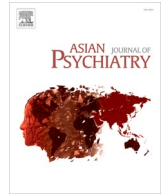




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COVID-19, adversities and depression among older adolescents in urban slums of India

Mercian Daniel^{a,*}, Lokender Prashad^a, Amanpreet Kaur^a, Sudha Kallakuri^a,
Siddhardha Devarapalli^a, Rajesh Sagar^b, Pallab K. Maulik^{a,c,d}

^a The George Institute for Global Health, India

^b Department of psychiatry, All India Institute of Medical Sciences, Ansari Nagar, Ansari Nagar East, New Delhi, 110029, India

^c University of New South Wales, Sydney

^d Prasanna School of Public Health, Manipal Academy of Higher Education, Madhav Nagar, Eshwar Nagar, Manipal, Karnataka 576104, India

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ABSTRACT

Purpose: We report findings from a survey on the mental health impact of COVID-19 factoring environmental adversities among older adolescents (15–19 years) living in urban slums in India.

Methods: We report survey results of 3490 older adolescents. Patient Health Questionnaire-9 was used to assess depression, slum adversity questionnaire for slum conditions, and for COVID-19 infection we recorded self-reported positivity status. Sociodemographic details were also collected. Additional sub-group analyses of sample who had depression and tested positive for COVID-19 infection was conducted. We used univariate and multivariate logistic regression models to identify factors and COVID-19 infection that were associated with depression.

Results: Adolescents with adversities were three times more likely to report depression. Adolescents who reported COVID-19 infection were about two times more likely to have depression. Sub-group analyses showed that adolescents having experienced adversities and girls were more likely to report depression following COVID-19 infection.

Conclusions: There is a need for an intersectional research framework that incorporates stress arising out of a pandemic, social disadvantage, and systemic inequities. Such a framework will help to assess mental health issues of developmentally vulnerable groups residing in disadvantageous conditions.

1. Introduction

Every fifth person in India is between the age of 10–19 years (Census of India, 2011a) and during this period adolescents are vulnerable because of continual physiological and psychosocial changes in their development (Crone and Dahl, 2012). Around 20 % of children and adolescents suffer from a disabling mental illness (WHO, 2013), while suicide is the third leading cause of death among adolescents (Patel et al., 2012). Adding to this, the COVID-19 pandemic has worsened the mental well-being of adolescents as they experience acute and chronic stress because of parental anxiety, disruption of daily routines, increased family violence, and home confinement for more than a year with little or no access to peers, teachers, or physical activity (Patra and Patro,

2020; UNICEF, 2021). A systematic review has reported a significant impact of COVID-19 on the mental health of adolescents and recommended that COVID-19 management among this group should focus on mental health (Octavius et al., 2020). In India, more than 65 million people live in about 14 million urban slum households (Census of India, 2011b). Slums can lead to social and health disadvantage of adolescents due to overcrowding, poor water and sanitation, noise and environmental pollution, substandard housing, insecure residential status, limited access to basic health, playgrounds, or recreational and education facilities, extreme poverty, and other hardships, like high unemployment, informal employment, poor or dangerous working conditions, domestic and community violence. These environmental factors that impact health outcomes of slum residents are further heightened by

* Corresponding author.

E-mail addresses: mdaniel@georgeinstitute.org.in (M. Daniel), lprashad@georgeinstitute.org.in (L. Prashad), dramanpreet.cp@gmail.com (A. Kaur), skallakuri1@georgeinstitute.org.in (S. Kallakuri), devarapalli@georgeinstitute.org.in (S. Devarapalli), rsagar29@gmail.com (R. Sagar), pmaulik@georgeinstitute.org.in (P.K. Maulik).

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notions of illegality and socio-economic exclusion (Ezeh et al., 2017). Deprived environments act as adversities and stressful risk factors for mental disorders and suicide for slum residents (Subbaraman et al., 2014) compared to other urban residents (Unger, 2013), and differentially impact the health and quality of life of children and adolescents exposed to these adversities (Chauhan et al., 2020; UNICEF and NIUA, 2020). Researchers have also highlighted that COVID-19 related sudden and complete nationwide lockdown in India had heightened social inequalities and had severely affected urban slum residents (Raju et al., 2021). While acknowledging individual personality traits, there is a growing recognition in understanding of social and environmental stressors that influence the mental health of children and adolescents living in slums (Unger, 2013). To the best of our knowledge, there is no research in India that has examined the mental health impact of COVID-19 factoring environmental adversities, especially among older adolescents (15–19 years) living in urban slums. We report findings specific to this from a larger survey on the “Mental Health Risk Factors among Older Adolescents living in Urban Slums: An Intervention to Improve Resilience” (ANUMATI).

2. Methods

The ANUMATI survey was conducted from January to April 2021 in Faridabad (Harivihar A and B and Chhajuram blocks) of Haryana in Northern India and Jubilee Hills of Hyderabad in Southern India. We started collecting data from these sites, after the first wave of COVID-19 pandemic started receding. The slums were purposively selected based on population size, accessibility, and proximity to regional field offices. A census of 9905 households was conducted with a population of 40,013, of which 4091 (10.2 %) adolescents were between 15 and 19 years. We report survey results of 3490 older adolescents (Fig. 1) with a mean age of 17.1 years (SD = 1.3).

2.1. Study Measures

Patient Health Questionnaire-9 (PHQ-9), a self-report screening tool was used to measure clinical depression outcome (validated among adolescents internationally and in India) (Ganguly et al., 2013). This questionnaire is comprised of nine items, each is scored 0–3. Maximum score being 27. Those scoring <5 do not suffer from depression. Those scoring 5–9, 10–14, and ≥ 15 , suffer from mild, moderate, and severe depression, respectively.

Slum adversity questionnaire (SAQ) consisting of 14 items adapted to the context of older adolescents from Subbaraman et al. (Subbaraman et al., 2015) was used for ascertaining slum adversities, which included questions on overcrowding, insecure residential status, poor structural quality of housing, inadequate water, sanitation, solid waste, or electricity access, safety, crime and the police, health conditions, income poverty, and occupation. Each item of the SAQ was scored dichotomously that represented a participant’s exposure to a particular adversity, coded as 1 if the participant was exposed and 0 if not. The adaptation of SAQ included keeping those items that were contextually

appropriate to older adolescents and the slum areas. For instance, items that had references to the name of the slums or administrative areas where the tool was initially developed were omitted. Additionally, a few items were slightly modified to make it more understandable to the study participants, while conceptually retaining its original meaning.

To assess COVID-19 infection, we recorded self-reported responses of COVID-19 positivity status in the individual, family, friends, and immediate neighbors. Those reporting a positive infection status for COVID-19 were recorded as testing positive, while the others were recorded as testing negative. We asked participants two related questions- (1) Did you/ your family members/ neighbors/ close friend test positive for COVID 19? (2) If yes, please indicate who all tested positive.

Under socio-demographic status of study participants, gender was initially coded as Male = 1, Female = 2 and Third Gender = 3. However, as the number of third gender was very few ($n = 3$), we recoded one as male and the other two participants as female under the gender they identified their orientation closely with. Education level data was collected as years of schooling completed with 0 years was never attended schooling and 15 years was either in final year or completed graduation. Social group data was collected as schedule caste (SC), schedule tribe (ST), other backward class (OBC), general, not willing to reveal and other. In India, these groups are stratified by the Constitution of India as per specific definitions. SCs, STs, and OBCs are marginalized and lower caste groups, while upper caste groups belong to the general category (Government of India, 2015). Family income was collected as a continuous variable. Data on family type was collected as nuclear, joint, and extended. The questionnaire comprising of socio-demographic status and key instruments were translated to Hindi and Telugu and back-translated to English, and piloted.

Data was collected electronically in RedCap© by trained field interviewers using 7-inch tablets. All data was checked for errors and any such were corrected during the data cleaning process. Ethics approval was obtained from the Independent Ethics Committee of the George Institute for Global Health, India. Written informed consent was taken from adolescents ≥ 18 years, and assent was obtained from parents of adolescents between 15 and 17 years.

2.2. Data analysis

STATA version 16© was used for analyses. Given that we wanted to capture presence or absence of depression, the dependent variable was dichotomized: no depression (PHQ9 score 0–4) = 0, depression (PHQ9 score 5–27, mild to severe) = 1. All SAQ scores were summed up for each participant and recoded dichotomously: no adversities (score 0) = 0, adversities (score 1–14) = 1. COVID-19 infection was also dichotomized: 1 = tested positive, 0 = tested negative. Survey site was coded as Faridabad = 1 and Hyderabad = 2. Gender was coded as Male = 1 and Female = 2. Education was grouped under three categories. Those with 0–5 years of education was grouped as educated upto 5th standard = 1, participants educated from 6 to 10 years were grouped under upto 10th standards = 2 and those educated 11–15 years were grouped under above 10th standards = 3. Social group data was recoded as SC/ST = 1, OBC = 2, and general = 3. Family income was categorized based on monthly median income where less than Rs. 15,000 = 1 and above Rs. 15,000 = 2. Data on family type was recoded as nuclear = 1 and joint (joint and extended combined) = 2. For additional sub-group analyses of sample who had depression and tested positive for COVID-19 infection, we computed the dependent variable with the following condition, Yes = 1 when depression = 1 and COVID positivity = 1, or else No = 0 when depression = 0 and COVID positive = 0. To identify independent variables and COVID-19 infection that were associated with depression, we used univariate and multivariate logistic regression models.

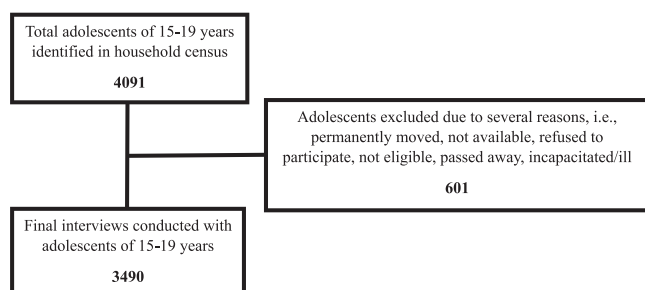


Fig. 1. Sample size of the survey.

3. Results

Socio-demographic characteristics and study variables are described in [Table 1](#). Among adolescents who reported COVID-19 infection in self, family member, immediate neighbor, and close friend; 8.1 % (n = 146) were from Hyderabad and 1.1 % (n = 18) were from Faridabad. A sub-sample (N = 69) of participants had COVID-19 infection and depression. Descriptive analysis of SAQ ([Supplementary Table 1](#)) showed that among 219 (6.3 %) participants who do not have an electricity meter in their homes, 193 (88.1 %) had to pay for electricity. Also, among 591 (16.9 %) participants who currently have an active loan, 383 (64.8 %) are having trouble repaying the loan. More than one-fourth of the participants' household spent on obtaining water in the last year (29.1 %).

Univariate logistic model shows that adolescents who were from Hyderabad were more likely to report depression compared to those from Faridabad. Adolescent girls compared to boys, and those from SC/ST and OBC compared to general social group were also more likely to report depression. Additionally, those adolescents who experienced adversities compared to those who did not and those who had a COVID infection compared to those who had none were more likely to report depression. Univariate model also indicated that those adolescents with monthly family income of less than Rs. 15,000 (about USD 200) and from joint families were less likely to experience depression ([Table 2](#)). Multivariate adjusted model indicates that adolescents living in Hyderabad slums were three times more likely to report depression than their Faridabad counterparts. Girls were more likely to experience depression than boys. Scheduled Caste/ Tribe (SC/ST) and other backward class (OBC) were about two times more likely to report depression than the general group. Adolescents who had studied upto 10th standard and above were less likely to report depression than those who studied

upto 5th standard. Adolescents with adversities were three times more likely to report depression with reference to those with no adversities. Furthermore, those adolescents who reported COVID-19 infection were about two times more likely to have depression compared to those who reported no COVID-19 infection ([Table 2](#)).

3.1. Adolescents with COVID-19 infection and depression

Sixty-nine adolescents who had experienced COVID-19 also suffered from depression based on their PHQ9 score of 5 and above. Sub-sample analyses were done on those individuals to examine the factors associated with depression. Univariate logistic model showed that the following factors were associated with increased depression following exposure to COVID-19 - residing in Hyderabad, being female, belonging to SC/ST/OBC social groups, and those with higher adversities. Those adolescents whose monthly family income was less than Rs.15,000 and who were living in joint families were less likely to report depression associated with COVID-19. Multivariate logistic model showed that - residing in Hyderabad, having experienced adversities, and being females were more likely to report depression following COVID-19 infection. ([Table 3](#)).

4. Discussion

There is evidence to indicate that the COVID-19 pandemic and lockdown has impacted the mental health of adolescents in many ways ([Octavius et al., 2020](#); [Singh et al., 2020](#)). A study done by [Zhou et al. \(2020\)](#) which used PHQ-9 to assess depression, showed similar findings with adolescents exhibiting mild to severe depressive symptoms. Given that there is limited data on adolescent mental health from low-and middle-income countries (LMICs) ([El Omrani et al., 2021](#)) and especially among marginalized communities, our survey adds to this body of knowledge with specific relevance to the COVID-19 pandemic ([Singh et al., 2020](#)). However, there is more research needed to understand and explain the nature, degree, and mechanisms by which the pandemic, quarantine and isolation, and physical distancing can affect the mental health of adolescents ([Imran et al., 2020](#)). This will be critical in informing policies, programs, and investments into the building back agenda for adolescent mental wellbeing.

The first wave of COVID-19 in India affected cities and 40 % of the total cases were in urban spaces ([Ghosh et al., 2020](#); [UN-Habitat, 2020](#)). Though our survey indicates that COVID-19 cases was reported from the slum areas of the two study sites; like other epidemiological data, there has been a significant lack of reporting from slums across the country ([Raju et al., 2021](#)). The environmental conditions of overcrowding, informal settlements, inadequate access to water, sanitation, waste management and healthcare services in slums are risk factors for increased transmission of communicable diseases, such as pneumonia, diarrhea, and tuberculosis ([Sclar et al., 2005](#); [Alon Unger and Riley, 2007](#)). These risk factors can therefore severely challenge the containment measures of physical distancing and handwashing and act as additional stresses for adolescents during the COVID-19 pandemic and lockdown.

There is evidence to indicate the links between conditions of slum life and mental health ([Subbaraman et al., 2014](#); [Unger, 2013](#)). Studies among non-adolescent population have shown quite similar findings to our survey where people living in urban and slum conditions have higher rates of depression, anxiety, suicide, and substance use ([Andrade et al., 2012](#); [Chandra et al., 2018](#); [Subbaraman et al., 2014](#); [Unger, 2013](#)). In India, social factors such as being a girl ([Pillai and Gupta, 2014](#)) and belonging to marginalized and lower caste groups increase vulnerability ([Bosher et al., 2007](#)). Social exclusion and discrimination can put already vulnerable adolescents living in urban slums at greater risk of being infected by COVID-19. Evidence on the mental health impact of COVID-19 on adolescent girls indicate that they have more depressive symptoms, anger and suicide attempts and poorer mental

Table 1
Adolescents' socio-demographic characteristics and study variables (N = 3490).

Socio-demographic and study variables	n (%)
Survey site	
Faridabad	1692 (48.5)
Hyderabad	1798 (51.5)
Gender	
Male	1912 (54.8)
Female	1578 (45.2)
Education Level	
Up to 5th standard	136 (3.9)
Up to 10th standard	1800 (51.6)
Above 10th standard	1554 (44.5)
Social group	
SC/ST	668 (19.2)
OBC	1777 (50.9)
General	1045 (29.9)
Monthly family income	
Above Rs. 15,000	1846 (52.9)
Below Rs. 15,000	1644 (47.1)
Family type	
Nuclear	2714 (77.8)
Joint	776 (22.2)
Slum adversity	
No adversities	1768 (50.7)
Adversities	1722 (49.3)
Covid-19 positive	
No	3326 (95.3)
Yes	164 (4.7)
Covid-19 positive status*	
Self	9 (5.5)
Family members	42 (25.6)
Immediate neighbours	109 (66.5)
Close friends	14 (8.5)
Depression	
No depression (PHQ-9 scores 0-4)	2845 (81.5)
Depression (PHQ-9 scores 5-27)	645 (18.5)

Note:* Multiple responses, SC/ST: Scheduled Caste/Tribe, OBC: Other Backward Class.

Table 2
Factors associated with depression in a multivariate logistic regression model (N = 3490).

Background Variables	No Depression (PHQ-9 ≤ 4)		Depression (PHQ-9 ≥ 5)		Univariate findings		Multivariate findings	
	n (%)	n (%)	Odds ratio (CI)	p-value	Odds ratio (CI)	p-value		
Survey site								
Faridabad	1528 (90.31)	164 (9.69)						
Hyderabad	1317 (73.25)	481 (26.75)	3.4 (2.81–4.12)	<000*	3.593 (2.84–4.55)	<000*		
Gender								
Male	1592 (83.18)	322 (16.82)						
Female	1253 (79.51)	323 (20.49)	1.27 (1.07–1.51)	0.005	1.21 (1.01–1.45)	0.040		
Education level								
Up to 5th standard	105 (77.21)	31 (22.79)						
Up to 10th standard	1482 (82.33)	318 (17.67)	0.73 (0.48–1.1)	0.135	0.611 (0.39–0.96)	0.033		
Above 10th standard	1258 (80.95)	296 (19.05)	0.8 (0.52–1.21)	0.290	0.606 (0.38–0.96)	0.031		
Social group								
General	947 (90.62)	98 (9.38)						
SC/ST	520 (77.84)	148 (22.16)	2.75 (2.09–3.63)	<000*	1.604 (1.19–2.17)	0.002		
OBC	1378 (77.55)	399 (22.45)	2.8 (2.21–3.54)	<000*	1.642 (1.26–2.14)	<000*		
Monthly family income								
Above Rs. 15,000	1446 (78.33)	400 (21.67)						
Below Rs. 15000	1399 (85.1)	245 (14.9)	0.63 (0.53–0.75)	<000*	0.963 (0.78–1.18)	0.719		
Family Type								
Nuclear	2172 (80.03)	542 (19.97)						
Joint	673 (86.73)	103 (13.27)	0.61 (0.49–0.77)	<000*	1.09 (0.85–1.4)	0.503		
Slum adversity								
No adversities	1559 (88.18)	209 (11.82)						
Adversities	1286 (74.68)	436 (25.32)	2.53 (2.11–3.03)	<000*	3.342 (2.73–4.09)	<000*		
Covid-19 positive								
No	2750 (82.68)	576 (17.32)						
Yes	95 (57.93)	69 (42.07)	3.47 (2.51–4.79)	<000*	1.785 (1.26–2.53)	0.001		

Note: *p-value is significant at <0.05, SC/ST: Scheduled Caste/Tribe, OBC: Other Backward Class.

Table 3
Factors associated with depression among those with Covid-19 in a multivariate logistic regression model (N = 69).

Background Variables	n (%)	Univariate findings Odds ratio (p-value)	Multivariate findings	
			Odds ratio (CI)	p-value
Survey site				
Faridabad	2 (0.12)			
Hyderabad	67 (3.73)	32.71 (<000*)	39.36 (9.23–167.82)	<000*
Gender				
Male	26 (1.36)			
Female	43 (2.72)	2.03 (0.005*)	1.85 (1.12–3.07)	0.017*
Social group				
General	4 (0.38)			
SC/ST	24 (3.59)	9.7 (<000*)	2.79 (0.93–8.34)	0.067
OBC	41 (2.31)	6.15 (0.001*)	1.91 (0.66–5.5)	0.233
Monthly family income				
Above 15,000	46 (2.49)			
Below 15,000	23 (1.4)	0.56 (0.022*)	1.28 (0.74–2.18)	0.376
Family type				
Nuclear	63 (2.32)			
Joint	6 (0.77)	0.33 (0.009*)	0.92 (0.37–2.26)	0.850
Slum adversity				
No adversity	10 (0.57)			
Adversity	59 (3.43)	6.24 (<000*)	8.77 (4.35–17.68)	<000*

Note: *p-value is significant at <0.05, SC/ST: Scheduled Caste/Tribe, OBC: Other Backward Class.

wellbeing compared to boys (Halldorsdottir et al., 2021); and were more likely to experience negative mental health outcomes (Samji et al., 2021). Though the setting and context in which these studies were conducted were different, the findings concur with our survey where girls were about two times more likely to have COVID-19 infection alongside depression compared to boys.

Studies have shown that SC and ST groups have higher rates of depression and psychological stress (Mathias et al., 2015; Prost et al.,

2012), and report lower life satisfaction (Spears, 2016) than other castes. Adolescents belonging to SC/ST/OBC in our survey were about two times more likely to report depression compared to General group, which additionally indicates that mental health outcomes differentially impact marginalized groups. The lockdown severely impacted economic activities and family income of slum residents who are mostly engaged in informal occupations and are daily wage earners (Armand et al., 2020). Although economic hardships may act as an additional stress, monthly family income was not found to be significant in adjusted models. Most poverty measures such as education, food insecurity, housing, social class, socio-economic status, and financial stress consistently show an association with common mental disorders including depression in low- and middle-income countries (Lund et al., 2010). Likewise, our survey showed that adolescents with higher educational level were less likely to report depression compared to those with lower educational level. However, the relationship of income and common mental disorders are still equivocal (Lund et al., 2010), which is similar to what we found in our survey.

The factors in a slum setting that affect the levels of stress and mental health of adolescents may be both proximal (open sewers) or further upstream or structural (social policies). Thus, it is important to consider the broader social context and determinants of mental illness and how these factors influence their outcomes (The Lancet, 2021). Though adolescents are an otherwise healthy group, there is limited research on how disadvantageous physical, social, and legal circumstances in slums may affect their mental health and wellbeing in various ways. This is crucial as the immediate or cumulative effects of early life stress is associated with increased risk of developing mental disorders later in adult life (Syed and Nemeroff, 2017). Findings from this study have shown the combined effects of slum adversities, gender, social caste on COVID-19 and depression particularly among adolescents residing in marginalized environments. The strength of this study is in highlighting the effects of these social and economic factors, which act as stressors, on adolescent depression in the context of COVID-19 while living in urban slums.

Adolescents in our survey were faced with economic hardships, like unable to repay their existing loans while having to pay for electricity

and water. Given the cross-sectional nature of our survey, evidence of the causal links between slum conditions, COVID-19 and mental health is difficult to establish in complex settings such as a slum. It would thus be important to examine whether these adversities have been heightened because of the Covid-19 pandemic. Longitudinal studies that include cohorts of children being followed-up at different time points of their adolescent lives would help in answering causal links of this nature. Another limitation of the survey was that the sample was not representative of the adolescent population living in urban slums and therefore these findings may not be wholly generalizable to similar settings. As this survey was part of a larger study, additional details like the time of being affected; and the impact of COVID-19, such as hospitalization, death, income loss, and intrafamilial conflict were not collected from study participants.

5. Conclusion and implications

There is a need for an intersectional research framework that incorporates stress arising out of a pandemic, social disadvantage, and structural and systemic inequities. Thus, research, programs, and policies need to consider both individual and community level factors to improve mental well-being of vulnerable adolescent groups affected by COVID-19. There should be more investment in culturally, contextually, accessible, affordable, non-stigmatizing, and non-discriminatory adolescent mental health support services. From a public health perspective, the implication of this study is that state governments should ensure that children and adolescents from marginalized communities have free access to COVID-19 testing, treatment and vaccines. In addition to this, families of adolescents should be provided social protection coverage that include financial and cash transfers to tide over hardships heightened by COVID-19.

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CRedit authorship contribution statement

MD and PKM conceptualized the manuscript. MD and PKM detailed the content of the paper and MD and LP prepared the initial draft. PKM, AK and LP provided preliminary inputs and comments to an earlier draft. PKM commented on a draft before sending a prefinal version to everyone listed as authors. All authors provided critical intellectual inputs and comments to the draft. LP contributed to the statistical aspects of the survey. Each author has critically reviewed, commented, and approved the final manuscript.

Declaration of Competing Interest

The George Institute has a part-owned social enterprise, George Health Enterprises, which has commercial relationships involving digital health innovations. PKM is partially supported through NHMRC/GACD grant (SMART Mental Health- APP1143911) and UKRI/MRC grant MR/S023224/1 - Adolescents' Resilience and Treatment Needs for Mental health in Indian Slums (ARTEMIS), MD, SD, SK and AK are partially or wholly supported through the SMART Mental Health NHMRC/GACD grant. AK is partially supported by Indigo Partnership (MR/R023697/1) award. LP is wholly supported through the ICMR ad hoc grant (2019-0531).

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ajp.2022.103194](https://doi.org/10.1016/j.ajp.2022.103194).

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