



Correlation between biometeorological forecast and the incidence of obstetric admissions in perinatal center during five years: A retrospective study of one center

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Abstract

Background and purpose: The aim of this study was to correlate obstetric admissions at a tertiary perinatal center with biometeorological forecast and weather conditions.

Materials and methods: This retrospective study was conducted at the Department of Gynaecology and Obstetrics Clinical Hospital "Sveti Duh" over five years, from January 1, 2014 to December 31, 2018. The hospital's emergency data was used for record of obstetric admissions on each day. The selected days were sorted in 4 groups based on biometeorological forecast.

Results: In the observed period, there were a total of 18,072 obstetric admissions. There were 216 days with fifteen or more admissions. The results showed no significant difference between obstetric admission based on the biometeorological forecast one day before or three days before. Most hospitalization were on days with a favorable biometeorological forecast in the observed period, 68 days with more than fifteen admissions per day. The day before, the biometeorological forecast was mostly favorable or relatively favorable.

Conclusion: Our retrospective single-center study did not show a significant difference between obstetric hospital admissions depending on biometeorological conditions, but the higher number of admissions during days with a favorable forecast is definitely the basis for future studies with larger dataset.

INTRODUCTION

Biometeorology is an interdisciplinary branch that studies the interaction of living organisms and processes in the atmosphere. All living organisms are able to adapt to weather conditions. Sometimes failure to adapt can cause unpleasant consequences. The aim of the biometeorological forecast is to warn vulnerable groups about specific weather conditions in order to prevent unpleasant consequences. The influence of weather on people's well-being and health has already been observed and is the subject of interest in many medical studies. Some studies link weather conditions and complications of rheumatic diseases, cardiovascular diseases, bleeding, stroke, epileptic seizures (1–3). Furthermore, there are studies that relate gynecological and obstetric pathology with the weather. Late pregnancy complications such as major obstetrics syndrome (preeclampsia, premature birth), gynecological emergencies, and parturition are the most studied (4–6).

The aim of this study was to relate the biometeorological forecast and weather conditions with the number of obstetric admissions at the Clinical Hospital “Sveti Duh” between 2014 and 2018.

MATERIAL AND METHODS

Data

This retrospective study was conducted at the Maternity ward, Department of Gynaecology and Obstetrics Clinical Hospital “Sveti Duh” during five years, from January 1, 2014, to December 31, 2018. The emergency data of the hospital was used for the records of obstetric admissions on each day. This study was approved by the Ethics Committee of the hospital. Days with fifteen or more admissions were selected and further analyzed and compared with the biometeorological forecast. Kruskal Wallis test for independent samples was used for data analysis. A value of $p < 0.05$ was considered significant.

Weather and biometeorological conditions

The biometeorological forecast and weather conditions were obtained from the Croatian Metrological and Hydrological Service, Zagreb, Croatia. Biometeorological forecast was based on the methods established by Krugler (7) that relate weather phases to the human organism, marking them as (a) favorable, (b) relatively favorable, (c) relatively unfavorable, and (d) unfavorable. The selected days were grouped based on biometeorological forecast of the previous day, before two and three days.

RESULTS

In the observed period of five years, there were a total of 18,072 obstetric admissions at the Department of Gynaecology and Obstetrics, University Hospital “Sveti Duh”, Zagreb, Croatia. There were 216 days with fifteen or more admissions. Each day in the observed period was assigned the biometeorological forecast of the State Hy-

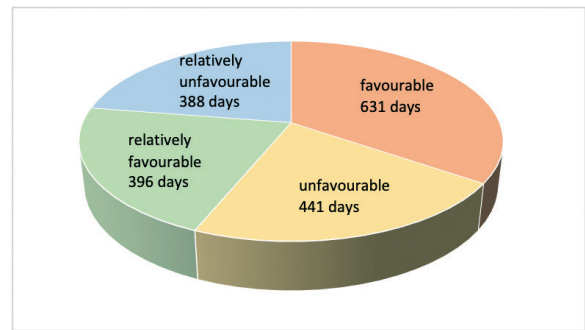


Figure 1. Relation between obstetric admissions and biometeorological forecast over five years.

drometeorological Institute Zagreb, Croatia, and the days were classified into four groups. The favorable biometeorological forecast was determined for 34.56 % days, relatively favorable for 21.68 % days, relatively unfavorable for 21.25 % days and unfavorable for 22.51 % days in observed period (Figure 1).

In 216 selected days with fifteen or more admissions, there were 68 days (31.48 %) with favorable forecast, 45 days (20.83 %) with relatively favorable, 56 days (25.93 %) with relatively unfavorable and 47 days (21.76 %) with unfavorable biometeorological forecast (Figure 2).

Analysis with Kruskal Wallis for independent samples did not show significant correlation ($p = 0.41$) of biometeorological forecast and obstetric admission in the hospital (Table 1). Also, there is no significant correlation of the obstetric admission and biometeorological forecast one or three days before.

Table 1. Statistics on obstetric admission and biometeorological forecast using Kruskal-Wallis test.

Forecast	p-value
0 day	0.41
1 day prior	0.58
2 days prior	0.38
3 days prior	0.40

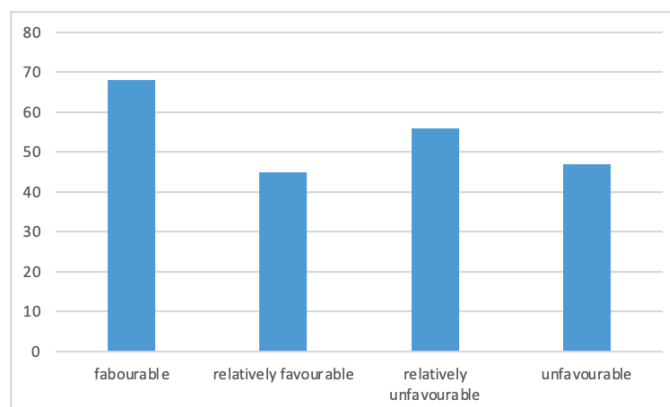


Figure 2. Number of obstetric admissions and biometeorological forecast with more than 15 obstetric admissions at the hospital.

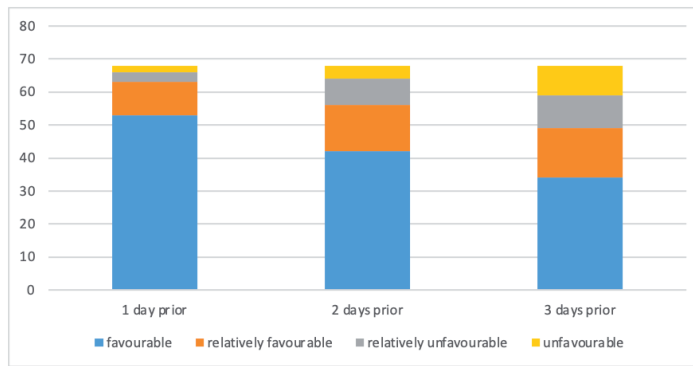


Figure 3. Biometeorological forecast one, two and three days before the day with a favorable forecast.

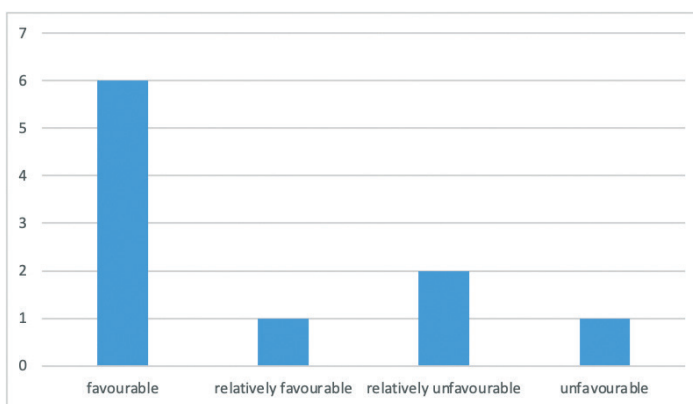


Figure 4. Number of obstetric admissions and biometeorological forecast for days with more than 20 obstetric admissions at the hospital.

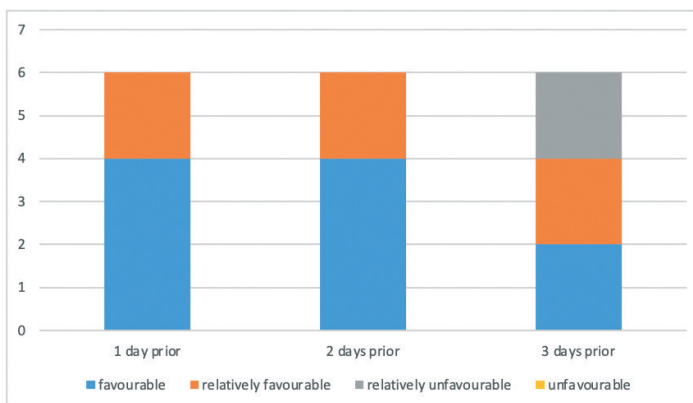


Figure 5. Biometeorological forecast one, two and three days before days with more than 20 obstetric admission at the hospital.

There were the most hospitalization during days with favorable biometeorological forecast in the observed period, 68 days with more than fifteen admissions at the day. The day before there was mostly favorable or relatively favorable biometeorological forecast (Figure 3).

If we look at just a few days with the highest number of admissions, there were ten days with more than twenty obstetric admissions. The prevailing forecast was mostly favorable for 6 days with more than twenty admissions at the hospital. Also, the biometeorological forecast was

mostly favorable a day and two before. Three days before, the prevailing forecast was mostly relatively favorable or relatively unfavorable (Figure 4, Figure 5).

DISCUSSION

There are several studies investigating the influence of weather conditions on pregnancy complications. It was mostly compared to the weather conditions and complications in the first trimester of pregnancy. One of the first

was made by a Swedish author that describes the distribution of abortion over two years with assumption of weather conditions as a possible cause (4). Goldenberg *et al.* reported a significantly higher risk for tubal pregnancy in winter and spring (5). Swiss authors described the association of meteorological factors with uterine bleeding, threatened abortion and pelvic pain (6). Also, one study that linked parturition and weather conditions described significant relationships between weather much colder than the day before, with strong winds and low pressure and increased onsets, and also an increased numbers of parturition during periods of increased atmospheric pressure (8).

However, a 1996 study found no association between the onset of labor and days with low mean pressure (9). That is contrary to the common belief that a sharp drop in atmospheric pressure causes labor to begin. Danish authors reported no relationship between barometric pressure and delivery (10). However, they reported that labor pains often begin at night, and recognized the relationship between labor and nature due to the body's circadian rhythm.

Labor pain is controlled by the autonomic nervous system and various hormones and is expected to be affected by weather and environmental changes. Among the reports demonstrating the association between meteorological factors and parturition, most of them showed a positive effect of falling barometric pressure on labor (11). A study from Japan observed patients who had spontaneous cephalic delivery to determine whether low barometric pressure induces labor pains, premature rupture of the membranes, and delivery and whether changes in barometric pressure affect delivery (12). The results showed a significant increase in the number of deliveries and rupture of the membranes on days with low barometric pressure ($p < 0.01$), although there was no significant correlation between the onset of labor and barometric pressure. Brazilian authors reported the influence of external temperature, atmospheric pressure, and lunar phase on the labor (13). Scientific data regarding the lunar influence upon labor admissions are controversial. Their results showed that increase in outside temperature and decrease in atmospheric pressure predicted a high labor rate. Also, an increase of tidal range (as a measure of the lunar gravitational pull) predicted a lower likelihood of high admission to the hospital for labor.

In 2010, authors from Chicago investigated the correlation between meteorological factors and the timing of the onset of labor with intact membranes or rupture of membranes before labor (14). Their results showed that gestational age, multiple gestation, and chorioamnionitis were associated with the time of initiation of parturition and that meteorological factors were associated with the time of parturition, but the magnitude of this association was small. A 2020 study in China investigated an effect of extreme environmental temperature and temperature

variations on the preterm labor (15). The results showed that sharp temperature variations are a likely risk for preterm labor. In 2013, authors from California published a systematic review on preterm labor, gestational weight, risk of pregnancy complications depending on weather conditions (16). They showed that the risk of preeclampsia is higher for women with conception during the warmest months, and delivery in the coldest months of the year. Also, most studies showed a decrease in gestation lengths associated with heat.

Our previous study investigated the relationship between complications of early pregnancy (such as spontaneous abortions or ectopic pregnancy) and biometeorological conditions (17). The results showed that there is no significant difference between the groups determined by the biometeorological forecast in the number of early pregnancy complications, and no increase in the number of complications related to a worse biometeorological forecast. A study from 2011 year at our department analyzed a day with an extreme number of spontaneous delivery and weather changes and biometeorological conditions on that day and a few days before (18). On that day, with the highest number of deliveries with spontaneous onset in 2011, biometeorological forecast was unfavorable. On the other hand, biometeorological forecast was favorable one and two days before the admission.

Herein, we analyzed biometeorological changes and the number of obstetric admissions. In the five-year period, we observed 216 days with the highest number of admissions. We assumed that days with an extreme number of admissions in the studied period should correlate with marked changes in meteorological and biometeorological conditions. We also analyzed biometeorological conditions one, two and three days before, because we expected that the weather would not only have an immediate effect on obstetric admissions at the hospital. However, our result showed that there is no significant difference between biometeorological forecast and obstetric admissions at the hospital. However, we determined a higher number of admissions during days with a favorable biometeorological forecast. Also, the day and two days before admission the forecast was mostly favorable.

CONCLUSION

From our database, we concluded that there were more admissions on days with a favorable forecast. Also, favorable forecast prevailed a day and two before those days. For better conclusion, that is, a statistically relevant correlation, we definitely need a larger database including more hospitals in the future study.

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