

ORIGINAL RESEARCH

Outdoor Activity and High Altitude Exposure During Pregnancy: A Survey of 459 Pregnancies



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Objective.—To evaluate whether women engage in outdoor activities and high altitude travel during pregnancy; the health care advice received regarding high altitude during pregnancy; and the association between high altitude exposure and self-reported pregnancy complications.

Methods.—An online survey of women with at least 1 pregnancy distributed on websites and e-mail lists targeting mothers and/or mountain activities. Outcome measures were outdoor activities during pregnancy, high altitude (>2440 m) exposure during pregnancy, and pregnancy and perinatal complications.

Results.—Hiking, running, and swimming were the most common activities performed during pregnancy. Women traveled to high altitude in over half of the pregnancies (244/459), and most did not receive counseling regarding altitude (355, 77%), although a small proportion (14, 3%) were told not to go above 2440 m. Rates of miscarriage and most other complications were similar between pregnancies with and without travel above 2440 m. Pregnancies with high altitude exposure were more likely to have preterm labor (odds ratio [OR] 2.3; 95% CI 0.97–5.4; $P = .05$). Babies born to women who went to high altitude during pregnancy were more likely to need oxygen at birth (OR 2.34; 95% CI 1.04–5.26; $P < .05$) but had similar rates of neonatal intensive care unit admission ($P =$ not significant).

Conclusions.—Our results suggest pregnant women who are active in outdoor sports and travel to high altitude have a low rate of complications. Given the limitations of our data, further research is necessary on the risks associated with high altitude travel and physical activity and how these apply to the general population.

Key words: pregnancy, exercise, high altitude, intrauterine growth retardation, preterm labor, travel, hypoxia

Introduction

Exercise during pregnancy is considered beneficial to both mother and fetus and is recommended by obstetrical guidelines.^{1,2} These guidelines note that exercise at high altitude may carry risks and specifically discourage certain high altitude activities, although more for concerns of trauma (eg, downhill skiing) than for hypoxic exposure. These and other recommendations for pregnant women traveling and recreating at high altitude are based on expert opinion and a few studies involving long-term high-altitude residents.³ The scant existing studies of nonresidents are limited to a small number of

women traveling to moderate altitudes (1800–2300 m) for only a few hours at a time.^{4,5} Whether these guidelines are thus valid for visits of days to weeks and whether pregnant women and their medical providers comply with these recommendations regarding high altitude activity are unknown.

The overall number of pregnant visitors to high altitude is also unknown, but likely sizable. Honigman et al⁶ documented that 3% of tourists at 1 Colorado high altitude resort area were pregnant during a summer survey, and given that millions of tourists visit these Colorado resorts each year, we can surmise that a very large number of pregnancies are exposed to high altitude. In addition, the physical activities of pregnant women and the incidence of pregnancy-specific complications related to altitude exposure remains undocumented. A retrospective survey of obstetricians and gynecologists in high altitude communities documented an impression of

Preliminary results were presented at the International Society for Mountain Medicine Meeting in Bolzano, Italy in May 2013.

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increased complications in pregnant visitors.⁷ Respondents identified dehydration and vigorous exercise as perceived risk factors. No medical records review or case studies were performed to confirm these impressions, however. To date, no study has systematically or prospectively studied the occurrence of pregnancy-related complications in women visiting high altitude locales.

Given the logistical and ethical difficulties of prospectively studying pregnant sojourners to high altitude, we sought to gather preliminary data on these questions through an anonymous survey of mothers regarding their exposure to high altitude and exercise during prior pregnancies and their pregnancy outcomes. The specific aims were to 1) identify the types of exercise activities and high altitude exposure women experienced during pregnancy; 2) determine whether women received advice from their health care providers regarding the safety of high altitude activities during pregnancy; and 3) determine if associations exist between high altitude exposure and self-reported pregnancy complications.

Methods

We conducted a cross-sectional survey of women who had been pregnant at least once. The study was considered exempt by the University of Washington and University of Colorado Institutional Review Boards.

SURVEY

We conducted an anonymous online survey via the Catalyst system, a web-based platform run from University of Washington servers with multiple functions including survey creation and administration.

The survey (see online [Supplementary Material](#)) took approximately 20 minutes and consisted of 24 questions regarding demographics, medical history, current activities, and high altitude exposure, followed by an additional 20 questions specific to each pregnancy including physical activity and high altitude exposure during pregnancy and whether there were any pregnancy complications. For each question, respondents were provided a list of potential activities and complications to which they were asked to respond “yes” or “no” and were given the opportunity to write in additional answers. Definitions were not provided for the terms listed. We considered preterm labor a distinct entity from preterm birth, and ascertained information about preterm births separately by asking about gestational age. Subjects had the opportunity to respond to pregnancy-related questions for up to the first 4 pregnancies, regardless of the time frame in which they occurred. The survey did not include questions about traumatic injuries during high-risk activities.

We defined high altitude as greater than 2440 m (8000 ft). When asked about the specific altitudes to which they traveled, respondents could list either numerical values or place names.

Subjects were asked specifically if they slept at high altitude and for how many nights. If a subject indicated a number of days spent over 2440 m but zero nights sleeping at high altitude, these were considered day trips. We defined high altitude residence during pregnancy as spending greater than 140 days above 2440 m during a given pregnancy. Participants were not required to answer every question; therefore, total answers do not always equal total survey respondents.

SUBJECTS

We recruited women with at least 1 prior pregnancy by posting survey announcements on websites, electronic mailing lists, internet discussion boards, social media platforms, and e-mail lists targeting mothers and/or mountain activities. This included announcements in national and local mountaineering society newsletters, blogs related to motherhood and women’s sports, and discussion boards related to motherhood and parenting in the United States and France. The survey announcement included a uniform resource locator (URL) for the anonymous online survey, which was in English. Respondents who clicked on the URL were directed to a webpage with further information about the study. Those who agreed to participate after reading that information were then directed to the start of the survey.

Women were free to distribute the survey URL at their discretion. Women who had not completed a pregnancy and men were excluded. A history of travel to high altitude either during or before pregnancy was not a requirement for participation.

DATA ANALYSIS

When subjects listed a location rather than a specific altitude in the survey, we performed a Google search on the place name to determine the corresponding altitude. Day trips were distinguished from overnight trips based on the difference between days reported at high altitude and nights slept at high altitude. Some respondents gave information about more than 1 pregnancy. Therefore, demographic data were described at the level of the individual respondent, but altitude exposure, activity, and complications were analyzed by pregnancy.

Descriptive statistics were calculated in Microsoft Excel. Complications were compared between women with and without high altitude exposure using χ^2 or Fisher exact test and odds ratios calculated for

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