

# Minority Stress Predicts Depression in Lesbian, Gay, and Bisexual Emerging Adults via Elevated Diurnal Cortisol

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## Abstract

Lesbian, gay, and bisexual (LGB) individuals report higher levels of stressful interpersonal conflicts with others because of their divergence from heterosexual social norms. In a biopsychosocial model of minority stress, we tested diurnal cortisol slopes and internalized homonegativity (IH) as two potential mechanisms linking experiences of LGB-related stress to depression. The sample consisted of 27 lesbian and bisexual young women and 35 gay and bisexual young men ( $N = 62$ ; age, 17–27,  $M = 21.34$  years) from the greater metropolitan area of Montréal, Québec. We predicted that (a) LGB-related stress, IH, and diurnal cortisol slopes would be positively associated with each other and with depression; and (b) flatter diurnal cortisol slopes and/or greater IH would mediate the link between LGB-related stress and depression. LGB-related stress, diurnal cortisol slopes, and IH were positively associated with depression, and mediation analyses showed that diurnal cortisol slopes mediated the link between LGB-related stress and depression. These findings suggest that external stressors associated with being LGB can impact individuals' physiological coping resources, thus affecting their psychological health.

## Keywords

minority stress, diurnal cortisol, internalized homonegativity, depression

On July 20, 2005, the Parliament of Canada passed the Civil Marriage Act, extending marriage rights to same-sex couples. Québec had passed marriage equality in 2004, after which we began a study of lesbian, gay, and bisexual (LGB) emerging adults in Montréal to examine the links between experiences of sexual prejudice, psychophysiological functioning, and mental health. In the years preceding and following Canada's Civil Marriage Act, several other countries around the world<sup>1</sup> have undergone similar series of legal decisions supporting the human rights of sexual minority citizens. What are the implications of these legal and societal changes for the psychological well-being of the current generation of sexual minority emerging adults? One source of insight into this question may come from looking at the development of sexual minority youth in other countries that went through similar changes in earlier years. We proposed that despite advances in legal rights, the well-being of LGB youth is still subject to the personal contexts of their lived experiences.

## The Minority Stress Model

The minority stress model posits that LGB individuals experience, anticipate, and internalize experiences of sexual prejudice as a result of their divergence from heterosexual social norms (Meyer, 2003), adversely impacting mental and physical

health (Lewis, Derlega, Griffin, & Krowinski, 2003). Indeed, LGB individuals report higher levels of stressful conflicts with family (Ryan, Huebner, Diaz, & Sanchez, 2009), peers (Russell, Ryan, Toomey, Diaz, & Sanchez, 2011), and others (D'Augelli, Pilkington, & Hershberger, 2002) than do heterosexual individuals. The mechanism by which the internalization of minority stress might affect well-being, however, is unclear. An allostatic load framework (McEwen & Stellar, 1993) could suggest that chronic sexual prejudice (i.e., LGB-related stress) undermines physiological resources for effective coping with challenges. A social cognitive framework could suggest that LGB young adults are vulnerable to LGB-related stress because emerging adulthood constitutes a critical time

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for identity development (Arnett, 2000). These potential pathways were tested in this investigation.

### Minority Stress, Diurnal Cortisol, and Depression

The physiological processes associated with effective adaptation require the metabolic allocation of energy (*allostasis*). Chronic stress can erode this adaptive process, leading to *allostatic load* (McEwen & Stellar, 1993) or a loss of flexible resource allocation. Cortisol is a key biomarker of allostatic load and an index of hypothalamic–pituitary–adrenal (HPA) axis functioning. The HPA axis is one of the body’s primary stress response systems and an essential component of adaptation to challenges (Gunnar & Adam, 2012), producing systemic effects via the hormone cortisol. The HPA axis is active throughout the circadian cycle, with a diurnal pattern of peak cortisol concentrations after waking, which drop throughout the day and are lowest in the evening. This negative diurnal slope is considered normative for healthy individuals, allowing the body to readily allocate resources for self-regulation.

Chronic stressors can cause the HPA axis to change its pattern of diurnal cortisol output. One potential pattern is a long-lasting cascade of elevated cortisol secretion beyond the period of the stressor. Continued elevated cortisol concentrations can disrupt cellular and neuronal functioning, which may lead to harmful psychological side effects, including depression (Guerry & Hastings, 2011). Individuals with depression often show a pattern of cortisol production that does not decline as steeply from the morning to evening, such that cortisol levels are less variable over, and higher for more of, the diurnal period (Guerry & Hastings, 2011; Gunnar & Adam, 2012).

Experiencing LGB-related stress could adversely impact sexual minority individuals’ physiological capacity for self-regulation by disrupting HPA-axis functioning. Huebner and Davis (2005) reported that gay men who had disclosed their sexual identity (i.e., were “out”) at the workplace experienced elevated diurnal cortisol levels over the course of the workday, compared to gay men who were not out. Juster, Smith, Ouellet, Sindi, and Lupien (2013), however, reported that although LGB individuals and heterosexual individuals did not differ in overall diurnal cortisol levels, LGB individuals who were not out had higher cortisol after awakening and had more psychiatric symptoms. These findings suggest that stressors specific to the lived experiences of LGB individuals are linked to their neurobiological regulation, but the discrepancies between studies warrant further investigation.

### Minority Stress, Internalized Homonegativity, and Depression

We proposed that social cognitive processes also were involved in the link between stress and adjustment. LGB-related stress can predict struggles in sexual identity consolidation (Mohr & Kendra, 2011), the process by which individuals accept and integrate their LGB identity across all domains of their lives. LGB-related stress may be associated with additive

psychological stress manifested in the form of internalized homonegativity (IH; Herek, Gillis, & Cogan, 2009) or negative feelings toward one’s own sexual identity and devaluation of the self (Herek et al., 2009; Igartua, Gill, & Montoro, 2009). IH has been linked with greater depression (Cochran, Sullivan, & Mays, 2003; Igartua et al., 2009; Shidlo, 1994). We postulated that IH may be a social cognitive mechanism by which LGB-related stress is internalized and, in turn, adversely affects mental health.

### Hypotheses

The present study tested the links between LGB-related stress, IH, diurnal cortisol activity, and depression. Through a biosychosocial model of minority stress, we hypothesized that LGB-related stress, diurnal cortisol slopes, and IH would be positively associated with each other and with depression symptomatology. Also, we expected diurnal cortisol slopes and/or IH to mediate the link between LGB-related stress and depression.

## Method

### Participants

Twenty-seven lesbian and bisexual young women and 35 gay and bisexual young men, total  $N = 62$ ; age, 17–27,  $M = 21.34$ , standard error ( $SE$ ) = 0.37, were recruited through LGB youth and student groups, college and university settings, and university health clinics in the greater metropolitan area of Montréal, Québec.

### Demographics

Participants’ primary language was English (76%) or French (24%). Most participants were Caucasian (75.80%), and most were students (71%). Most participants (79%) self-identified as predominantly or exclusively homosexual, and 21% self-identified as bisexual. Self-identification as LGB tended to occur during late adolescence ( $M = 17.86$  years). Ninety percent of the sample had come out to one or both parents ( $M = 18.6$  years), and 100% had come out to at least some other people (including siblings, peers, and coworkers;  $M = 19.01$  years). Thus, the sample represented youth who lived openly as LGB individuals.

### Sample Available for Analyses

Three participants reported taking antidepressants known to normalize cortisol levels (Deuschle et al., 2003). These participants were retained because the current study focuses on depressive symptoms, and including these participants makes analyses more generalizable.<sup>2</sup> Four participants reported eating an hour or less before one of their samples; those four values were removed prior to analysis. Twelve participants were excluded from analysis: three who used medications that increase cortisol levels (e.g., corticosteroids) and nine who failed to comply with cortisol collection instructions (e.g.,

**Table 1.** Descriptive Statistics and Correlations.

Variables	Mean	SE	Min.	Max.	Cortisol	IH	Depression
LGB-related stress	0.94	0.19	0.00	5.00	0.27 <sup>†</sup>	0.33*	0.30*
Cortisol slopes	-0.00026	0.00002	-0.00051	0.00	—	0.13	0.39**
IH	80.60	2.64	52.00	127.00	—	—	0.37**
Depression	9.04	0.92	0.00	33.00	—	—	—

Note. IH = internalized homonegativity; LGB = Lesbian, gay, and bisexual.  $N = 50$ .

\* $p < .05$ . \*\* $p < .01$ . <sup>†</sup> $p = .06$  (all tests were two-tailed).

participants did not report collection times). Table 1 shows descriptive information of the final sample ( $N = 50$ ).

### Procedure

Bilingual research staff introduced the study and addressed questions about its methodology and purpose. Participants received an envelope that contained all questionnaires. Standardized French translations were available for all measures.

Also included in the packet was a clear, re-sealable plastic bag that contained six saliva sampling vials with absorbent oral swabs (Salivettes™, Salimetrics Inc., State College, PA) with instructions. Participants were asked to refrain from eating, drinking (except water), smoking, and brushing teeth 1 hr before sampling. Participants were instructed to provide the first sample at awakening, the next four samples at 2-hr intervals throughout the day, and the sixth sample 4 hr subsequent to the fifth sample, in order to obtain a 12-hr profile. The precise times of sample collection varied across participants but conformed to each participant's typical circadian cycle (Adam & Gunnar, 2001). Participants were instructed to store saliva samples in their home freezers at  $-20^{\circ}\text{C}$  until they were picked up by research staff. Saliva samples then were stored in a  $-80^{\circ}\text{C}$  medical freezer in the laboratory until all data were collected, in order to assay cortisol in one batch.

### Measures

**Sexual orientation scale.** Sexual orientation was assessed with the 7-point Kinsey Likert scale (Kinsey, Pomeroy, & Martin, 1948) where 1 = *exclusively heterosexual* and 7 = *exclusively homosexual*.

**Sexual orientation disclosure.** The Sexual Orientation Developmental Milestones questionnaire (Floyd & Stein, 2002) was used to assess participants' age of self-identification as LGB, the degree of "outness," as well as the age at which participants disclosed their sexual orientation to their parents and others (please refer to Demographics section).

**LGB-related stress.** The incidence of recent (past 3 months) stressful life events related to LGB identity was assessed with the 12-item (True/False) Revised Gay-Related Stressful Life Events Measure (Rosario, Schrimshaw, Hunter, & Gwadz, 2002). Three items were removed due to zero variability across responses. Hence, the possible range for this scale was 0–9,

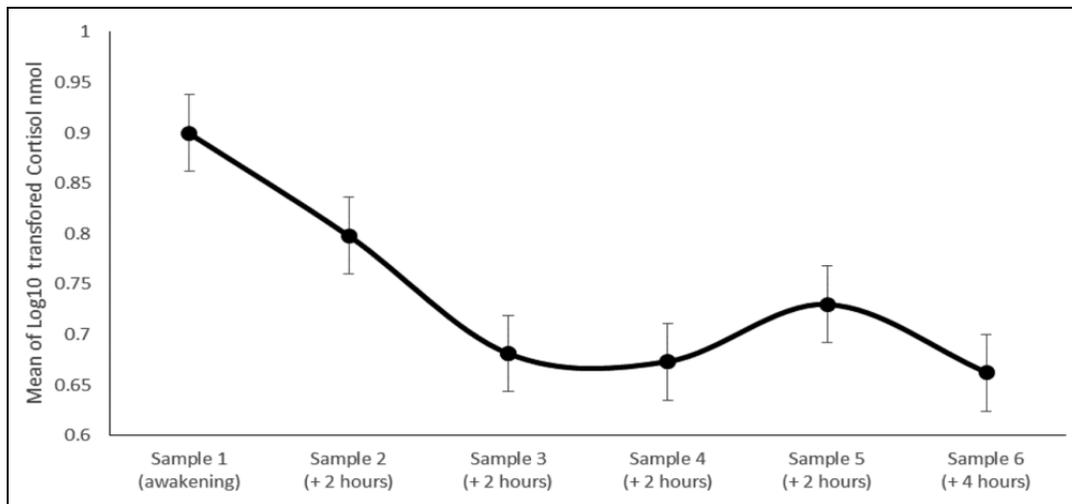
with greater scores representing greater stressful events related to participants' LGB identity. Tetrachoric interitem correlations were computed to derive  $\phi$  as an index of internal consistency of the scale,  $\phi = .81$ .

**IH.** The Nungesser Homosexual Attitudes Inventory–Revised (Shidlo, 1994) consists of 40 items regarding attitudes toward homosexuality. Participants answered on 5-point Likert-type scales where 1 = *strongly disagree* and 5 = *strongly agree*. The possible range for the scale is 40–200, with greater scores representing greater levels of IH ( $\alpha = .91$ ).

**Depressive symptoms.** The Beck Depression Inventory–Second Edition (Beck, Steer, Ball, & Ranieri, 1996) was used to measure the severity of depression ( $\alpha = .95$ ). The possible range for the scale is 0–63, with greater scores representing greater levels of depression. Scores above 29 are indicative of clinically significant levels of depression.

**Salivary cortisol.** Participants provided six saliva samples over the course of 1 day to capture circadian rhythms of cortisol production. Assays were completed at the Douglas Hospital of the McGill University Health Centre. Salivary cortisol concentrations were determined using an enzyme-linked radio-immunoassay procedure using a commercial kit from DSL (DSL-2000; Sanofi Diagnostics, Montreal, Canada). Bound cortisol was counted in a gamma counter, and cortisol concentrations were calculated from a standard curve. The limit of detection for cortisol was .01 mg/dl, and the intra- and interassay variabilities were 4.0% and 4.6%, respectively.

Raw cortisol values were  $\log_{10}$  transformed to correct for positive skew. Statistical Analysis Software was used to calculate individual intercepts and slopes from the log-transformed cortisol values using multilevel linear modeling with a random intercept and random slope of time; this allowed the variance associated with specific cortisol sample times, as well as waking time, to be accounted for in the model. Individual random effects for the linear slopes were estimated and stored for secondary analysis. Computing diurnal cortisol slopes allowed us to capture the degree to which individuals' patterns of cortisol production over the day conformed to or deviated from normatively expected declines (Adam & Gunnar, 2001; Guerry & Hastings, 2011; Gunnar & Adam, 2012). Cortisol slopes with more negative values were indicative of greater decreases in



**Figure 1.** Mean log<sub>10</sub>-transformed diurnal cortisol values over sample times.

cortisol production from waking throughout the course of the day. Slopes with smaller negative values, or with zero or positive values, were indicative of less change in cortisol secretion over the day (i.e., flatter diurnal slopes). Flatter diurnal slopes have been associated with depression symptomatology (Guerry & Hastings, 2011; Gunnar & Adam, 2012). In this study, cortisol intercepts were not associated with LGB-related stress, IH, and depression and therefore were not used in the subsequent analyses.

### Analysis Plan

After examining zero-order correlations, we tested whether diurnal slopes and IH mediated the relation between LGB-related stress and depression. Parallel multiple mediation (PMM) modeling (Hayes & Preacher, 2014) was used for this analysis. The PMM model separates the total, direct, and indirect effects of LGB-related stress on depression (while accounting for potential covariates). Statistical significance of the indirect effects, above and beyond the total and direct effects, indicates the presence of mediation. The PMM model was fitted using structural equation modeling using the package lavaan in R.

The total effect was the effect of LGB-related stress on depression symptomatology, not accounting for mediation. The direct effect was the effect of LGB-related stress on depression symptomatology when both mediators (diurnal cortisol slopes and IH) were added into the model. Indirect effects were the influence of LGB-related stress on depression symptomatology through each of the two hypothesized mediators. We calculated indirect effects by multiplying the direct effect of LGB-related stress on depression through diurnal cortisol slopes and IH, and we then obtained confidence intervals for those estimates using bootstrapping (Preacher & Hayes, 2008). Thus, the PMM model generated three indirect effects: specific indirect effects through diurnal cortisol slopes, IH, and the combined influence of diurnal cortisol slopes and IH.

## Results

### Descriptive Analyses

Table 1 displays the means, *SEs*, and zero-order correlations for all measures. On average, participants reported low levels of LGB-related stress, IH, and depression. The measures were positively intercorrelated in the hypothesized directions; the two hypothesized mediators (diurnal cortisol slopes and IH) were not significantly correlated with each other.

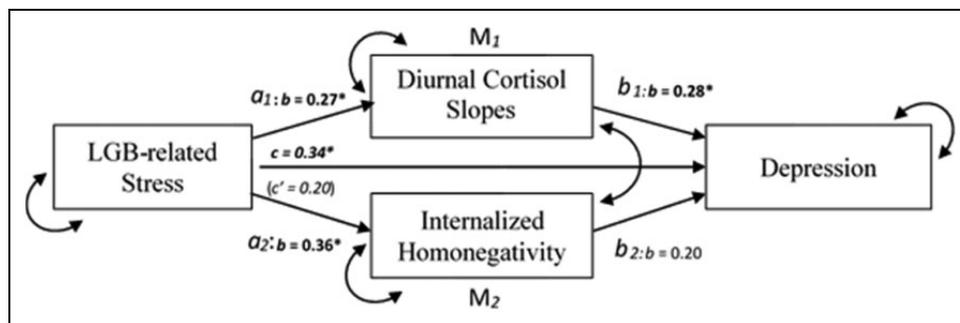
Participants' mean diurnal cortisol slopes followed a typical profile, decreasing over a 12-hr period of the day (Figure 1). Repeated measures analysis of variance showed significant differences across sample collection times on average,  $F(1, 40) = 134.93, p < .001$ . Bonferroni post hoc analyses indicated that the cortisol concentrations for Sample 1 (waking) and Sample 2 ( $M = 0.90$  and  $0.80$ ;  $SE = 0.05$  and  $0.05$ , respectively) were nonsignificantly different from each other,  $p > .05$ , and both were significantly higher than that for Samples 3–6 ( $M = 0.68, 0.67, 0.73$ , and  $0.66$ ;  $SE = 0.06, 0.05, 0.06$ , and  $0.06$ ,  $p < .05$ ), except that cortisol at Sample 2 was nonsignificantly higher than at Sample 5 ( $p > .05$ ). Cortisol concentrations in Samples 3–6 were nonsignificantly different from each other ( $p > .05$ ). This lack of consistent variation over the midday period may have been due to individual variation in the exact times at which participants provided their samples, as more consistently significant decreases in cortisol levels over the day are noted when time of sampling is controlled across participants (Smyth et al., 1997).

Next, *t*-tests and correlations were conducted to test for significant relations between the physiological and psychological measures and participants' sex, age, ethnicity (Caucasian vs. non-Caucasian), and language (English vs. French). English-speaking participants reported more depression ( $M = 10.36$ ;  $SE = 1.18$ ;  $t(48) = 2.46$ , 95% CI = [1.11, 8.92],  $p = .02$ ) and marginally higher IH ( $M = 83.36$ ;  $SE = 3.24$ ;  $t(48) = 1.71$ , 95% CI = [−1.72, 21.44],  $p = .09$ ) than French-speaking

**Table 2.** Parallel Multiple Mediation Analysis.

Dependent	Independent	Label	Estimate	SE	CI [Lower, Upper]
Depression	LGB-related stress	(c')	0.19	0.17	[-0.10, 0.56]
		Cortisol slopes	3050.01	1265.32	<b>[731.01, 5686.93]</b>
		IH	0.01	0.01	[-0.004, 0.03]
		Language	-0.88	0.35	<b>[-1.61, -0.26]</b>
Cortisol slopes	LGB-related stress	(a <sub>1</sub> )	2.37e-05	1.11e-05	<b>[1.63e-06, 4.52e-05]</b>
IH	LGB-related stress	(a <sub>2</sub> )	4.89	1.71	<b>[0.60, 7.46]</b>
Covariances IH	Cortisol slopes		1.83e-05	2.86e-04	[-0.001, 0.001]
	Language		-2.36	1.13	<b>[-4.67, -0.22]</b>
Indirect effects	Parameters:				
	Cortisol slopes	(a <sub>1</sub> *b <sub>1</sub> )	0.07	0.05	<b>[0.01, 0.19]</b>
	IH	(a <sub>2</sub> *b <sub>2</sub> )	0.07	0.06	[-0.01, 0.22]
	Sum of indirect effects	(a <sub>1</sub> *b <sub>1</sub> ) + (a <sub>2</sub> *b <sub>2</sub> )	0.14	0.08	<b>[0.02, 0.32]</b>
Total effect		(c)	0.33	0.19	<b>[0.01, 0.72]</b>

Note. IH = internalized homonegativity; LGB = Lesbian, gay, and bisexual; CI = bias-corrected 95% confidence interval; 10,000 bootstrap samples. Beta values for  $a$ ,  $b$ ,  $c$ , and  $c'$  represent unstandardized regression coefficients. Subscript 1 refers to cortisol slopes, and subscript 2 refers to IH. Language was covaried with IH and depression. Both mediators, cortisol slopes and IH, also were covaried. Significant CIs are presented in bold font.

**Figure 2.** Parallel multiple mediation model of two stress internalization mechanisms.

participants ( $M = 5.43$  and  $73.50$ ;  $SE = 1.08$  and  $3.93$ , respectively). Sex, age, and ethnicity were not significantly associated with the target variables. Language was included as a covariate.

### Links Between LGB-Related Stress, Diurnal Cortisol Slopes, IH, and Depression

We tested the two proposed stress internalization mechanisms as potential parallel mediators of the link between LGB-related stress and depressive symptomatology, adjusting for participants' primary language. Depression symptoms, diurnal cortisol slopes, and IH were mean-centered in the models. The unstandardized regression coefficients for total, direct, and specific indirect effects are reported in Table 2. To facilitate interpretation, standardized coefficients are provided in path diagram form for the model in Figure 2.

As expected, the total effect between LGB-related stress and depression was significant ( $b = .34$ ,  $SE = 0.19$ ,  $95\% CI = [0.01, 0.72]$ ). The specific indirect effect of LGB-related stress

on depression through diurnal cortisol slopes was also significant ( $b = .08$ ,  $SE = 0.05$ ,  $95\% CI = [0.01, 0.20]$ ). Participants who had experienced more LGB-related stress showed flatter diurnal cortisol slopes and, in turn, reported more depression. The total indirect effect of LGB-related stress on depression symptomatology through IH was nonsignificant ( $b = .07$ ,  $SE = 0.07$ ,  $95\% CI = [-0.01, 0.22]$ ). Finally, the direct effect of LGB-related stress, while accounting for both cortisol slopes and IH, was nonsignificant ( $b = .20$ ,  $SE = 0.17$ ,  $95\% CI = [-0.10, 0.56]$ ). Overall, the model met mediation criteria and was an excellent fit to the data ( $\chi^2 = 1.48$ ,  $df = 2$ ,  $p = .48$ ; comparative fit index = 1.00; root mean square error of approximation = 0.00), accounting for 35%, 7.2%, and 12.7% of the variability in depression, diurnal cortisol slopes, and IH, respectively.

### Discussion

By applying a biopsychosocial lens to the minority stress model, we showed that lived experiences of sexual prejudice

were associated with higher and less variable (i.e., flatter) circulating levels of diurnal cortisol, which in turn predicted more depression problems. These results extend the minority stress model by demonstrating that changes in HPA-axis functioning account for the association of LGB-related stress with depression in self-disclosed LGB emerging adults. Conversely, although experiencing more LGB-related stress diminished positive regard for one's own sexuality, IH was not a mechanism linking stress to depression. Thus, in accord with an allostatic load framework, LGB-related stress functioned akin to other chronic life stressors, undermining mental health by compromising basic neurobiological regulatory processes (Guerry & Hastings, 2011; McEwen & Stellar, 1993) and indexed via flatter (less variable) diurnal cortisol slopes. It is well documented that flattened diurnal cortisol slopes capture the degree of change in HPA-axis functioning linked to chronic stress (Adam & Gunnar, 2001; Guerry & Hastings, 2011, Gunnar & Adam, 2012).

As predicted, LGB-related stress, diurnal cortisol slopes, and IH were positively linked to depression. Yet, diurnal cortisol slopes and IH were not associated with each other. LGB-related stress may have multiple but independent effects on LGB youth, or some LGB youth may be susceptible to internalizing stress through other mechanisms, such as avoidance coping strategies that have been shown to tax LGB individuals' physiological resources (Juster et al., 2015). The measure of IH involved conscious self-evaluation and endorsement of attitude statements. As such, IH was relatively distal from basic neurobiological activity. Elevated diurnal cortisol can have somatic and affective effects, such as disrupted sleep, depleted energy, and irritability, and cognitive effects on attention and memory (Guerry & Hastings, 2011; Gunnar & Adam, 2012; Juster, McEwen, & Lupien, 2010), but these may not be as evident in measures of higher-order social cognitive functioning.

This does not mean that IH associated with LGB-related stress should not be concerning. Our observation that IH was associated with depression replicates prior studies linking it to distress and psychopathology in LGB individuals (Cochran et al., 2003; Igartua et al., 2009; Shidlo, 1994). The lack of a social cognitive mediation effect could suggest that LGB-related stress has been related more strongly to somatic and affective symptoms of depression, whereas IH may have been related to more cognitive symptoms. Consistent with this, rumination has been found to mediate the link between IH and psychological distress (Hatzenbuehler, Dovidio, Nolen-Hoeksema, & Phillips, 2009). Further investigation into the possibly multiple mediated pathways linking LGB-related stress, IH, neurobiology, and mental health is warranted.

This study has important implications for the current international generation of LGB emerging adults. When these data were collected, 2004–2005, marriage by same-sex couples was legal in only four countries. At the time of this writing, marriage rights have been fully extended to same-sex couples in 22 countries, yet it remains the case that marriage by same-sex couples is either unrecognized or explicitly banned in the vast majority of countries across the globe. Research has shown

that this is not a healthy political and cultural context for the development of LGB emerging adults. For example, prior to the extension of marriage to same-sex couples in the United States, studies reported that LGB individuals who lived in states with constitutional amendments banning same-sex marriage reported more psychiatric disorders than those living in states without such marriage bans (Hatzenbuehler, McLaughlin, Keyes, & Hasin, 2010). Further, Hatzenbuehler and McLaughlin (2014) found that LGB individuals who were raised in stigmatizing environments (e.g., states with prohibitive marriage laws) showed a flattened acute cortisol response to a laboratory stressor, compared to those raised in lower-stigma environments. Still, given that 21 additional countries aside from Canada have extended full marriage rights to same-sex couples since the Netherlands first did so in 2001, one might expect that LGB youth in these countries, and others with progressive attitudes and laws, would be relatively buffered against such psychological and physiological tolls.

Canada passed the Civil Marriage Act in 2005, at the same time that we collected these data. Indeed, most of the individuals in our study, who lived in a province and country that supported marriage equality, reported relatively low LGB-related stress, IH, and depression. Yet the predicted associations among the variables still emerged, and these LGB youth remained vulnerable to the adverse physiological, social-cognitive, and psychological effects of prejudicial acts that targeted their sexual minority status. The fact that we observed these associations in a relatively small and well-functioning sample could even suggest that we have presented conservative estimates of the risks, given the study design that captured within-group individual differences. It will be important to conduct future research with larger samples of LGB emerging adults or with a between-group design comparing stress, adrenocortical functioning, and psychological adjustment in LGB versus heterosexual young adults, to see whether our findings are replicated.

Institutionalized policies that protect the rights of sexual minorities have been shown to reduce mental health costs (Hatzenbuehler et al., 2012), but such policies do not automatically change the lived experiences of sexual minorities who may face daily rejection and intolerance (D'Augelli et al., 2002; Russell et al., 2011; Ryan et al., 2009). Although the extension of marriage rights to same-sex couples throughout the United States, Canada, and 20 other countries around the world (Pew Research Center, 2015) can be seen as a watershed event for human rights, it is not a panacea. Social policy makers and mental health experts need to recognize that sexual minority youth remain vulnerable to the prejudice and violence that they disproportionately experience in their home countries (Amnesty International, 2015).

The earlier extension of marriage equality to same-sex couples is, of course, just one of many legal, political, and social differences between Canada and the other countries that also have extended marriage equality to all their citizens. Whether the same links between LGB-related stress, cortisol levels, IH, and depression would be evident in LGB youth living in

those countries today is an open question. Nonetheless, we conclude that even in a time of progressive societal change, LGB youth who experience the unique stressors of prejudice against their sexuality pay a high toll, evident in their neurobiology, self-regard, and mental health. The evidence that anti-LGB prejudice may affect mental health via allostatic load may be useful for identifying the common effects of stress across many contexts and populations, identifying possible points of intervention to assist those who face prejudice, and strengthening arguments for the need for further social and legal changes to diminish mental and physical health disparities in LGB populations.

### Author Contribution

Luis A. Parra contributed to analysis and interpretation; drafted manuscript; critically revised manuscript; gave final approval; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Michael Benibgui contributed to conception and design; contributed to acquisition, analysis, and interpretation; gave final approval; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Jonathan L. Helm contributed to analysis and interpretation; gave final approval; and agrees to be accountable for all aspects of work ensuring integrity and accuracy. Paul D. Hastings contributed to conception and design; contributed to analysis and interpretation; drafted manuscript; critically revised manuscript; gave final approval; and agrees to be accountable for all aspects of work ensuring integrity and accuracy.

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### Notes

1. For a current list of the legal relationship status for same-sex couples around the world, see Pew Research Center "Gay Marriage Around the World," accessed November 15, 2015, <http://www.pewforum.org/2015/06/26/gay-marriage-around-the-world-2013/>
2. Excluding the three participants who reported taking antidepressants had no substantive effects on the pattern of results, and the indirect effect via diurnal cortisol remained significant.

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