

## ON WEATHER, MEDICINE AND A WEATHER STAND: A HISTORY ECHOING INTO THE PRESENT

Stella Fatović-Ferenčić<sup>1</sup>, Tatjana Buklijaš<sup>1,2</sup>

### SUMMARY

*Stimulated by an increase in the number of reports on heat-related mortality in August 2003, we wanted to show the role and significance of weather-related factors in medical practice throughout the history. Climatic factors were incorporated in main medical concepts such humoral, miasmatic, or constitutional; they were applied in therapeutic approaches and in the formation of some medical disciplines only to end up discarded in favour of evidence-based medicine. Here we deal with typical examples, significant for Croatia, with an emphasis on a weather stand? set up by Adolf Holzer (1834–1885), a military and spa physician, in Zagreb in 1884.*

**Keywords:** weather reports; history of human health; history of meteorology; meteorological factors; Zagreb; Croatia; climate change; environmental health

*Whoever wishes to investigate medicine properly, should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces (for they are not at all alike, but differ much from themselves in regard to their changes). Then the winds, the hot and the cold, especially such as are common to all countries, and then such as are peculiar for each locality.*

*(Hippocrates, c.400 BC)*

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<sup>1</sup> Department of History of Medical Sciences, Institute for History and Philosophy of Science, Croatian Academy of Sciences and Arts For correspondence: Stella Fatović-Ferenčić, Gundulićeva 24, Zagreb, Croatia, E-mail: [stella@hazu.hr](mailto:stella@hazu.hr)

<sup>2</sup> Department of History and Philosophy of Science, Cambridge University

Disturbing news quickly spread from Europe to every corner of the world: after the torrential rains and floods of the summer 2002, the record temperatures of 2003 took an even heavier human toll. In the scorching sun of Southern Europe, temperatures exceeding 40 °C first hit elderly people suffering from chronic diseases; in England, young people unaccustomed to heat drowned when trying to cool down in lakes and canals [1]. France fared the worst. The number of deaths in Paris during the hottest days tripled, and morgues and cemeteries found themselves unable to cope with the flood of corpses [2]. On 18 August, French director-general of health, Lucien Abenheim, resigned. Socialists and the ecological party joined in the criticism of what they described as government “inaction” [3]. On 19 August, a Croatian daily published an article investigating the effects of the heat wave on general mortality in Zagreb [4]. Although it was too early to provide definitive answers, because the mortality data would be analyzed at the end of the year, the impression of both the Department of Forensic Medicine in Zagreb and public health officials was that the mortality indeed significantly increased. “It would be good” said a doctor from the Croatian Institute of Public Health “to investigate the relationship between specific mortality and meteorological aspects such temperature and air pressure”.

This comment made us historians of medicine pause and think. Extreme phenomena, as those described above, had always called for attention of the academic community. Having in mind that weather played an essential role in medical practice throughout history, we thought that the moment was right for a retrospection on this issue. Establishing a diagnosis or prognosticating the course of a disease in the past was virtually impossible without a thorough knowledge of weather conditions. But somewhere down the road ties not only between weather and medicine, but also between the humankind and its environment broke down. How and when did it happen? And why are they being rebuilt now?

In this paper we intend to briefly describe how climatic factors were incorporated and utilized in main medical concepts such humoral, miasmatic, or constitutional; how they were applied in therapeutical approaches as well as in the formation of some medical disciplines; and how they were finally discarded in favour of evidence-based medicine. This paper does not intend to be extensive, but illustrative, using examples typical and significant for Croatia.

## ANTIQUITY: HUMORAL DOCTRINE AND NATURAL ENVIRONMENT

In antiquity, meteorology included the study of weather as well as the study of geological, seismological and astronomical phenomena, such as earthquakes and comets. Eventually it ceased to be just a matter of practical value. Poets, philosophers and physicians used meteorology to raise important questions about the nature of the world and how we understand it, about the unity and character of the cosmos, and about the relationship between weather and supernatural phenomena on one side and the humankind on the other side. The basic principles of the Western understanding of weather influences on human health originate from ancient Greece and *Corpus Hippocraticum*, a collection of (anonymous) medical treatises from the 4<sup>th</sup> century BC [5]. The treatise on air, water and soil, titled in Latin “De aere, aquis et locis” and attributed to the legendary physician Hippocrates himself, discussed the influence of natural environment on the human health as well as on the biological and cultural properties of various European and Asian peoples. A physician, argued the author, should not regard the patient as an isolated being, but as a part of environment. An accurate prognosis or therapy required a meticulous knowledge of the local climate, earth and water. This knowledge, in turn, contributed not only to the understanding of the individual health, but also of the spreading of diseases from one place to another, discussed in more detail in unfinished pieces on epidemics titled “Epidemiorum libri septem”[5]. How these theoretical concepts worked in practice is illustrated by a well known legend, according to which Hippocrates was invited to Illyria by its ruler to put under control the plague epidemic that broke out in the country. However, the invitation was rejected because from the information received on the direction and strength of winds there, Hippocrates concluded that the plague would soon spread to his own country [6]. The aetiology of infectious diseases, fevers in particular, was for many centuries explained by the notion of *miasmas*, poisons in the air spreading by winds. Malaria, the fever that dominated the Mediterranean basin from antiquity until the 20<sup>th</sup> century, which contains the notion of *miasma* even within its name (*male area* = corrupted air), probably motivated Hippocrates to construct his notion of constitution [7]. The Hippocratic medicine that defined the state of health as a balance of four humors (blood, phlegm, black and yellow bile), where the dominant humor determined the constitutional type and temperament of the individual, and four qualities (dry, moist, cold and hot) remained the

cornerstones of the Western medical tradition until the 19<sup>th</sup> century. A physician who endeavored to restore the patient's health by re-establishing the disturbed balance of fluids and qualities would unavoidably take into account the state of the natural environment.

### MEASUREMENTS, REPORTS AND INFLUENCE OF TUBERCULOSIS

Throughout the Middle Ages and early modern period, notwithstanding the changes in methods and approaches to meteorology that followed the development of human knowledge, the awareness of environmental influences on health did not decrease. In the 17<sup>th</sup> century, the connection between the weather and the human health was seen in a different although no less important perspective. For instance, Santorio Santorio (1561-1636), the physician who introduced quantitative measurement into medicine, among other instruments and appliances constructed the anemometer to measure the force of the wind, perfected Cusani's hygrometer and constructed the thermometer [8]. Santorio traveled to Senj, Karlovac and Ozalj, where he measured temperature, humidity and wind force in relation to his notions of human physiology, in particular perspiration. The link between nature and human body was therefore not interrupted but quantified.

In the 18<sup>th</sup> century, enlightened rulers sought to increase the military and economic power of their countries by improving the health of their subjects [9]. Physicians, who, by virtue of their privileged medical knowledge, found themselves in the position to safeguard and promote the advancement of a nation, were assigned to assess the health of a population and write reports and treatises to record not only the number of deaths and births, but also climatic conditions. In the 19<sup>th</sup> century, rapid urbanization and industrialization contributed to the emergence of new diseases such as tuberculosis. New, affluent middle classes sought to improve their health in increasingly popular climate resorts that were supposed to recruit the constitution by the benefit of good weather and pure air. Public health authorities frequently advertised the benefit of sun and mountain air for a successful therapy of tuberculosis, with messages such as "Sun for the tuberculosis patients" (*Sunca za tuberkulozne*) [10]. Consequently, this led to a boom of health tourism. Towns and islands along the Croatian coast such as Opatija, Lošinj or Brijuni, as well as similar places throughout Europe, were discovered as extremely beneficial for curative properties of their mild

climate and the sea water. Weather reports in connection with health became more and more important and detailed.

#### GLEDE VRIEMENA I ZDRAVLJA - OBSERVATIONS OF MEDICAL PRACTITIONERS IN CROATIA

In the 19<sup>th</sup> century, general orders of keeping weather reports were issued in different parts of the world including Croatia, where municipal officials were required to provide both health and meteorological reports including ecological states which affected human health. As an example we quote a 1825 report preserved in the State Archives in Zagreb, first published by historian Emil Laszowski:

*November 1825 initially foggy, followed by gusty winds, and when the winds had dropped, the rain fell once again, warm and pleasant. Towards the end of the month again foggy and cold. Yellow fever dominated as well as rheumatic fever. They were treated with salts and other cleansing medicines. December, foggy with light snow cold then windy with some snow, followed by nice warm weather... no other illnesses recorded... Jun 1926, very dry no illness recorded; July almost no rain at all, no illness recorded; August dry with terrible heat, fevers appeared which were healed by purgatives; in September which was pleasant and dry but often foggy fevers were recorded [11].*

Many similar reports are preserved in the Croatian archives. Although written by different physicians, most observed the prescribed form for writing reports and bore the same title "On the weather and health" (Glede vriemena i zdravlja). This practice became more and more sophisticated and reports increasingly detailed towards the turn of the 20<sup>th</sup> century. In Croatia, weather and health-related data were included in annual morbidity reports or similar articles often printed on the pages of *Liječnički vjesnik*, the official journal of the Croatian Medical Association, which was first published in 1877. The bibliography of *Liječnički vjesnik* for the period 1877-1977 shows that an interest of the medical community in weather persisted into the late 1930-ies [12].

The 19<sup>th</sup> century medical reports were qualitative, describing weather as "dry", "foggy", or "windy", and did not contain relevant quantitative parameters such as temperature, air pressure, or humidity. They remained unchanged well into the 20<sup>th</sup> century, in spite of the new opportunities resulting from the institutionalization of meteorology from the mid 19<sup>th</sup> century onwards. The first meteorological service recording daily temperature, humidity rain and other meteorological data on the territory of

Croatia was founded on 16 February 1853 in the National Museum (today the Natural History Museum in Demetrova 1) in Zagreb. But the activity of the first meteorological station was later interrupted on several occasions and the original reports were lost. It took some time until the establishment of the meteorological station in 1861 on Grič [13]. The first meteorologist to work there was the physicist Ivan Stožir (1834-1908), who retired in 1891. According to Sijerković, Stožir was the first in Croatia to start measuring ozone holes, a phenomenon today believed to have a direct effect on human health. His endeavors led to the establishment of weather stations in Petrinja and Lepoglava [13].

As we have shown, observations of medical practitioners about weather and health preceded the establishment of official meteorological institutions in Croatia. But even after the institutionalization of weather reporting within the disciplinary domain of physics and geophysics, the link between medicine and weather remained strong. A physical proof of that fact is the elegant (weather post) mounted in the northern part of Zrinjski park in 1884 (*Figure 1*). The construction of the display was supervised by Ivan Stožir and financed by Adolf Holzer (1834-1885), a military doctor who practiced in spas throughout the Hapsburg Empire (*Figure 2*). Holzer was a physician of broad interests that included meteorology. After expressing regrets to the city administration that Zagreb did not have an appropriate place where its citizens could observe weather changes, like in other European towns, Holzer offered to finance such project [14, 15]. His offer was readily accepted by the municipal authorities. The originally planned location in Jelačić square was abandoned for its present site. On 10 June 1884, the municipal officials met to approve the beginning of construction works of the display according to the design of Herman Bollé (1845-1926), one of the most productive architects of the period. The stand was made of Istrian marble, while meteorological instruments were delivered from Göttingen [16]. As a note of thanks, on behalf of the city of Zagreb and its citizens the municipality included a tribute to Dr Adolf Holzer, advisor to the provincial health commission and knight of the order of emperor Franz Josef I [17] (*Figure 3*). Although created by a famous architect, the monument first and foremost represented applied science in an eye-catching form, rather than an artistic decoration for the recently designed Zrinjski square. Zagrebians were both delighted and curious to check weather conditions, which has not changed until the present day. However, the name of Adolf Holzer has remained unknown in public and the links between health and





Figure 1 The weather Stand, Zrinski square, Zagreb.



*Figure 2 Adolf Holzer (1834-1885),  
physician and donor of the weather stand*

atmospheric conditions, which he and many other medical practitioners of the period deemed essential for understanding health and illness, have lost their importance in the decades that followed.

#### ON THE WAY TO LOSING HOLISTIC APPROACH

Simultaneously with the institutionalization of meteorology and the rise of climatic health resorts that resulted in the disciplinary development of balneoclimatology, the 19<sup>th</sup> century revolution in medicine slowly replaced the holistic with a reductionist approach to the patient and consequently reduced the importance of weather and other environmental factors. First in the early 19<sup>th</sup> century, the development of pathology postulated that the seat of disease was not in the balance of humors and qualities, but in a well-defined change in an organ or tissue. Then around the mid-century, the germ theory proposed by Louis Pasteur and Robert Koch, who saw the cause of contagious diseases in a



Br. 23096 iz 1884.  
I.

Velemožnomu i veličanomu gospodinu  
Dru. Adolfu Holkeru,  
ličniku, viteru reda Franje Josipa I., savjetniku  
zdravstvenoga vijeća kr. zemaljske vlade itd.  
" Zagrebu.

Govodom proglašenja rapionika od 30. rujna  
t. g. o razhvatu meteorološkoga stupa, koji je  
troškom i brigom Vaše Velemožnosti podignut  
na Trnjavskom trgu u Zagrebu, s. i. p. tina su.  
stupstva i slov. i kr. glavnoga grada Zagreba,  
držana dne 8. listopada t. g. razhvatila je jedno.  
dušno: da se Vašoj Velemožnosti na tom sjaj.  
nom daru, koji ste glavnomu gradu Zagrebu  
dali, za vječnu uspomenu u rapionik skup.  
stinah gradskoga zastupstva izrazi i ubijeri  
najtoplija zahvalnost gradskoga zastupstva i  
svoga obci i ova grada Zagreba.

Figure 3 Testimonial on the weather meteorological stand (1884)

microscopic organism, microbe, won over the more environmentally-inclined theories. The most prominent representative of the latter was a German hygienist, Max von Pettenkofer (1818-1901). He believed that, in addition to microbe and the characteristics of the individual (age, health, economic status, etc), a successful transmission of a disease required two factors: the “local” and the “weather” disposition. The “local” was related to the composition of the soil and the “weather” disposition to the climate, season, and other aspects that by varying degrees of warmth and humidity affected the “local” disposition. [18].

The reductionist approach, which concentrated on the changes within the organism itself and paid little or no attention to weather and other environmental factors, remained at the core of scientific medicine for a century to follow. This is not to say that weather was altogether excluded from the 20<sup>th</sup> century medicine. For instance, a discipline of biometeorology developed to study the association between the biological and meteorological phenomena and furthermore branched into meteorophysiology, meteoropathology and seasonal biology [19]. Medical geography appeared as a specialization within the field of geography in the early 1950s with the aim of studying health variations in relation to international cultural and environmental interactions. In the second half of 20<sup>th</sup> century, an interest in the effect of meteorological factors on the manifestations of different pathological conditions subsisted within clinical medicine proper. Articles published in Croatian medical journals of the period demonstrate that conditions most frequently studied in relation to weather changes and atmospheric factors were myocardial infarction, atrial fibrillation, blood coagulation changes in cerebrovascular disease and peptic ulcer hemorrhage [20-25]. However, the influence of these considerations was not strong.

That weather is now back in the focus of medical practitioners and scientists is the result of the influences from the outside rather than from medicine itself. The 1960s saw the rise of alternative movements that confronted the existing social structure of modern societies. The central concept of modernity, stating that the industrial progress cannot be stopped and that it is of the ultimate benefit to the humankind was challenged by activists and authors such as Rachel Carson, who in her landmark book “Silent Spring” (1962) exposed the risks created by the ubiquitous use of industrial chemicals to the human and animal health [26]. By the 1970s, early environmentalist ideas were institutionalized within influential non-governmental organizations such as “Greenpeace” and

green political parties who, by the 1980s, gained the support of a substantial part of electorate throughout the Western world [27]. Over the past two decades, the conflict between environmentalists and the establishment has only deepened. But the topics such as acid rains, deforestation of the Amazon area, ozone depletion and “global warming” (or “greenhouse effect”), the interaction between the humankind and its environment (united in the 20<sup>th</sup> century technical term “biosphere”) have managed to become the central issues of public interest.

Medicine, as a meeting point between science and society, could not remain outside these developments. Although the influence of weather and climatic changes on human health is understandably difficult to study using the methods of modern medicine such as clinical trials, because weather cannot be easily reduced to a set of measurable factors, these topics have been widely discussed in prominent medical journals [28, 29]. Biometeorological forecasts, informing patients at risk or suffering from certain conditions about possible adverse effects of weather on their health, have become an integral part of weather reports. They are aired on television and radio, published in the newspapers and posted on the websites of medical institutions, such as the City of Zagreb Public Health Institute [30]. The Institute also advertised a number of lectures and workshops on weather and health, directed to medical practitioners, but also open to the public, [31, 32]. In consequence of extreme summer temperatures in 2003, different projects aiming to develop health/heat monitoring/warning systems (such as EU, PHEWE, CCASHH) were established in various corners of the world.\*

## CONCLUSION

It is almost as if we made the full circle and returned to Hippocrates and the philosophy of holism that was neglected for the most part of the 20<sup>th</sup> century. Of course, as we pointed out in the article, the differences between then and now are manifest. First, the Hippocratic medicine concentrated on the effects of weather on infectious diseases while today the focus is on a limited group of chronic, noninfectious conditions such as cardiovascular disorders or allergies, although the influence of global warming on the development of pathogenic microorganisms is increasingly gaining on significance. Second, while weather was built in the very foundations of natural philosophy as theoretical basis of medicine in the past, medical interest in weather today came from the outside, thanks to environmentalists, media and the general public. Still, it seems time has

come to reconsider the human relation to the environment and biosphere. Weather in relation to human health, as various physicians have pointed out in the past, should be examined more precisely and using multidisciplinary methods. The Holzer weather post in Zagreb, a product of collaboration between a meteorologist and a physician, could therefore be a reminder and an incentive in that direction.

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