



The Kinetics of SARS-Cov-2 Infections Analyzed by Means of Statistical Methods on the Basis of Official Data in Germany

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Abstract

The officially reported number of incidences of infections by SARS-CoV-2 by the German RKI were analyzed concerning periodic effects where not only the expected week-induced periodicity was found, but also for $3\frac{1}{2}$ and 18 days. Consequences thereof were discussed.

Introduction

Infections with SARS-CoV-2 are presently one of the most important menaces for humans [1] and thus, subject of various scientific activities where impressive successes were obtained concerning vaccination and treatment and general preventive

measures such as disinfections [2]. However, the formation of mutants requires a continuation of such research. Statistical methods were applied for analyzing local outbreaks and developments [3]. On the other hand, a periodicity of such processes obtained much less attention and is subject of this study.

Materials And Methods

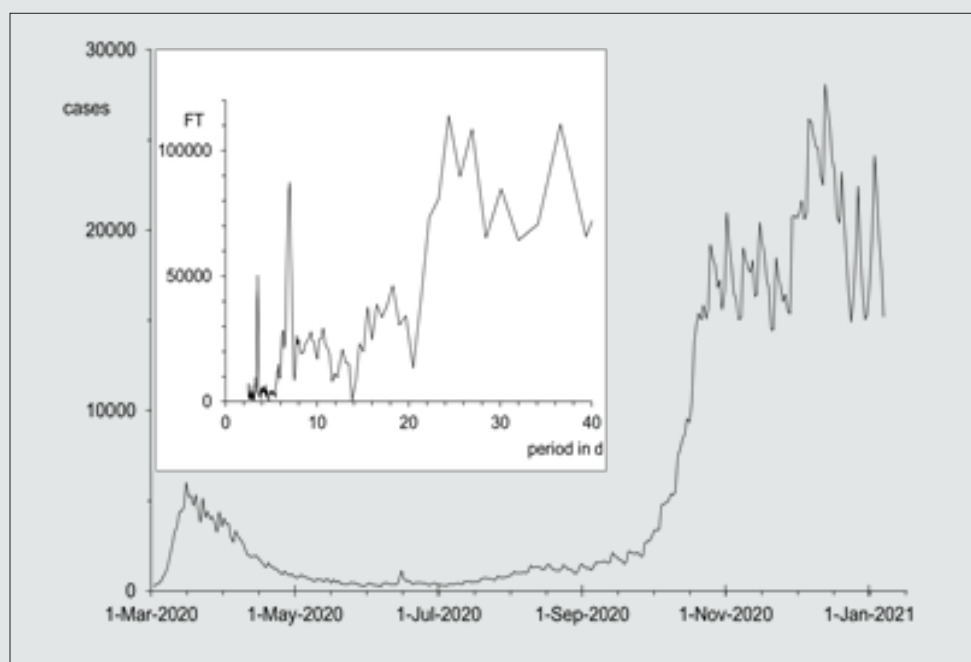


Figure 1: Number of daily reported cases of infections in Germany in the period of March 2, 2020, until January 8, 2021. Inset: Fourier transformation (FT) of the number of cases transformed to the periods in days.

Daily registered numbers of infections by SARS-CoV-2 were officially published in Germany by the RKI (Robert Koch Institute) [4] and were the basis of analyses. The period of March 2, 2020, until January 8, 2021, was preferred because infections were dominated by one variant of the virus so that minimal interference can be expected. The used data are reported in Figure 1. The last number of incidence was daily exponentially damped by a factor of 0.9 for filling the data up until 512 values to obtain an integer exponent of 2. This avoids artifacts by an abrupt termination. A Fourier transformation (FFT) was applied to the data to obtain the frequencies where the absolute intensities were calculated as the square root of the squares of the real and imaginary components. These somewhat abstract frequencies were transformed into the clearer periods in days (inset in Figure 1).

Results and Discussion

Periodic processes in the course of infections according to Figure 1 during the complete period were investigated by means of the Fourier transformation to obtain the frequency domain from the time domain in Figure 1. Fluctuations such as induced by local events or holidays may cause some noise but are unimportant because of no contribution to periodicity. The obtained comparably abstract frequencies were transformed to the more descriptive time of corresponding periods reported in the inset of Figure 1. One firstly finds the expected 7 days period induced by the weekly human activities; this indicates the basic viability of the concept. More interesting is the sharp peak at 3 ½ days indicating a temporarily limited process of efficient infecting. Further interesting maxima were found at 18 and at 24 days. The latter is not so pronounced as the former where there may be further maxima at even longer periods. One problem of such very long periods is the comparably low number of points because the period is the

inverse of the frequency. Thus, the discussion is concentrated to the first two periods except the weekly. It seems that the infectivity is very pronounced after 3 ½ day and then decreases to lower values; special care is recommended for this short period if possible. The infectivity seems to be recovered after about 18 days; this may be problematic for mild infection with declined symptoms and might be an explanation that it was not successful to find all chains of infections even in regions of low numbers of incidences and the fact that declining proceeds very slowly in regions of high incidences.

Conclusion

Pronounced periodicities were found in the course of infections with SARS-CoV-2 and may be important for the handling in pandemic situations. There are two pronounced periodicities besides the human activity-induced weekly effect:

(i) A strong and temporarily sharp limited periodicity of 3 ½ days and

A second after 18 days. The former may be important for the handling and indicating of acute infections, whereas special care is recommended for latter to prevent a recovering of infections from persons with obviously declined infections.

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