Dynamics of Covid-19 Cases in Russia

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ANNOTATION

A wavelet analysis was carried out using asymmetric wave functions of daily statistical data for all cases of Covid-19 dynamics in Russia from 03/01/2020 to 01/10/2022 for 681 days. The wavelet identification method showed that in Russia there is a very close oscillatory adaptation of the virus parameters. The main changes for 681 days occur in the first quantum of behavior in the form of a power function, which becomes the first component of the general formula according to Rene Descartes with asymmetric wavelets.

Keywords: Covid-19; Cases; Dynamics; wavelet signals

INTRODUCTION

In comparison with [1, 2], the date 03/01/2020 (instead of 03/25/2020) is taken as the beginning of the Covid-19 dynamics in Russia in this article due to the fact that the President and the government have already begun to take measures against penetration into the country since March 1 coronavirus. Therefore, the daily dynamics of the spread of the virus is only 681 days.

Based on the concept of oscillatory adaptation in nature and the use of trigonometric cosine sums, we proposed a method for determining [3] stable wave patterns from tables of quantitative data, especially from tables of statistical data [4, 5]. The purpose of the article is to conduct a wavelet analysis, to identify behavioral quanta by cases.

INITIAL DAILY DATA

Table 1 gives a fragment of daily data from the site https://стопкоронавирус.рф/information/ by cumulate Kca -all cases.

The average current rate of cases is calculated as follows: $= \overline{S}_{c\!i} = K_{c\!i} / \tau$.

FORMULA FOR IDENTIFICATION

We adhere to the concept of René Descartes on the need for a direct application of the general algebraic additive equation. An asymmetric wavelet signal is mathematically written according to the wave formula [3] of the form:

Table 1: *Current average rate of all Covid-19 cases in Russia*

Date of	Time τ, day	Cumulate $K_{c\!i}$	Speed cases $\overline{S}_{c\!i}$
25.03.2020	25	658	26.32
26.03.2020	26	840	32.31
27.03.2020	27	1036	38.37
...	...	...	...
08.01.2022	679	10634605	15662.16
09.01.2022	680	10650849	15663.01
10.01.2022	681	10666679	15663.26

$$y = \sum_{i=1}^{m} y_i, \ y_i = A_i \cos(\pi x / p_i - a_{8i}), \ A_i = a_{1i} x^{a_{2i}} \exp(-a_{3i} x^{a_{4i}})$$

$$p_i = a_{5i} + a_{6i} x^{a_{7i}}, \qquad (1)$$

where y – indicator, i– component number (1), m– number of members (1), x– explanatory variable, a1.. a3 – model parameters (Table 2), which takes values in CurveExpert-1.40 (URL: http://www.curveexpert.net/), Ai– amplitude (half) of the wavelet (axis y), Pi – half cycle (axis x).

Table 2: *Parameters (1) of the average current speed of all cases of Covid-19*

Number i	Asymmetric wavelet $y_i = a_{1i} x^{a_{2i}} \exp(-a_{3i} x^{a_{4i}}) \cos(\pi x (a_{5i} + a_{6i} x^{a_{7i}}) - a_{8i})$								Coeff. correl. r
	amplitude (half) oscillation				half cycle			shift	
	a_{1i}	a_{3i}	a_{3i}	a_{4i}	a_{5i}	a_{6i}	a_{7i}	a_{8i}	
1	1.02896e7	3.08834	14.27786	0.095773	0	0	0	0	0.9991
2	-347.5347	0.29923	34.1129-5	1.58999	70.84820	0.083179	1.01334	1.16880	
3	-253.3340	0.40255	0.52013	0.27558	-1.41993	3.73431	0.43106	1.52950	0.8155
4	7.83335	10.33802	0.0008098	1.42427	56.17644	0	0	4.43545	0.9090

The correlation coefficient above 0.999 corresponds to the level of adequacy "extremely strong factorial relationship". In this case, the third and fourth wavelets also have a high correlation coefficient.

DYNAMICS OF ALL CASES

As you can see (Fig. 1), the fourth term (similarly, the third one, which is not shown) is at the end of the dynamic series. The fourth term appeared approximately from 11/05/2020 and has an oscillation with a constant period of 2 56.17644 = 112.35 days.

CONCLUSION

The fourth oscillation appeared 250 days after the start of virus registration. Therefore, it shows that the quantum of behavior is the result of the variability of Covid-19 in long phase transitions. Since the beginning of 2022, the fifth oscillation has already appeared due to the rapid spread, that is, the phase transition, of the Omicron virus. The high adequacy of wavelet analysis allows the Covid-19 parameters to be put on a par with the distributions of many genes [4], as well as many amino acids [5] in a variety of human foods.

References:

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