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Short Communication

Revisiting an Old Hypothesis: Should We Narrow Our Search for a Possible Link between Sunspot Cycles and Viral Infection Outbreaks Primarily to Nordic Countries?

Seyed Alireza Mortazavi[1], Joseph J Bevelacqua[2], Abdollah Jafarzadeh[3], Seyed Mohammad Javad Mortazavi[4], James S Welsh[5,6*]

[1]Department of Medicine, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran;[2]Department of Radiation Oncology, Bevelacqua Resources, Richland, Washington 99352, United States;[3]Department of Immunology, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran;[4]Department of Medical Physics and Engineering, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran;[5]Department of Radiation Oncology, Edward Hines Jr VA Hospital Hines, Illinois, United States;[6]Department of Radiation Oncology, Stritch School of Medicine, Loyola University, Chicago, IL, United States

ABSTRACT

This commentary expresses our viewpoints regarding the possible relationship between solar activity cycles and viral outbreaks, including the 1918 Spanish Flu pandemic and the recent COVID-19 pandemic. We discuss whether the diminished solar activity associated with solar minima (when the number of sunspots decreases) can influence virally caused outbreaks. Earth's geomagnetic field deflects electrically charged particles and funnels them towards the magnetic poles of the northern and southern hemispheres. Given this consideration, we also discuss whether research should focus on possible linkages between solar cycles and viral outbreaks primarily in Nordic countries.

Keywords: COVID-19; Earth; Geomagnetic field, Hemispheres, Solar cycles

DESCRIPTION

The Sun has a natural heartbeat in the form of an 11-year sunspot cycle. Approximately every 11 years, our Sun enters solar maximum (solar max), when its magnetic activity peaks and has a visible correlate of increased sunspots on the photosphere. This 11-year cycle is accompanied by flip of the solar magnetic poles so that magnetic north becomes magnetic south and vice versa. The periodic return of solar magnetic north to magnetic north every 22 years is sometimes called the Hale cycle. The sunspot cycle or solar Schwabe cycle is an 11-year cycle of solar maxima (and sunspot maxima).

The visible rise in sunspot activity during solar max is due to increasing internal magnetic solar activity. Solar max is accompanied by an increase in the solar wind as well as more frequent and strong solar flares and coronal mass ejections. In short, solar max means more intense solar "weather". The augmented solar weather in turn expands the heliosphere, which is the extensive, interplanetary magnetic shield emanating from the Sun and permeating our Solar System. The intensified solar wind and strengthened heliosphere serves to deflect incoming Galactic Cosmic Rays (GCRs), highly energetic charged particles streaming in from beyond the Solar System. There are certain high-energy, high atomic number nuclei with very high Linear Energy Transfer (LET) among these galactic cosmic rays. These heavy galactic cosmic rays are sometimes called HZE's and potentially have very strong biological effects. During solar max, the strong solar wind and intense solar weather tend to deflect these incoming galactic cosmic rays. In contrast, during solar minimum, the heliosphere is attenuated and galactic cosmic ray influx is higher. The relative importance and influence of increased solar particle influx during solar max versus the increased GCR influx during solar minima are debated topics for human health, the biosphere in general, as well as our climate.

There is substantial evidence that the Sun's activity can have significant impact on human health. Increased solar activities with periods of 10-11 and 5-6 years have been correlated with cyclic biological rhythms with similar periods in human physiology and pathophysiology [1]. Previously, a potential association have been reported between solar activity and certain indices of geomagnetic activity and human physiological state (as well as some pathophysiological effects) [2,3]. The earliest reports on a possible relationship between sunspot activity and the timing of influenza pandemics date back to 1978 [4]. However the association between influenza pandemics and sunspot activity has been challenged by other scientists, due to flaws found in the older analyses [5].

Correspondence to: James S. Welsh, Department of Radiation Oncology, Stritch School of Medicine, Loyola University, Chicago, IL, United States, Tel: +1 708-202-7091; Email: shermanwelsh@gmail.com

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Nevertheless, analyses conducted by Hoyle and Wickramasinghe suggested that some influenza outbreaks might be linked to solar cycles dating as far back as 1761. And they speculated that such novel influenza pandemics might originate *via* unique, electrically-charged influenza molecules originating through panspermia and driven to Earth's atmosphere through solar activity [6,7].

A report published on December 7, 2020 by the National Center for Atmospheric Research/University Corporation for Atmospheric Research indicated that, in direct contradiction to the official forecast, the sunspot cycle at that time could be one of the strongest on record [8]. Moreover, a more recent report published on April 6, 2022 shows that the number of sunspots exceed estimates for 18 consecutive months. This report states that the monthly measure at the end of March 2022 was the highest in 7 years and more than twice the forecasted value. We believe that this level, at least to some extent, can possibly explain the reason behind the recent COVID-19 peak in Nordic countries. Factors such as herd immunity may explain why, when the peak is reached, the new infection rate decreases (Figure 1) [9].

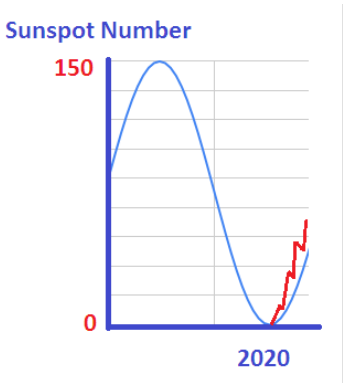

Figure 1: After 2020 the sunspot numbers exceeded the prediction.

While the putative biological consequences of solar activity are compelling, with respect to COVID-19, the global month-to month number of COVID-19 patients does not reveal any strong link to the sunspot count. As shown in Figure 2, while an apparent link might exist between influenza and cosmic rays/solar activity, it does not follow that there would be such a link with coronavirus pandemics. However, the biological effects of sunspot activity should be more prominent in Nordic countries since their geographical location makes them more susceptible to increased solar-induced alterations in cosmic ray flux. When we look at the situation in Nordic countries, a better relationship can be observed (Figures 2-6).

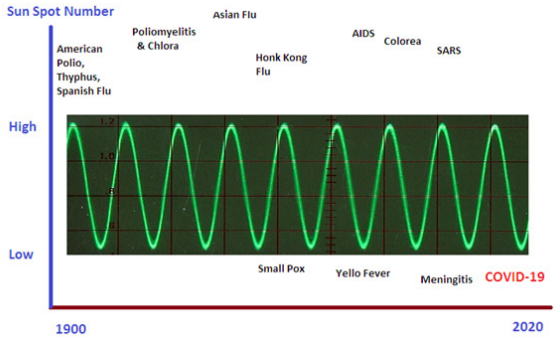

Figure 2: While an apparent link might exist between some viral infections and cosmic rays/solar activity, this relationship cannot be found for other viral infections.

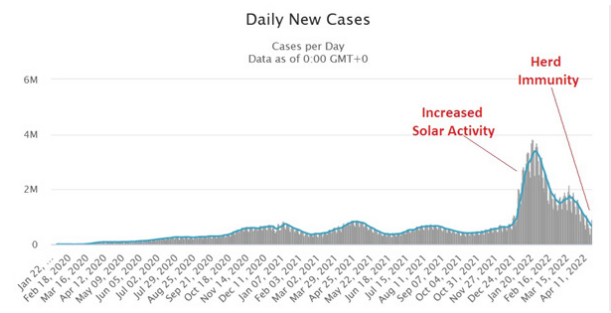

Figure 3: Worldwide Daily New Cases (Source: https://www.worldometers.info/coronavirus/country/finland, accessed on April 22, 2022).**Note:** (●) 7-day moving average

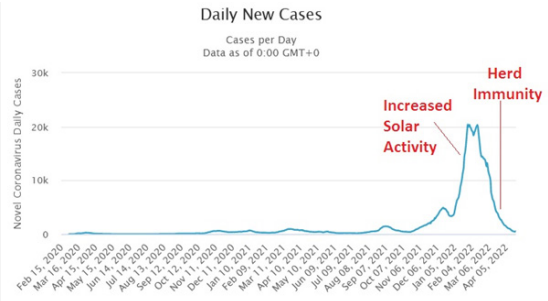

Figure 4: Daily New Cases in Norway (Source: https://www.worldometers.info/coronavirus/country/finland, accessed on April 22, 2022).**Note:** (●) Daily Cases; (●) 3-day moving average; (●) 7-day moving average

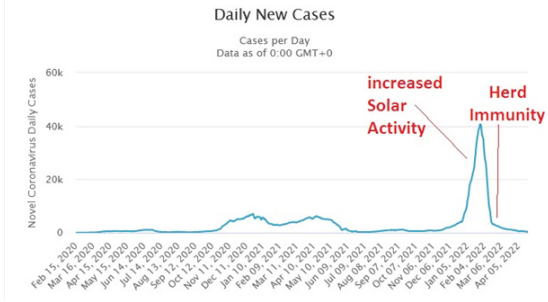

Figure 5: Daily New Cases in Sweden (Source: https://www.worldometers.info/coronavirus/country/finland, accessed on April 22, 2022).**Note:** (●) Daily Cases; (●) 3-day moving average; (●) 7-day moving average

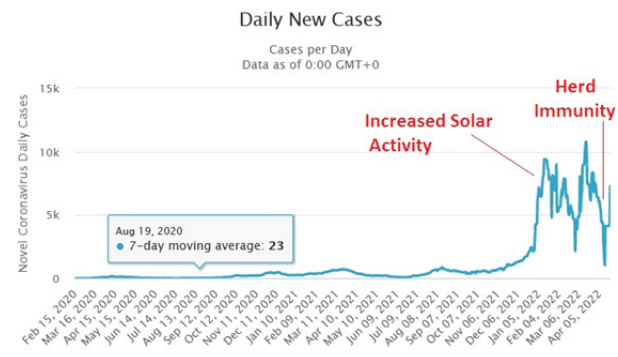

Figure 6: Daily New Cases in Finland (Source: https://www.worldometers.info/coronavirus/country/finland, accessed on April 22, 2022).**Note:** Aug 19, 2020 (●) 7-day moving average: 23.

While the supposed biological effects of altered cosmic ray flux throughout the Schwabe cycle appear to be convincing, we could not come up with a plausible direct mechanism. We believe that the link lies not directly between cosmic rays and viruses themselves but instead between solar activity and atmospheric aerosols. In other words, when solar activity diminishes, the galactic cosmic ray influx increases. When that GCR influx increases, atmospheric aerosols increase due to a nucleation effect induced by GCR secondary cosmic rays. Of note, this is akin to the so-called Svensmark effect wherein the climate can be affected by prolonged periods of diminished solar activity and a consequent increase in galactic cosmic ray influx with an accompanying increase in cloud cover due to secondary cosmic ray-induced aerosols [10]. These are plausible conjectures, but additional research is required to establish a definitive correlation.

An alternative mechanism could be the role of increased solar activity in the resistance of microorganisms such as bacteria and viruses. In 2017 we reported that gamma radiation emitted from soil samples collected from the high background radiation areas of Ramsar in northern Iran were capable of eliciting significant alterations in bacterial resistance to antibiotics. Given this consideration, we postulated that high levels of natural background radiation can provoke adaptive response phenomena that allow some microorganisms to better fend off the lethal effects of antibiotics [11].

Moreover, a new paper published in Environmental Pollution reports the occurrence of Antibiotic-Resistant Bacteria (ARB) and Antibiotic Resistance Genes (ARGs) in uranium mines. The authors emphasized the need for assessment and control of the ecological risk of antibiotic resistance in highly radioactive environments [12]. In addition, some antibiotic-resistant bacteria have been discovered on board the International Space Station (ISS) [13], where space radiation is among the key stressors astronauts face in space [14]. Other stressors including microgravity, the unique environment of the ISS, and other special ISS characteristics are also possible causes. However, the favourable consequences of radiation exposure as noted in the aforementioned discussion merit further review. The collective set of the favourable effects of radiation exposure appears to be more than a coincidence, and merits a careful review.

CONCLUSION

Emissions of matter and electromagnetic fields from the Sun make it difficult for cosmic rays to penetrate the Earth we assess the possible effects of sunspot numbers on the world virus appearance has no sufficient results about these phenomena so to confirm these phenomena and the generation of new viruses because of solar activity associated with solar minima so the magnetic activity peaks has a visible correlate of increased sunspots on photosphere so the strong solar wind and intense solar weather tends to tends to deflect the incoming galactic cosmic rays.

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