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How seasonality and weather affect perinatal health: Comparing the experiences of indigenous and non-indigenous mothers in Kanungu District, Uganda

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ABSTRACT

Maternal and newborn health disparities and the health impacts of climate change present grand challenges for global health equity, and there remain knowledge gaps in our understanding of how these challenges intersect. This study examines the pathways through which mothers are affected by seasonal and meteorological factors in sub-Saharan Africa in general, and Kanungu District (Uganda), in particular. We conducted a community-based study consisting of focus group discussions with mothers and interviews with health care workers in Kanungu District. Using *a priori* and *a posteriori* coding, we found a diversity of perspectives on the impacts of seasonal and weather exposures, with reporting of more food available in the rainy season. The rainy season was also identified as the period in which women performed physical labour for longer time periods, while work conditions in the dry season were reported to be more difficult due to heat. The causal pathways through which weather and seasonality may be affecting size at birth as reported by Kanungu mothers were consistent with those most frequently reported in the literature elsewhere, including maternal energy balance (nutritional intake and physical exertion output) and seasonal illness. While both Indigenous and non-Indigenous mothers described similar pathways, however, the *severity* of these experiences differed. Non-Indigenous mothers frequently relied on livestock assets or opportunities for less taxing physical work than Indigenous women, who had fewer options when facing food shortages or transport costs. Findings point to specific entry points for intervention including increased nutritional support in dry season periods of food scarcity, increased diversification of wage labour opportunities, and increased access to contraception. Interventions should be particularly targeted towards Indigenous mothers as they face greater food insecurity, may have fewer sources of income, and face greater overall deprivation than non-Indigenous mothers.

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1. Introduction

Climate change will have substantial impacts for populations worldwide (K. R. Smith et al., 2014; Watts et al., 2015). In response, research investigating climate impacts on health has grown rapidly in the past two decades. Research has, however, primarily focused on health outcomes with relatively direct or proximal relationships with climate (e.g., infectious disease, heat-related illness, mortality due to extreme events (K. R. Smith et al., 2014)). Less attention has been paid to health outcomes with more indirect or distal links to climate or weather, despite predictions that most climate impacts are mediated through indirect social and ecological factors (Watts et al., 2015). Research has shown, for example, an empirical relationship between weather and/or season and size at birth in multiple regions and contexts (Beltran et al., 2014; Laaidi et al., 2011; Strand et al., 2011).

While the effects of climate change will have health impacts worldwide (Costello et al., 2009; Few, 2007; Haines and Patz, 2004; McMichael et al., 2006; K. R. Smith et al., 2014; Watts et al., 2015), Indigenous populations will face a disproportionate burden of these negative impacts due to their traditional reliance on biophysical resources and existing health inequalities. (Ford, 2012). The holistic definition of health in many Indigenous populations means environmental and individual health are seen as inextricably linked, thus the effects of climate change on the environmental are also felt at a personal level in such communities (Berry et al., 2010). Connectedness to the land (both physical and spiritual) is seen as one of the essential components to Indigenous health, and therefore a critical consideration in the planning of health adaptations to climate change in these communities (Green and Minchin, 2014). Much of the literature on Indigenous health comes from North America, Australia, and New Zealand, and to a lesser extent, South and Central America. There is a limited body of literature regarding the health of Indigenous populations in Africa, where the existing burden of ill-health is high and investigation of differential vulnerability between ethnic groups has been negligible (Ohenjo et al., 2006).

The burden of climate change on maternal and infant health will be inequitably distributed. The groups already facing the greatest vulnerability—women, the poor, and Indigenous populations—have been identified as being particularly at risk for adverse health impacts due to climate change (McMichael et al., 2006; K. R. Smith et al., 2014; Watts et al., 2015). As Busby et al. (2013) write, ethnicity may prove a key determinant in differential vulnerability to climate change. Already, Indigenous mothers in remote areas often face inequities in perinatal health and are at risk of poorer perinatal outcomes than non-Indigenous mothers (Gracey and King, 2009; Graham et al., 2007); poor women in both industrialized and low-resource settings tend to face disparities when compared to their wealthier counterparts (M. S. Kramer et al., 2000; J. E. Lawn et al., 2009). There is a double-burden of maternal and infant health inequity in populations reliant on subsistence agriculture: subsistence-based Indigenous women are among the most vulnerable populations in the world due to persistent health inequality and reliance on fluctuating food sources.

In both developed and developing settings, low birth weight is considered an important determinant of infant mortality (M.S. Kramer, 1987; Joy E. Lawn et al., 2005; McCormick, 1985). More than 80% of neonatal deaths in sub-Saharan Africa and south Asia occur in small babies as a result of both preterm births and intrauterine growth restriction (IUGR) (Joy E. Lawn et al., 2014). The effects of being born small can persist throughout infancy and childhood (Joy E. Lawn et al., 2014; Paneth, 1995). A number of studies indicate that IUGR may increase risk of a range of adult-onset conditions (Barker et al., 2002; Botero and Lifshitz, 1999; Harding, 2001; Kajantie et al., 2005; Low et al., 1992). A combination of birth weight, gestational age, and Apgar scores are the recommended predictors for infant mortality (Ma and Finch, 2010), and are often the outcomes of interest when examining in utero exposures (Chou et al., 2014; Porpora et al., 2013).

Maternal energy balance (i.e., food intake versus physical activity output) and seasonal patterns in infectious disease (particularly malaria) are theorized in the literature as the predominant pathways through which season and weather affect pregnant women in low-income country settings (Beltran et al., 2014; Laaidi et al., 2011; Rayco-Solon et al., 2005). For populations reliant on subsistence agriculture, seasonal food shortages and seasonal trends in agricultural labour activities are affected by weather and seasonality. Though research is mixed, most literature has reported that increased incidence of lower birth weights coincides with periods of increased energy expenditure, particularly when these periods coincide with food shortages. Variation in patterns of malaria and other infectious diseases have also been associated with both weather and birth outcomes, with malaria believed to be a key pathway for low birth weights resulting from preterm births (Kinabo, 1993; Rayco-Solon et al., 2005). Grace et al. (2015) investigate the role of weather on birth outcomes across Africa, characterizing the variation in the relationships between weather and birth weight across different livelihood zones. What remains unclear, however, is the extent to which these aggregated results mask heterogeneity in the effect of weather on birth outcomes in different countries, contexts, and *within* livelihood zones.

Climate, agricultural practices (Grace et al., 2015), birthing and pregnancy cultures (Brighton et al., 2013; Magadi et al., 2000), and malaria transmission patterns (Noor et al., 2014) differ regionally, and the direction, magnitude, and nature of weather and/or climatic determinants of infant health vary in diverse contexts (Beltran et al., 2014; Carolan-Olah and Frankowska, 2014; Chodick et al., 2009; Laaidi et al., 2011; Strand et al., 2011). Further, inequities in maternal and infant health are multifactorial in origin, and arise based on different factors in different contexts (Wirth et al., 2006). This regional diversity necessitates local studies characterizing the place-specific experience of weather and season during pregnancy. Where regional differences do exist, we do not yet have a complete picture as to how and why they differ—do the pathways through which weather and pregnancy experiences may be linked differ in different regions? To date, there has been limited qualitative investigation characterizing the pathways linking weather to birth outcomes, and whether these are heterogeneous across and within populations. With the exception of one paper among nomadic Turkana pastoralists (Pike, 2000), we are aware of no studies exploring the pathways by which weather influences perinatal health using empirical results from fieldwork and qualitative analysis.

We address this research gap by bringing a qualitative lens to a problem that has primarily benefitted from quantitative examination. This paper contributes to our understanding of how and why season and weather influence pregnant mothers and newborns in a rural east African setting, specifically among Indigenous and non-Indigenous subsistence-based populations in rural Uganda where we have previously identified associations between in utero rainfall and temperature exposures and birth weight (MacVicar et al., 2017). Despite significant progress through Millennium Development Goals initiatives, maternal mortality in Uganda remains 325 per 100 000 (Kassebaum et al., 2014) and infant mortality 22 per 1000 live births (United Nations Inter-agency for Child Mortality Estimation (UN