

SHORT COMMUNICATION

Does stress mediate the association between personal relative deprivation and gambling?

Sandeep Mishra¹  | Tyler J. S. Meadows²

¹Faculty of Business Administration,
University of Regina, Regina, Canada

²Department of Psychology, University of
Regina, Regina, Canada

Correspondence

Sandeep Mishra, Faculty of Business
Administration, University of Regina, 3737
Wascana Parkway, Regina, SK S4S0A2,
Canada.

Email: mishrs@gmail.com

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Abstract

Evidence has linked subjective feelings of personal relative deprivation with general gambling involvement and problem gambling tendencies. In turn, problem gambling tendencies have been linked with a wide array of damaging physical and mental health consequences. It has been theorized that the deleterious effects of perceived inequality on mental and physical health operate at the individual level through the experience of personal relative deprivation leading to psychosocial stress. We empirically examined whether the experience of perceived stress contributes to explaining the deprivation-gambling link using cross-sectional, self-reported survey data collected from a crowdsourced population of adults ($n = 565$). Results indicate that personal relative deprivation is associated with problem gambling tendencies (but not general gambling involvement) and that this association is mediated by perceived stress. These associations were particularly strong among participants who reported non-zero levels of problem gambling tendencies. Together, our results further emphasize the importance of individual-level social comparison reactions in the context of health.

KEYWORDS

gambling, inequality, mental health, relative deprivation, stress

1 | INTRODUCTION

High-frequency gambling behaviour that causes distress to self or others is classified as a behavioural addiction in the Diagnostic and Statistical Manual of Mental Disorders. Furthermore, a large body of evidence has shown that gambling has wider effects on mental and physical health and well-being. Specifically, alcohol and nicotine dependence, substance use disorders, mood disorders (e.g., depression), anxiety disorders (e.g., panic attacks), and antisocial personality disorder are all comorbid with problem gambling (reviewed in Lorains, Cowlshaw, & Thomas, 2011). Problem gambling has also been associated with poorer general physical health, chronic bronchitis, fibromyalgia, migraine headaches, and many other physical maladies (reviewed in Afifi, Cox, Martens, Sareen, & Enns, 2010).

Growing research suggests that the subjective experience of personal relative deprivation—a negative emotional reaction to social comparisons seen as unfair or disadvantaged (Smith, Pettigrew, Pippin, & Bialosiewicz, 2012)—is associated with a wide array of negative social and health outcomes, including gambling. It has been theorized that these effects of relative deprivation may operate through perceived stress. In the following, we review evidence suggesting that personal

relative deprivation, stress, and gambling should be linked and present a study directly examining whether personal relative deprivation operates through stress to influence general gambling involvement and problem gambling tendencies.

2 | RELATIVE DEPRIVATION AND HEALTH

Substantial epidemiological evidence has accumulated demonstrating that various forms of objective relative deprivation (e.g., income inequality) are associated with a wide array of poorer mental and physical health and well-being outcomes at the societal level. For example, income inequality has specifically been linked with such diverse conditions as substance use, anxiety disorders, obesity, poorer cardiovascular health, as well as such general health outcomes as poorer mental health, general mortality, and poorer life expectancy (reviewed in Pickett & Wilkinson, 2015; Wilkinson & Pickett, 2009). Recently, research has begun to examine whether the individual, subjective experience of relative deprivation—that is, personal relative deprivation—shows similar associations with poorer health and well-being.

Personal relative deprivation describes feelings of anger and resentment in response to a disadvantaged comparison relative to others (reviewed in Smith et al., 2012). Growing evidence suggests robust associations between personal relative deprivation and various mental and physical health outcomes. Callan, Kim, and Matthews (2015) demonstrated across six studies that self-reported physical and mental health were robustly predicted by personal relative deprivation, even when controlling for objective socio-economic status. Mishra and Carleton (2015) showed that greater feelings of personal relative deprivation were associated with poorer self-reported physical and mental health, above and beyond demographic factors associated with both (e.g., age, educational attainment, household earnings, and social support). Others have demonstrated more specific associations between personal relative deprivation and (a) depressive symptoms (Beshai, Mishra, Meadows, Parmar, & Huang, 2017), (b) such functional disorders as fibromyalgia and irritable bowel syndrome (Beshai, Mishra, & Carleton, under review), and (c) gambling-related outcomes (reviewed below). Together, these findings suggest that personal relative deprivation is robustly associated with poorer physical and mental health outcomes.

3 | GAMBLING AND RELATIVE DEPRIVATION

As noted earlier, gambling is a key mental health outcome, with substantial associated comorbidity with other mental and physical maladies. A growing literature has linked personal relative deprivation specifically with elevated general gambling behaviour and gambling urges (Callan, Ellard, Shead, & Hodgins, 2008; Callan, Shead, & Olson, 2011; Callan, Shead, & Olson, 2015; Haisley, Mostafa, & Loewenstein, 2008), as well as disordered or problem gambling tendencies (Mishra & Carleton, 2017; Mishra & Novakowski, 2016; Tabri, Dupuis, Kim, & Wohl, 2015). Callan et al. (2008), for example, demonstrated that personal relative deprivation was associated with both problem gambling tendencies and general gambling urges above and beyond relevant control variables. They also provided experimental evidence linking greater personal relative deprivation with a higher likelihood of opting to gamble when presented with the opportunity. Experimental manipulations of relative deprivation (manifesting in the form of individual-level income inequality and competitive disadvantage) have also been associated with increased levels of more general economic risk-taking (Mishra, Barclay, & Lalumière, 2014; Mishra, Son Hing, & Lalumière, 2015; Payne, Brown-Iannuzzi, & Hannay, 2017). These findings are collectively suggestive of a causal pathway leading from relative deprivation to gambling-related outcomes.

4 | RELATIVE DEPRIVATION, STRESS, AND GAMBLING

Numerous researchers have theorized that negative consequences of relative deprivation are mediated through the experience of stress (e.g., Adjaye-Gbewonyo & Kawachi, 2012; Beshai et al., 2017; Callan et al., 2015; Lhila & Simon, 2010; Sapolsky, 2005; Yngwe, Fritzell, Lundberg, Diderichsen, & Burström, 2003). Some empirical evidence

supports the hypothesis that personal relative deprivation and stress are closely linked. Smith, Cronin, and Kessler (2008) demonstrated that faculty members who felt they were undeservedly underpaid compared to their colleagues reported higher levels of stress. Callan, Shead, et al. (2015) and Beshai et al. (2017) demonstrated relatively strong zero-sum associations between personal relative deprivation and perceived stress. Furthermore, Callan, Kim, et al. (2015) demonstrated that changes in personal relative deprivation over a 6-week period were significantly associated with changes in perceived stress, suggesting that the two are tightly linked.

Stress is a particularly relevant candidate variable for explaining the pathway from relative deprivation to gambling given that stress and its antecedents (e.g., adverse life events and trauma) have been robustly associated with gambling (Elman, Tschibelu, & Borsook, 2010; Ste-Marie, Gupta, & Derevensky, 2006). Disordered problem gambling tendencies in particular have been strongly associated with stress. For example, Ste-Marie et al. (2006) demonstrated that social stress was associated with likelihood of being a probable pathological gambler. Elman et al. (2010) demonstrated that pathological gambling patients had significantly higher scores on a daily stress inventory compared to healthy subjects and that stress was an independent predictor of gambling urges above and beyond numerous other relevant measures. Pathological gambling has also been associated with chronically elevated levels of stress hormones both at waking and throughout the day (Wohl, Matheson, Young, & Anisman, 2008).

5 | OVERVIEW

The research reviewed above suggests that (a) personal relative deprivation is robustly associated with poorer health and well-being, (b) there is evidence for a causal pathway leading from relative deprivation to gambling-related outcomes, and (c) relative deprivation, stress, and gambling are reliably linked. In the present study, we sought to examine whether stress mediates the association between personal relative deprivation and gambling. This research replicates and extends previous work in two ways. First, we examine whether associations between personal relative deprivation, stress, and gambling are robust. Second, we examine whether there is evidence for a mediational pathway leading from personal relative deprivation to gambling through stress. We predicted that our planned mediation analysis would support this model.

6 | METHODS

Six hundred seventy-eight participants (382 women, 287 men, 1 trans*, 8 unreported gender; age: $M = 38.5$, $SD = 13.3$, Range: 18 to 80) were recruited from Crowdfunder, an online crowdsourcing platform. Such platforms have been widely used in both clinical and behavioural research (reviewed in Chandler & Shapiro, 2016) and have been shown to be demonstrably useful for gambling research in particular (Mishra & Carleton, 2017). Participants were compensated with \$0.60 USD or the equivalent (i.e., translated into site-specific currencies for some Crowdfunder channels). Participants were recruited only from western, English-speaking countries that have similar culture (i.e., Australia, Canada, Ireland, New Zealand, the United Kingdom, and the

United States) in line with previous gambling-related research on crowdsourced populations (Mishra & Carleton, 2017). Participants completed (a) demographic measures: age, gender, relationship status, estimates of household and personal income, highest educational attainment, and employment status; (b) measures of personal relative deprivation, stress, general gambling involvement, and problem gambling, and (c) additional measures not reported here (unrelated to the present investigation). Participants also completed an attention check as described in Goodman, Cryder, and Cheema (2013); 565 participants successfully completed the attention check. All analyses below involve these participants only.

6.1 | Personal relative deprivation

Relative deprivation was measured using the revised Personal Relative Deprivation Scale. The Personal Relative Deprivation Scale consists of five items (e.g., "I feel deprived when I think about what I have compared to what other people like me have"; Callan et al., 2011) rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). This measure has been previously associated with problem and pathological gambling tendencies (e.g., Callan et al., 2008; Callan, Kim, et al., 2015; Callan et al., 2011; Mishra & Carleton, 2017; Mishra & Novakowski, 2016).

6.2 | Stress

Stress was measured using the stress subscale of the short-form Depression and Anxiety Stress Scale (DASS), a widely-used mental health inventory (Henry & Crawford, 2005). The stress subscale of the DASS consists of seven items evaluating experiences over the past week (e.g., "I found it hard to wind down") rated from a scale of 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). The DASS has been used in thousands of studies and exhibits excellent psychometric properties (Henry & Crawford, 2005).

6.3 | General gambling involvement

General gambling involvement was assessed using a portion of the Gambling Behaviour Scale (GBS; Mishra, Lalumière, & Williams, 2010), which assesses self-reports of frequency of engagement of up to 11 different gambling behaviours in the last year (e.g., gaming machines and lottery tickets). Mean frequency of gambling for each behaviour was coded categorically as follows: 0 = *never*; 1 = *1–11 times total*; 2 = *1 time per month*; 3 = *2–3 times per month*; 4 = *1 time per week*; 5 = *2–6 times per week*; 5 = *daily*. A total score of general gambling involvement was computed by summing the z-scores of the frequency and number of activities measures. This measure has been used in previous studies and has been in part psychometrically validated on Crowdfunder (Mishra & Carleton, 2017).

6.4 | Problem gambling tendencies

Problem gambling tendencies were measured using the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). The PGSI measures frequency of nine outcomes and behaviours associated with disordered gambling (e.g., "Have you felt that you might have a problem with gambling"). Items were rated on a scale from 0 (*never*) to 3 (*almost always*). For categorical analyses, we used the following clinically-

informed PGSI cut-off scores recommended by Williams and Volberg (2014): non-gamblers or non-problem gamblers (0), likely at-risk gamblers (1–4), and likely problem and pathological gamblers (5–27). The PGSI is one of the most widely used measures of problem and pathological gambling. The measure is highly reliable with excellent external and internal validity (e.g., Orford, Wardle, Griffiths, Sproston, & Erens, 2010). The PGSI has been shown to have good psychometric properties among crowdsourced samples (Mishra & Carleton, 2017).

7 | RESULTS

Descriptive statistics and reliabilities for all relevant measures are presented in Table 1. All scales had high observed reliabilities in line with previous research. Participants were categorized by the PGSI as follows: non-gamblers or non-problem gamblers (70.3%); likely at-risk gamblers (16.5%), and likely problem and pathological gamblers (13.3%). These estimates are consistent with previous studies of crowdsourced samples (Mishra & Carleton, 2017).

Exploratory analyses were conducted to examine associations between personal relative deprivation and the demographic variables collected. There was no significant gender difference, $t(561) = -.27$, $p = .78$. Personal relative deprivation was significantly negatively associated with age ($r = -.22$, $p < .001$), educational attainment ($r = -.13$, $p = .002$), personal income ($r = -.25$, $p < .001$), and household income ($r = -.25$, $p < .001$). Significant differences were observed for relationship status, $F(4, 558) = 6.74$, $p < .001$; those who were married or cohabiting reported lower deprivation compared to those who were dating or single (both $ps < .013$). No other differences were observed. Significant differences were also observed for employment status, $F(4, 559) = 9.92$, $p < .001$. Follow-up contrasts revealed that those who were never employed reported significantly higher deprivation compared to all other groups (all $ps < .030$). Those employed full-time reported less deprivation compared to all other groups, save for retirees (all $ps < .001$). Retirees reported lower relative deprivation compared to all other groups (all $ps < .001$), save for those employed full-time ($p = .052$).

Correlations between relative deprivation, stress, and gambling are presented in Table 2. Relative deprivation was significantly associated with problem gambling tendencies but not general gambling involvement. Similarly, stress was significantly associated

TABLE 1 Descriptive statistics and reliability for relative deprivation, stress, and gambling

Measure	M (SD)	Median	Reliability (α)
PRDS-R	17.47 (6.26)	18.00	.86
PGSI	1.80 (4.06)	0.00	.95
GBS (number of activities)	2.58 (2.92)	2.00	–
GBS (frequency in last year)	5.32 (7.82)	2.00	.88
GGI	0.00 (1.94)	–0.62	–
DASS-stress	5.98 (4.51)	5.00	.90

Note: M = mean; SD = standard deviation; PRDS-R = Personal Relative Deprivation Scale (Revised); GBS = Gambling Behaviour Scale; GGI = general gambling involvement; PGSI = Problem Gambling Severity Index; DASS = Depression and Anxiety Stress Scale (stress subscale).

with problem gambling tendencies and personal relative deprivation but not general gambling involvement. Associations between demographic variables, stress, and gambling outcomes (replicating previous findings) are presented in the Supplementary Information.

To examine if stress mediates the association between relative deprivation and problem gambling tendencies, we used Hayes' (2013) PROCESS plugin for SPSS to conduct a mediation analysis using a bootstrapped bias-corrected method with 5,000 resamples. Demographic variables that were significantly associated with relative deprivation (i.e., all but gender) were included as statistical controls. Results support mediation (Figure 1a). The model remained significant with similar effect estimates if covariates were not included (Figure 1b). The model remained significant (and effect sizes were stronger) if non-gamblers (those who reported PGSI scores = 0; $n = 168$) were excluded (Figure 2).

8 | DISCUSSION

The present study indicates that subjective feelings of personal relative deprivation are associated with both stress and problem gambling tendencies. The data support a mediation model whereby personal relative deprivation operates through stress to affect problem gambling tendencies. We did not observe any significant associations between personal relative deprivation and general gambling involvement. The results support the hypothesis that negative health effects of relative deprivation in part operate through stress at the individual level.

That we found significant associations between personal relative deprivation and problem gambling tendencies but not general gambling involvement is somewhat puzzling. Previous research has shown associations between personal relative deprivation and gambling urges measured experimentally (Callan et al., 2008). However, previous cross-sectional research has shown inconsistent associations between personal relative deprivation and general gambling involvement, with some studies showing positive associations (Callan et al., 2008; Haisley et al., 2008; Mishra & Novakowski, 2016) and others showing null associations (Mishra & Carleton, 2017).

One explanation for the null association between relative deprivation and general gambling involvement might involve the nature of the samples examined; significant associations between relative deprivation and general gambling involvement have been shown in indigent, high-risk populations (Mishra & Novakowski, 2016) but not among crowdsourced samples

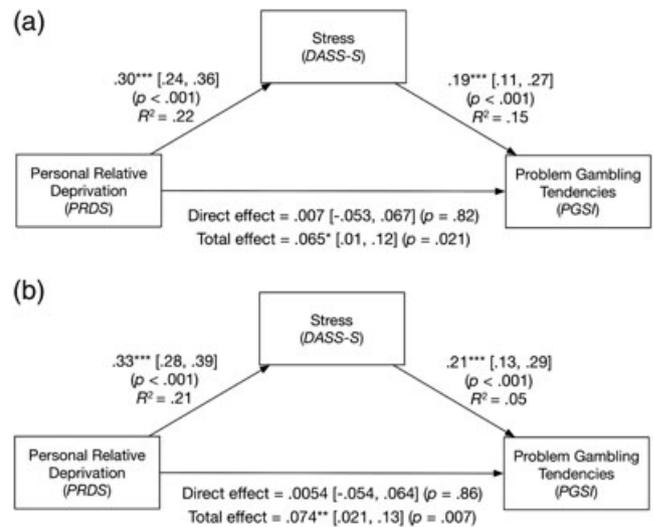


FIGURE 1 The association between personal relative deprivation and problem gambling tendencies is mediated through stress. The direct effect is the association between relative deprivation and problem gambling tendencies when controlling for stress; the total effect does not control for stress. Model A controls for the following demographic variables: age, relationship status, personal income, household income, educational attainment, and employment status; Model B does not include these statistical controls (note: *** $p < .001$; ** $p < .01$; * $p < .05$; 95% confidence intervals are in square brackets). DASS-S = Depression and Anxiety Stress Scale-stress; PGSI = Problem Gambling Severity Index; PRDS = Personal Relative Deprivation Scale (Revised)

(Mishra & Carleton, 2017). Another possibility is that stress might play a bigger role in the aetiology of pathological gambling rather than more general gambling. A third possibility is that the association between personal relative deprivation and general gambling is moderated by perceptions of economic mobility derived from gambling (vs. more conventional means; e.g., Tabri et al., 2015). Those who feel relatively deprived may seek high-risk options (like gambling) to fulfil their economic needs when acceptable low-risk options are unavailable (consistent with risk-sensitivity theory; e.g., Mishra et al., 2014, 2015). Further research should examine if relative deprivation and/or stress have differential influences on general gambling involvement and more specific problem gambling tendencies and consequences.

Our results suggest that stress is an important factor mediating the association between personal relative deprivation and problem gambling tendencies. The mediation pathway seems to be particularly

TABLE 2 Correlations between relative deprivation, stress, and gambling

	PGSI	GBS-num	GBS-freq	GGI	DASS-stress
PRDS-R	.11** (.007)	-.015 (.73)	-.020 (.64)	-.018 (.67)	.46*** (<.001)
PGSI		.48*** (<.001)	.52*** (<.001)	.51*** (<.001)	.23*** (<.001)
GBS-Num			.89*** (<.001)	.97*** (<.001)	.079 (.062)
GBS-Freq				.97*** (<.001)	.081 (.055)
GGI					.082 (.052)

Note. Exact p values are provided in brackets below each correlation coefficient. PGSI = Problem Gambling Severity Index; GBS-num = Gambling Behaviour Scale-number of activities; GBS-freq = Gambling Behaviour Scale-frequency in last year; GGI = general gambling involvement; PRDS-R = Personal Relative Deprivation Scale (Revised); DASS-Stress = Depression and Anxiety Stress Scale (stress subscale).

* $p < .05$;

** $p < .01$;

*** $p < .001$.

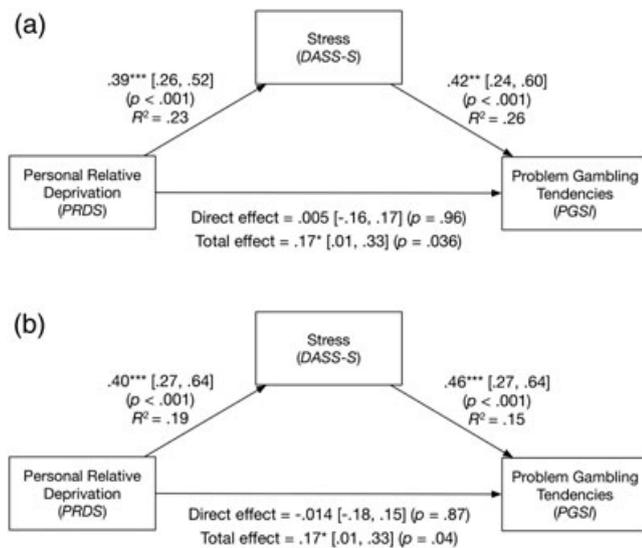


FIGURE 2 The association between personal relative deprivation and problem gambling tendencies is mediated through stress among participants who report non-zero problem gambling tendencies (i.e., PGSI total score > 0). The direct effect is the association between relative deprivation and problem gambling tendencies when controlling for stress; the total effect does not control for stress. Model A controls for the following demographic variables: age, relationship status, personal income, household income, educational attainment, and employment status; Model B does not include these statistical controls (note: $^{***} p < .001$; $^{**} p < .01$; $^* p < .05$; 95% confidence intervals are in square brackets). DASS-S = Depression and Anxiety Stress Scale-stress; PGSI = Problem Gambling Severity Index; PRDS = Personal Relative Deprivation Scale (Revised)

relevant to explaining variance in problem gambling among those who report non-zero gambling problems (as indicated by analyses excluding non-gamblers with PGSI = 0 scores). These findings complement a growing literature on mediators of the deprivation-gambling link. Callan et al. (2011) and Tabri, Shead, and Wohl (2017) have demonstrated, for example, that delay discounting mediates the deprivation-gambling link. Delay discounting may operate alongside stress to motivate gambling. Consistent with this hypothesis, evidence suggests that there is a moderate to large association between delay discounting and stress (Fields, Lange, Ramos, Thamocharan, & Rassa, 2014) and that stress may influence discounting through a cortisol-related endocrinological pathway (Kimura et al., 2013). Others have noted there are multiple different motives for gambling, some of which are associated with stress (e.g., coping; Stewart & Zack, 2008). Further research is necessary to understand the multiple (overlapping) pathways leading from deprivation to gambling. Further research is also necessary to examine the boundary conditions (and potential moderators) of the deprivation–stress–gambling relationship. Multiple individual differences may be relevant, including general risk-propensity (Mishra et al., 2010), materialism (Fang & Mowen, 2009), perceived economic mobility (Tabri et al., 2015), and financial self-concept (Tabri et al., 2017), among others.

Because our data is cross-sectional, claims about causality cannot be made. The hypothesis that stress mediates associations between deprivation and negative health outcomes broadly is based on epidemiological evidence that meets conditions of causality (i.e., covariation, temporal precedence, non-spuriousness, and biological plausibility;

reviewed in Pickett & Wilkinson, 2015). In addition, several of the implied causal pathways in our model have supporting evidence: Stress and relative deprivation covary over time (Callan, Shead, et al., 2015), experimentally manipulated relative deprivation leads to increased gambling urges (Callan et al., 2008), and stress can (sometimes) lead to increased risk-taking (reviewed in Porcelli & Delgado, 2017). Still, it remains the case that our data also support a mediation model leading from problem gambling tendencies to personal relative deprivation operating through stress. Stress is a likely input into the subjective perception of relative deprivation, regardless of the causes of stress (although this hypothesis has not yet been empirically tested). Experimental examination of whether induced stress leads to personal relative deprivation would be illuminating.

Our sample was obtained from an online crowdsourcing platform (Crowdfunder). Although participants recruited from such platforms are much more representative of general community members than most other convenience samples (e.g., local community samples and undergraduate students), there are still systematic differences. However, participants on crowdsourcing platforms show remarkably elevated levels of problem gambling tendencies (Mishra & Carleton, 2017) that make such participants useful for gambling research that requires variability in gambling-related behaviours and outcomes. Regardless, the nature of the sample source means that generalizability of our results is somewhat limited.

We did not conduct a power analysis prior to data collection. However, a post hoc analysis of power according to the criteria set forth in Fritz and MacKinnon (2007) indicated that we had sufficient power to detect a mediation effect. That is, for the conservative criteria of $\alpha \approx .26$ and $\beta \approx .14$, both of which are underestimates of our observed effects, a bias-corrected bootstrap model requires $n = 368$ for .80 power, which is comfortably exceeded by our functional $n = 565$. This analysis suggests that our findings are likely robust.

Taken together, our results underscore the importance of stress in the context of emotional social comparison reactions and further link relative deprivation and stress to problem gambling tendencies. We look forward to future examination of the role of personal relative deprivation and stress in explaining variance in other mental and physical health outcomes.

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ORCID

Sandeep Mishra  <http://orcid.org/0000-0002-8390-1853>

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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