, D – 0 % and I – 0 % of all cases of corresponding predictions.

Thus, taking into account the extreme instability of the initial time series of observations, the results of short-term forecasting of the values of C, D and I, in our opinion, can be considered quite satisfactory.

Conclusion

In the future, we will continue to carry out regular monthly forecasting of C, D and I values in Georgia. We will also consider the prospects for increasing to more than one month the time to predict Covid-19-related infection cases, deaths cases and infection rates.

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