



# Ethnic discrimination predicts poor self-rated health and cortisol in pregnancy: Insights from New Zealand



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## ABSTRACT

Despite growing research emphasis on understanding the health effects of ethnic discrimination, little work has focused on how such exposures may influence a woman's biology and health during pregnancy. Understanding such effects is important given evidence that maternal stress experience in pregnancy can have long term effects on offspring health. Here we present data evaluating the relationship between perceived discrimination, self-rated health, and the stress hormone cortisol measured in late pregnancy among a diverse sample of women living in Auckland, New Zealand (N = 55). We also evaluated possible intergenerational impacts of maternal discrimination on stress reactivity in a subset of offspring (N = 19). Pregnant women were recruited from two antenatal care clinics in Auckland. Women were met in their homes between 34 and 36 weeks gestation, during which time a prenatal stress questionnaire was administered and saliva samples (morning and evening from two days) were obtained. Offspring cortisol reactivity was assessed at the standard six week postnatal vaccination visit. We found that 34% of women reported having experienced ethnic discrimination, with minority and immigrant women being more likely to report being angry or upset in response to discrimination experience compared with NZ-born women of European descent. Women reporting discrimination experience had worse self-rated health, higher evening cortisol and gave birth to infants with higher cortisol reactivity, all independent of ethnicity and material deprivation. These findings suggest that discrimination experience can have biological impacts in pregnancy and across generations, potentially contributing to the ethnic gradient in health.

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## 1. Introduction

The consistent documentation of health disparities within and across societies has generated interest in exploring what factors contribute to these outcomes (Marmot and Wilkinson, 2009). Since genetic differences are unlikely causes of complex health outcomes such as low birth weight, cardiovascular disease and psychiatric disorders (David and Collins, 1997; Gravlee, 2009), research has instead focused on the importance of environmental factors, such as differential stress exposure, as key drivers of disparities in health (Lu and Halfon, 2003; Chapman and Berggren, 2005; Williams and Mohammed, 2009; Williams et al., 2010; Thayer and Kuzawa, 2011).

One important source of stress is ethnic discrimination, defined as unfair treatment that an individual perceives to be due to their ethnicity (Greene et al., 2006). Ethnic discrimination has been associated with a wide range of poor health outcomes, including hypertension, self-reported health, health risk behaviors and adverse birth outcomes (Collins et al., 2000; Dailey, 2009; Dole et al., 2003; Harris et al., 2006b; Pascoe and Smart Richman, 2009; Schulz et al., 2006). Cortisol, a hormone released following activation of the Hypothalamic Pituitary Adrenal (HPA)-axis, is modified in response to discrimination experience (Fuller-Rowell et al., 2012; Zeiders et al., 2012) and is hypothesized to contribute to the adverse health effects of discrimination through downstream impacts on other physiological systems (Williams and Mohammed, 2009).

Of the outcomes that have been previously associated with discrimination, adverse offspring birth outcomes are of particular relevance given evidence that being born small increases risk for developing cardiovascular disease, diabetes, and psychiatric

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disorders in adulthood (Abel et al., 2010; Barker, 1994). These findings suggest that the experience of discrimination may not only impact risk for developing chronic disease in the present generation, but also in future generations (Goosby and Heidbrink, 2013; Kuzawa and Sweet, 2009; Wells, 2010). In support of this hypothesis, both elevated maternal cortisol outside of pregnancy, and ethnic discrimination experience, have been independently associated with the development of smaller birth size (Collins et al., 2000; Thayer et al., 2012). However, no study has evaluated whether the normal increase in cortisol during gestation (Wadhwa, 2005) is further elevated in response to discrimination experience.

Given this background we sought to investigate whether maternal cortisol and self-rated health are associated with reports of discrimination among an ethnically diverse sample of women living in Auckland, New Zealand (NZ). We hypothesized that: (1) women who reported ethnic discrimination would report poorer self-rated health, and (2) have cortisol levels in late pregnancy that were lower in the morning and higher in the evening, consistent with a pattern of chronic strain (Powell et al., 2002; Skinner et al., 2011). Based on prior research on the intergenerational effects of maternal stress, we also tested the hypothesis that women who experienced ethnic discrimination would (3) have offspring with altered cortisol reactivity in early infancy (Tollenaar et al., 2011).

## 2. Materials & methods

### 2.1. Study setting

Auckland is a diverse city with a population of approximately 1.5 million inhabitants, including major NZ European (59%), Asian (19%), non-Māori Pacific Islander (14%) and indigenous Māori (9%) sub-groups (Statistics New Zealand, 2013b). Auckland has the largest population of Polynesians in the world, and is home to approximately one quarter of all Māori in NZ (Statistics New Zealand, 2013a). Auckland is also notable for being a city with a large immigrant population. In the 2006 Census, 37% of Auckland's inhabitants were born overseas. Notably, this figure rises to 57% when one combines immigrants with their first generation, NZ born children (Spoonley and Meares, 2011). Immigration was historically difficult for individuals not coming from Britain or Polynesia (Ongley and Pearson, 1995). However economic privatization of many industries led to increased demand for skilled labor in the 1980s and 1990s, particularly from strengthening Asian economies (Ip and Pang, 2005). As a result, between 1986 and 1995 the percentage of immigrants to NZ coming from Asian countries increased from 17% to 59% (Spoonley and Bedford, 2008). While immigrants to NZ today have higher than average measurable skills than NZ-born workers, they are 17% less likely to be employed, which has been interpreted as an outcome of institutional racism against Asian immigrants (Spoonley and Bedford, 2008).

A recent analysis of data from the 2006/2007 NZ health survey found a reported lifetime discrimination prevalence of 35% among Asians, 29.5% among Māori, 23% among non-Māori Polynesians, and 13.5% among NZ Europeans (Harris et al., 2012). Māori and Asians completing this survey were also 10 times more likely to report experiencing multiple types of discrimination compared with Europeans, suggesting ethnic differences in chronicity of discrimination experience as well. The problem of ethnic discrimination in NZ has led to a growing interest in documenting and understanding its biological effects. Prior research utilizing several large, nationally representative samples has found that both adults and adolescents who report ethnic discrimination have worse self-rated health, with adults reporting discrimination also having poorer mental and physical functioning and higher rates of cardiovascular disease (Crengle et al., 2012; Harris et al., 2006a; Harris

et al., 2012). However no study in NZ or elsewhere has evaluated ethnic discrimination in relation to stress physiology in pregnancy or offspring soon after birth.

### 2.2. Study sample

Pregnant women were recruited at two antenatal care clinics in Auckland (see Thayer and Kuzawa, 2014 for more details) (N = 64). Following recruitment, women were met by the study researcher in their homes during late pregnancy (34–36 weeks gestation) to retrieve saliva samples collected over two days and administered a structured questionnaire asking about discrimination and other potential covariates (described below). Ethnicity was recorded using self-report according to Statistics NZ standards for recording ethnicity (Ministry of Health, 2004). It is important to note that with the exception of Māori, all other major ethnic groupings in NZ (NZ European, Pacific and Asian) are aggregate groupings composed of multiple ethnic groups (Harris et al., 2012). Using major ethnic groupings as an index, the ethnic composition of the sample closely approximates that of Auckland as a whole (Table 1), reflecting high diversity. This study was conducted under conditions of written informed consent and was approved by the NZ Upper South B Health and Disability Ethics Committee and the Institutional Review Board of Northwestern University.

### 2.3. Saliva collection

Maternal saliva was collected in both the morning and evening to account for diurnal variation in cortisol levels. Women were sent four 2.0 ml saliva vials between 34 and 36 weeks gestation and instructed to fill them immediately upon waking and before going to sleep on two consecutive weekdays without eating, drinking or brushing their teeth for at least 30 min beforehand. Women

**Table 1**

Sample characteristics and comparison of women based on report of ethnic discrimination.

	Total sample (N = 64)	No ethnic discrimination (N = 41)	Experienced ethnic discrimination (N = 23)
Age (years)	30.8 (4.8)	31.4 (4.8)	29.5 (4.7)
Pre-pregnancy BMI (kg/m <sup>2</sup> )	25.1 (7.1)	25.1 (8.0)	24.9 (5.7)
Ethnicity			
NZ European	53%	53%	54%
Pacific Islander/ Māori	27%	28%	25%
Asian	20%	20%	21%
Bachelors degree or greater	49%	55%	37%
Smoked before pregnancy	20%	17%	25%
Days/week exercise in 1st trimester	2	2.2	1.7
Diagnosed with depression	23%	15%	38%
Materially deprived (NZiDep ≥ 2)	19%	12%	29%
Morning cortisol (ng/ml)	3.2 (1.1)	3.1 (0.9)	3.4 (1.4)
Evening cortisol (ng/ml)	1.0 (0.2)	0.9 (0.3)	1.4 (1.1)
Weeks pregnant at delivery	39.2 (1.4)	39.3 (1.3)	39.2 (1.4)
Offspring birth weight (g)	3486.4 (530.9)	3484.1 (523.0)	3507.9 (579.4)
Male offspring	58%	62%	52%

Mean (SD) values reported for continuous variables, while percentages are presented for categorical variables.

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