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Effects of the local and geocosmic environment on the efficacy of energy medicine treatments: An exploratory study

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ABSTRACT

Introduction: Outcomes of medical treatments tend to be highly variable. Some of the underlying variance is due to well-known factors such as age, gender, ethnicity, and effects of local weather. There are also less obvious influences including variations in solar wind, the Earth's geomagnetic field, and the interplanetary magnetic field.

This study explored possible effects of these local and solar/geomagnetic variables on the outcomes of energy medicine treatments. The context was a pilot clinical trial involving 17 energy medicine practitioners who treated a total of 190 participants presenting with hand and wrist pain.

Methods: Eighteen environmental variables were correlated against changes in subjective pain and against changes in objective measures of nerve conduction velocity.

Results: The results showed that local barometric pressure, interplanetary magnetic field, lunar illumination, proton fluence, electron fluence, and solar radio flux showed statistically significant relationships with these health outcomes (at $p < 0.05$ or better) before correction for multiple comparison corrections. The variable of barometric pressure had a robust correlation with nerve conduction velocity, surviving adjustment for false discovery rate among the 18 variables at $p < 0.05$.

Discussion: This study lends support for future research into local weather, and potentially also to fluctuations in the solar/geomagnetic environment environmental measures as potential sources of variation in energy medicine sessions.

1. Introduction

It is well known that health outcomes are influenced by numerous variables, including the person's age, gender and ethnicity, and the type of therapist.[1,2] Other known sources of variance include environmental factors such as air pollution, humidity, barometric pressure, and air temperature.[3] Less obvious sources of variance are factors such as solar activity and fluctuations of the Earth's geomagnetic field.[4,5]

A small body of literature suggests that these same factors may also correlate with more subtle aspects of human behavior, including purported abilities such as mind-to-mind communication, perception through space and time, and direct mental influence of the physical world.[6,7] Given the resemblance of these latter, "psychic" phenomena to energy medicine treatments such as Reiki, Johrei, or Therapeutic Touch,[8] the question arises as to whether energy medicine outcomes are also sensitive to environmental factors.

To investigate this possibility, the present study analyzed possible effects of local and solar/geomagnetic variables on the efficacy of energy medicine treatments. The context was a clinical trial involving 17 practitioners who individually treated a total of 190 participants presenting with hand or wrist pain. The treatments involved 30-minute sessions, as described in another article in this issue of the journal. In that study, subjective pain and nerve conduction velocity (NCV) measures were collected from participants prior to the energy medicine session (i.e., at baseline), immediately after the session (post-session), and three weeks later during a follow-up visit.

1.1. Objectives

The objectives of this study were to evaluate the relationships between environmental variables and the changes in subjective pain and NCV measurements from a 30-minute energy medicine session. Three analyses were conducted, evaluating:

1. Changes in these measures from before to after the healing sessions and solar/geomagnetic variables recorded before the sessions,

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2. Changes in these measures from before to three weeks after the healing sessions, and solar/geomagnetic variables recorded before the sessions, and
3. Changes in these measures from before to three weeks after the healing sessions, and solar/geomagnetic variables recorded three weeks after the healing sessions.

2. Methods

2.1. Measures

2.1.1. Subjective pain

The primary outcome for this study was the *Numeric Pain Rating Scale (NPRS).* The NPRS is a segmented numeric version of the Visual Analog Scale, where participants select a whole number (0 = “No pain” to 10 = “Worst possible pain”) that best reflects the intensity of their current pain.[9] This is considered the gold-standard for measuring subjective pain in clinical settings.[10] This scale was assessed prior to the session (at baseline), post-session (post), and 3 weeks later (3weeks). These self-reported current pain scores were significantly decreased after the energy medicine session and three weeks later (baseline 3.7 ± 2.3, post-session 1.7 ± 1.9, 3weeks 2.4 ± 2.1; $F(2, 565) = 3.82$ $p < 0.000005$) (For further details see the accompanying article in this issue). The change in NPRS score from baseline to post-session (**post-baseline)** and baseline to 3 weeks later (**3weeks-baseline)** were used in this paper for the quantitative analyses reported in this paper. For both of these difference variables, negative numbers indicated less subjective pain.

2.1.2. Nerve Conduction Velocity (NCV)

Participants recruited for the study presented with hand or wrist pain similar to that observed in carpal tunnel syndrome. Pain in such cases can occur because nerve impulses are slowed down as they pass through the carpal tunnel due to compression of the nerve. If the compression is released, the speed of nerve impulses increases, and this is objectively measured as NCV.[11] NCV of the median sensory nerve was measured on both wrists using a XLTEK Neuromax 1002 nerve conduction stimulator (Excel-Tech Ltd., Oakville, Canada). The electrical stimulus was applied at the affected wrist and the signal recorded from the index finger of the same arm. The distance between electrodes was measured manually and entered into the Neuromax device, which determined the onset latency, peak latency, and amplitude based on processing the recorded waveform. Conduction velocity was determined by the ratio of the distance measured divided by the onset latency. A minimum threshold for onset latency was set at 2 milliseconds. NCV was collected at baseline, post-session, and 3weeks. There was no significant change in NCV values from baseline (44.9 ± 10.6 m/s), post-session (45.3 ± 10.7 m/s), and three weeks later (43.4 ± 9.7 m/s; $F(2,426) = 1.0$, $p = 0.39$) (See accompanying articles in this issue). Two NCV change variables were calculated: **post-baseline** and **3weeks-baseline**. For both measures, negative numbers reflected slower nerve conduction velocity, which is associated with increased pathology and/or pain.

2.1.3. Solar/geomagnetic variables

Two sets of values were included for each of the following variables. One for the day of each participant’s energy medicine session (i.e., at **baseline**), and a second for the day each participant’s 3-week follow-up visit (i.e., at **3weeks**).

Values for 18 variables were extracted from databases maintained by the Jet Propulsion Labs of the National Aerospace and Space Administration (https://ssd.jpl.nasa.gov/horizons.cgi), and by the National Oceanic and Atmospheric Administration’s National Centers for Environmental Information, including the solar terrestrial database (https://www.ngdc.noaa.gov/stp/GEOMAG/kp_ap.html), space weather database (https://www.ngdc.noaa.gov/stp/solar/solarwind.html), and the local climatological database (https://www.ncdc.noaa.gov/cdo-web/datatools/lcd).

The variables were:

1) *lunar illumination*, the proportion of the moon illuminated from the perspective of the Earth, with 0 as new moon and 100 as full moon,
2) *solar wind,* the speed of ions and electrons emitted by the sun in km/second, as monitored by deep space satellites up-wind from the Earth, typically at the L1 Lagrange point,
3) *solar plasma,* the speed of plasma (protons) emitted by the sun, associated with the solar magnetic field, in km/second,
4) *interplanetary magnetic field*, the strength of the sun’s magnetic field extending throughout the solar system,
5) *mean proton flux*, average proton radiant energy emitted by the sun at 10, 50, and 100 meV (million electron volts),
6) *mean proton fluence*, average proton radiant energy at 1, 10, and 60 meV,
7) *mean electron fluence*, average electron radiant energy at 2, 8, and 100 meV,
8) *solar radio flux,* solar electromagnetic emissions at a wavelength of 10.7 cm,
9) *sunspot number,* the number of visible sunspots (i.e. regions of reduced surface temperature caused by concentrations of magnetic field flux that inhibit convection),
10) *sunspot area,* the area of the sun covered by sunspots,
11) *geomagnetic K-index*, the global sum of daily quasi-logarithmic local indices of the 3-hourly range in magnetic activity relative to an assumed quiet-day curve for a single geomagnetic observatory site,
12) *geomagnetic Ap-index*, the average of irregular disturbance levels in the horizontal field components, observed at selected magnetic observatories worldwide, and
13) local weather parameters including *wind speed*,
14) *precipitation*,
15) *maximum daily temperature,*
16) *minimum temperature*,
17) *barometric pressure*, and
18) *relative humidity*.

2.2. Statistical Analyses

All analyses were conducted in the programming language, R.[12] Six linear regression models were constructed to explore changes in subjective pain and NCV from the energy medicine session and the solar/geomagnetic variables:

1) pain change from baseline to post with baseline solar/geomagnetic variables,
2) pain change from baseline to 3week with baseline solar/geomagnetic variables,
3) pain change from baseline to 3week with 3week solar/geomagnetic variables,
4) NCV change from baseline to post with baseline solar/geomagnetic variables,
5) NCV change from baseline to 3week with baseline solar/geomagnetic variables,
6) NCV change from baseline to 3week with 3week solar/geomagnetic variables.

These models were chosen to evaluate the immediate changes in pain and NCV (from before the energy medicine session began to immediately after) and longer-term changes (from before the session to 3 weeks later), and the relationship of those changes to environmental measures on the day of the session and on the day of the 3 week follow-up visit.

For the six linear regression models, the full linear regression model was fit with generalized least squares using REML (Restricted Maximum Likelihood), and then compared to a corresponding model with random intercept (also fit using REML) for the variable *practitioner* using the likelihood ratio test in the R package *nlme*.[13] No difference was observed in outcomes between the practitioners, so adding a random intercept for effects potentially contributed by variations among deemed unnecessary. Thus, a multiple linear regression was used rather than a mixed effects model.

Models were then examined for collinearity and multicollinearity using a correlation matrix and variance inflation factors (VIFs). Where feasible and logical, highly collinear related variables (e.g. Proton Fluence at 1, 10 and 100 meV) were represented as a mean of those variables. If VIFs still exceeded about 5, the variables with the highest VIF were removed one at a time. The remaining model assumptions were examined using diagnostic and influence plots. Violations of the constant variance assumption were assessed visually and using the non-constant variance test.

Variable independence was assessed visually and using the Durbin-Watson Test. Studentized residuals were examined for adherence to normality using QQ-plots, the Shapiro-Wilk test, and the Lilliefors Kolmogorov-Smirnov test. Unless otherwise noted, all resulting linear regression models had VIFs < 6 and there was no evidence of heteroscedasticity, non-independence, and non-normality of the residuals.

3. Results

3.1. Subjective pain

3.1.1. Model 1: Change in pain and baseline solar/geomagnetic variables

For the relationships between changes in pain from baseline to post-session ($\Delta pain$) and solar/geomagnetic variables (*geo*), the multiple R^2 was 0.09 and the adjusted R^2 was -0.02. Overall the relationship between $\Delta pain$ and *geo* was not significant ($F(19, 169) = 0.85$, $p = 0.65$). There was an individually positive association between $\Delta pain$ and the interplanetary magnetic field variable ($t = 2.07$, $p = 0.04$), but when adjusted by the False Discovery Rate algorithm given the 18 variables tested, that coefficient was no longer significant at alpha < 0.05.[14,15]

3.1.2. Model 2: Change in pain at 3 weeks and baseline solar/geomagnetic variables

For the relationships between changes in pain from baseline to 3weeks later ($\Delta pain3wk$) and *geo*, the multiple R^2 was 0.06 and the adjusted R^2 was -0.05. The overall relationship was nonsignificant ($F(19, 161) = 0.53$, $p = 0.94$). In addition, none of the individual coefficients were significant.

3.1.3. Model 3: Change in pain at 3 weeks and 3 week solar/geomagnetic variables

For the relationships between $\Delta pain3wk$ and 3-week solar/geomagnetic (*geo3wk*) variables, the variable *sunspot area* was removed from the model due to VIF > 12. The resulting multiple R^2 was 0.08 and the adjusted R^2 was -0.03. Overall the relationships were not significant ($F(18, 151) = 0.70$, $p = 0.81$), nor were any of the individual coefficients significant.

3.2. Nerve conduction velocity

3.2.1. Model 4: Change in NCV and baseline solar/geomagnetic variables

For the relationships between baseline to post-session NCV changes (ΔNCV) and *geo*, a cube root transformation was applied to ΔNCV to address violation of normality, and one outlier was removed. The multiple R^2 was 0.40 and the adjusted R^2 was 0.11. Overall, the relationship between ΔNCV and *geo* was not significant ($F(18, 40) = 1.38$, $p = 0.20$).

There were a few individually significant correlations suggesting associations between ΔNCV and lunar illumination ($t = -2.373$, $p = 0.023$), interplanetary magnetic field ($t = 2.345$, $p = 0.024$), mean proton fluence ($t = 2.304$, $p = 0.027$), mean electron fluence ($t = -2.733$, $p = 0.009$), solar radio flux ($t = -2.03$, $p = 0.049$), and humidity ($t = 2.097$, $p = 0.042$). These relationships suggested that faster NCV corresponded with lower levels of lunar illumination, mean electron fluence, and solar radio flux, and slower NCV corresponded to lower levels of interplanetary magnetic field, mean proton fluence, and humidity. However, none of these *p*-values survived adjustment for false discovery rate at alpha < 0.05.

3.2.2. Model 5: Baseline to 3-week NCV change and baseline solar/geomagnetic variables.

For the relationships between baseline to 3-week NCV changes ($\Delta NCV3wk$) and *geo*, the multiple R^2 was 0.20 and the adjusted R^2 was 0.03. The overall relationship was not significant ($F(19, 88) = 1.16$, $p = 0.31$), but there was potential evidence of an association between $\Delta NCV3wk$ and barometric pressure ($t = -2.169$, $p = 0.033$) and local wind speed ($t = -2.715$, $p = 0.008$). Neither of these effects survived adjustment for false discovery rate at alpha $<$ 0.05.

Please see Supplemental Data Tables 1-5 for detailed results of models 1-5.

3.2.3. Model 6: Baseline to 3-week change and 3-week solar/geomagnetic variables

Relationships between $\Delta NCV3wk$ and *geo3wk* are shown in Table 1. The variable *sunspot area* (3weeks) was removed due to VIF > 12, and *solar radio flux* (3weeks) was removed due to VIF > 7. The multiple R^2 was 0.28 and the adjusted R^2 was 0.12. The predictors in this model accounted for 12% of the variation in the three-week NCV scores. Unlike the other models, in this case the overall relationship between $\Delta NCV3wk$ and *geo3wk* was significant ($F(17, 81) = 1.81$, $p = 0.041$). There was also evidence of an association between $\Delta NCV3wk$ and electron fluence ($t = 2.548$, $p = 0.013$), and with barometric pressure ($t = -3.25$, $p = 0.002$), the latter surviving adjustment for false discovery rate at alpha < 0.05.

Table 1
Fitted model examining the relationship between $\Delta NCV3wk$ and *geo3wk*.

Variable (at 3 weeks)	Coefficient Estimate	SE	*t*-value	*p*-value
(Intercept)	2270.080	695.177	3.265	0.002
Lunar illumination	-0.059	0.057	-1.033	0.305
Solar wind speed	-0.020	0.039	-0.512	0.610
Interplanetary magnetic field	0.142	0.796	0.178	0.859
Solar plasma	-0.017	0.026	-0.672	0.503
Mean proton flux	-1.145	2.146	-0.533	0.595
Mean proton radiation	-3.66E-05	1.96E-05	-1.872	0.065
Mean electron Fluence	4.11E-09	1.61E-09	2.548	0.013
Sunspot number	0.403	0.234	1.721	0.089
Geomagnetic K index	0.262	0.335	0.783	0.436
Geomagnetic Ap index	0.067	0.458	0.147	0.883
Barometric pressure	-74.342	22.873	-3.250	**0.002***
Humidity	-0.375	0.233	-1.609	0.112
Wind speed	-0.291	0.943	-0.309	0.758
Precipitation	-4.398	13.029	-0.338	0.737
Maximum daily temperature	-0.108	0.282	-0.384	0.702
Minimum daily temperature	0.122	0.594	0.205	0.838
Local time of day	-0.303	0.792	-0.383	0.703

* survives adjustment for false discovery rate at alpha < 0.05

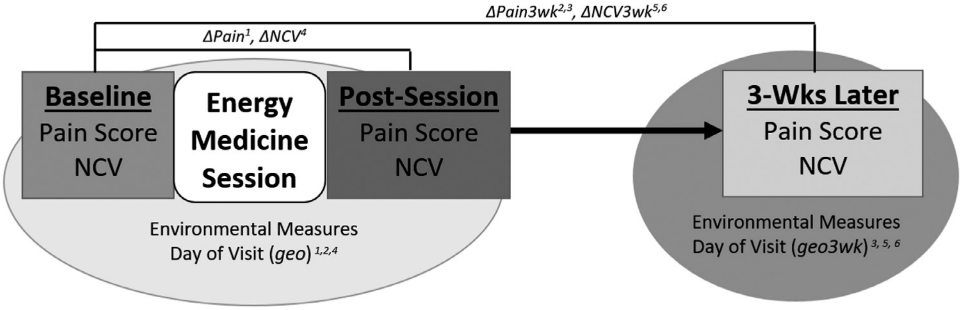

Figure 1. Statistical Analysis. Numerical superscripts denote the variables used in that statistical model.

4. Discussion

Five of the six regression models evaluating the relationship between changes in subjective pain and NCV and baseline and three-week solar/geomagnetic variables were not significant. Despite a lack of model significance evaluating linear relationships, there were a number of individual variables that were significant before correction for multiple comparison corrections and some measure variation was accounted for by the environmental variables. The variance accounted for by the environmental variables can be considered separate from the significance of the linear relationship among the variables. For example, in model 4, 11% of the variation of the baseline to post-session NCV score was explained by the variables in the model, independent of whether the linear relationship was statistically significant. While these effects tended to be rather small in absolute magnitude, from the pragmatic perspective of seeking to improve health care, gaining a better understanding of any and all sources of variance is important.

The other potentially important variables were interplanetary magnetic field, lunar illumination, proton fluence, electron fluence, and solar radio flux. While these did not retain their significance after multiple comparison correction, it is noteworthy that the same variables achieved lower *p*-values in multiple models. This pattern would not be expected if these were randomly significant due to chance. These environmental variables are related to the influence of the sun on the Earth. Many studies have observed a broad range of influences of solar and geomagnetic field effects on human health and behavior, including acute myocardial infarctions,[19] shifts in heart rate variability,[4,20] symptoms of multiple sclerosis,[21] rates of suicide,[5] violence in prisons,[22] and mortality.[23,24] It might be noted that most previous studies that have reported relationships between health and solar/geomagnetic factors have used much larger sample sizes than were available for the present study. That alone might account for the general lack of statistically significant solar/geomagnetic correlations observed in the present study.

The one significant model examined the linear relationship between changes in NCV from baseline to three weeks versus solar/geomagnetic variables at three weeks. There was also one individually significant variable that survived adjustment for false discovery rate (NCV at three weeks and barometric pressure at three weeks). These factors should be explored in more detail in future studies, especially considering that other clinical studies have also observed significant relationships with barometric pressure, including health conditions such as osteoarthritis,[16] fibromyalgia,[3] and headache.[17] Why barometric pressure remained significant in the model of NCV change at three-weeks compared to the other models is uncertain. The environmental values presented two different time-points, the day of the participant's energy medicine visit and the day of the three-week follow-up visit. It seems more reasonable to assume that barometric pressure on the day the NCV was recorded would have influenced the measurements more than the barometric pressure on a different day. Future research would help us understand if these results were due to chance. So far, only a few studies have explored relationships between hand and wrist pain versus variations in local weather.[18]

In summary, the present results lend support for further investigation of the influence of local, solar and geophysical factors as potential sources of variation in health outcomes. While these correlations appear to be small in magnitude, because the art and practice of medicine contains many uncertainties, the study of possible influences on health and healing, including subtle and not-so-subtle environmental factors, remains pragmatically important (Fig. 1).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.explore.2020.09.002.

References

1 Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, Gender, and Pain: A Review of Recent Clinical and Experimental Findings. *J Pain*. 2009;10(5):447–485. https://doi.org/10.1016/j.jpain.2008.12.001.

2 Gould L, Abadir P, Brem H, et al. Chronic wound repair and healing in older adults: current status and future research. *J Am Geriatr Soc*. 2015;63(3):427–438. https://doi.org/10.1111/jgs.13332.

3 Fagerlund AJ, Iversen M, Ekeland A, Moen CM, Aslaksen PM. Blame it on the weather? The association between pain in fibromyalgia, relative humidity, temperature and barometric pressure. *PloS One*. 2019;14(5).

4 Alabdulgader A, McCraty R, Atkinson M, et al. Long-term study of heart rate variability responses to changes in the solar and geomagnetic environment. *Sci Rep*. 2018;8(1):1–14.

5 Nishimura T, Tsai I-J, Yamauchi H, Nakatani E, Fukushima M, Hsu CY. Association of Geomagnetic Disturbances and Suicide Attempts in Taiwan, 1997–2013: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2020;17(4):1154.

6 Palmer J, Simmonds-Moore CA, Baumann S. Geomagnetic Fields and the Relationship between Human Intentionality and the Hemolysis of Red Blood Cells. *J Parapsychol*. 2006;70(2).

7 Ryan A. New Insights into the Links between ESP and Geomagnetic Activity. *J Sci Explor*. 2008;22(3):335–358.

8 Doğan MD. The effect of reiki on pain: a meta-analysis. *Complement Ther Clin Pract*. 2018;31:384–387.

9 Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res*. 2011;63(Suppl 11):S240–S252. https://doi.org/10.1002/acr.20543.

10 Farrar JT, Young JP, LaMoreaux L, Werth JL, Poole MR. Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. *Pain*. 2001;94(2):149–158. https://doi.org/10.1016/S0304-3959(01)00349-9.

11 Moon P, Maheshwari D, Sardana V, Bhushan B, Mohan S. Characteristics of Nerve Conduction Studies in Carpal Tunnel Syndrome. *Neurol India*. 2017;65(5):1013–1016.

12 R Development Core Team R. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing; 2019. http://www.R-project.org/.

13 Pinheiro J, Bates D, DebRoy S, Sarkar D, Team RC. nlme: Linear and nonlinear mixed effects models. R package version 3.1–140. Published online2019.

14 Benjamini Y, Hochberg Y. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *J R Stat Soc Ser B Methodol*. 1995;57(1):289–300. https://doi.org/10.2307/2346101.

15 Mundfrom D, Perrett J, Schaffer J, Piccone A, Roozeboom M. Bonferroni Adjustments in Tests for Regression Coefficients. *Mult Linear Regres Viewp*. 2006;32(1):1–6.

16 McAlindon T, Formica M, Schmid CH, Fletcher J. Changes in barometric pressure and ambient temperature influence osteoarthritis pain. *Am J Med*. 2007;120 (5):429–434.

17 Maini K, Schuster NM. Headache and Barometric Pressure: a Narrative Review. *Curr Pain Headache Rep*. 2019;23(11):87.

18 Warrender WJ, Henstenburg J, Maltenfort M, Lutsky K, Beredjiklian PK. Seasonal Variation in the Prevalence of Common Orthopaedic Upper Extremity Conditions. *J Wrist Surg*. 2018;7(3):232–236. https://doi.org/10.1055/s-0037-1612637.

19 Buccelletti E, Gilardi E, Scaini E, et al. Heart rate variability and myocardial infarction: systematic literature review and metanalysis. *Eur Rev Med Pharmacol Sci*. 2009;13(4):299–307. 19694345.

20 Caswell JM, Singh M, Persinger MA. Simulated sudden increase in geomagnetic activity and its effect on heart rate variability: Experimental verification of correlation studies. *Life Sci Space Res*. 2016;10:47–52. https://doi.org/10.1016/j.lssr.2016.08.001.

21 Papathanasopoulos P, Preka-Papadema P, Gkotsinas A, et al. The possible effects of the solar and geomagnetic activity on multiple sclerosis. *Clin Neurol Neurosurg*. 2016;146:82–89. https://doi.org/10.1016/j.clineuro.2016.04.023.

22 Ganjavi O, Schell B, Cachon JC, Porporino F. Geophysical variables and behavior: XXIX. Impact of atmospheric conditions on occurrences of individual violence among Canadian penitentiary populations. *Percept Mot Skills*. 1985;61(1):259–275. https://doi.org/10.2466/pms.1985.61.1.259.

23 Stoupel E, Petrauskiene J, Abramson E, Kalediene R, Sulkes J. Distribution of monthly deaths, solar (SA) and geomagnetic (GMA) activity: their interrelationship in the last decade of the second millennium: the Lithuanian study 1990-1999. *Biomed Pharmacother Biomédecine Pharmacother*. 2002;56(Suppl 2):301s–308s. https://doi.org/10.1016/s0753-3322(02)00306-2.

24 Stoupel E, Kalediene R, Petrauskiene J, et al. Three kinds of cosmophysical activity: links to temporal distribution of deaths and occurrence of acute myocardial infarction. *Med Sci Monit Int Med J Exp Clin Res*. 2004;10(2). CR80-84.