



## Changes in perceived stress and food or housing insecurity associated with COVID-19 in doctor of pharmacy students: A pre- and current-COVID-19 survey

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### ABSTRACT

**Background:** The novel coronavirus 2019 (COVID-19) pandemic impacted everyday life for most individuals, including students. Unique COVID-19 stressors among students may include virtual learning, mental stress, and being socially distanced from classmates. Studies examining the impact of COVID-19 on stress and lifestyle changes among pharmacy students are limited.

**Objective:** The primary purpose of this study was to compare stress and food or housing insecurity changes associated with COVID-19 in U.S. Doctor of Pharmacy (PharmD) students pre-COVID vs. during-COVID.

**Methods:** A 23-item survey was administered via Qualtrics® to multiple PharmD programs across the U.S. in pre-COVID-19 (spring 2019) and during-COVID-19 (spring 2021). Participants were recruited via e-mail. The survey included questions related to demographics, lifestyle (sleep, exercise, work hours, extracurricular activities), and food and housing insecurities. The survey also included a validated instrument to measure stress (Cohen-Perceived Stress Scale). Results from 2021 were compared to a similar national survey serendipitously administered prior to COVID-19 in Spring 2019.

**Results:** Pre- and COVID-19 analytical cohorts included 278 and 138 participants, respectively. While pre-COVID-19 students were slightly older ( $29.9 \pm 4.7$  vs.  $27.7 \pm 4.2$ ,  $p < 0.001$ ), relative to COVID-19 students, other demographic factors were similar. No significant difference was observed in reported stress levels (PSS =  $20.0 \pm 6.3$  vs.  $19.7 \pm 6.2$ ,  $p = 0.610$ ) between time periods. Significant differences in food (53.2% vs. 51.4%,  $p = 0.731$ ) and housing (45.0% vs. 47.1%,  $p = 0.680$ ) insecurity were also not seen.

**Conclusions:** These findings highlight that PharmD students' perceived stress and food and housing insecurities due to COVID-19 may have been minimal. Additional studies on pharmacy students should be conducted to validate these results. These results may help inform policymakers and stakeholders during the early stages of any future pandemics.

### 1. Introduction

In March 2020, the coronavirus 2019 (COVID-19) pandemic changed

the landscape of everyday life for most individuals. In response to the public health crisis, states mandated emergency stay-at-home orders for non-essential workers and students to slow the spread of infection. The

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stay-at-home orders isolated these individuals from friends and family, resulting in unintended consequences such as loneliness and low distress tolerance.<sup>1,2</sup> These changes may have posed unique stressors for college students, including increased class workload, difficulty adapting to virtual learning, financial uncertainty, and concerns regarding their living and working environment.<sup>3</sup> Moreover, COVID-19 may have had an independent effect on stress and depression in students.<sup>2-4</sup>

In addition to increased stress and inability to focus on schoolwork, many college students experienced food and housing insecurities. Per the United States Department of Health and Human Services, food insecurity is defined as the household-level economic and social condition of limited or uncertain access to adequate food while housing insecurity is an umbrella term that encompasses several challenges including but not limited to having difficulties paying rent, moving frequently, or spending the bulk of household income on housing.<sup>5,6</sup> A cross-sectional online survey study conducted among college students in Texas between May and June 2020 reported that 1 in 3 students experienced food insecurity during the 30 days preceding the survey.<sup>7</sup> This study noted the most prevalent reason for food insecurity among college students was due to changes in living arrangements and income loss.<sup>7</sup> The authors suggested assistance programs employed during the pandemic might be insufficient for some college students, and the impact and financial hardship due to sudden income loss experienced during the pandemic may significantly burden these students.

Prior studies examining the impact of COVID-19 on college students have generally focused on non-healthcare discipline students. Studies focusing on health profession students, (i.e., medical, nursing students) have predominantly reported an increase in stress and other mental health symptoms related to COVID-19.<sup>8-10</sup> In contrast, studies that surveyed pharmacy students were less conclusive<sup>11-18</sup> While some studies did align with the findings from medical or nursing students and noted an impact on student wellness, reported stress, and food or housing insecurity due to the pandemic, other studies found no significant differences in these reported factors. Furthermore, some pharmacy student studies even noted opportunities for strengthening areas such as emotional intelligence due to the changes associated with remote learning.<sup>19</sup> Limitations of prior pharmacy student studies include not surveying multiple campuses, not using a widely validated measure of stress, and lack of a proper pre-COVID baseline to serve as a control.<sup>12</sup> Additionally, these previous studies did not appear to query students regarding lifestyle measures such as sleep, exercise, work, and extracurricular hours. The limitations of these previous studies, along with the opportunity to study the impact of a major and sudden shift to the pharmacy student learning environment provided the rationale for the current study.

This study aimed to analyze changes in perceived stress and food or housing insecurity associated with the COVID-19 pandemic in pharmacy students. It compares results from a multi-school survey administered during COVID-19 with results from an identical survey that had been serendipitously administered prior to COVID-19.

## 2. Methods

Participants were recruited from individual pharmacy schools from the Midwest, East Coast, and West Coast via e-mail. The initial survey was administered before the pandemic in the spring of 2019, and the follow-up survey was administered in the spring of 2021 while the pandemic was ongoing. With both surveys, an initial e-mail announcement was sent out by a faculty representative to the currently enrolled PharmD students, along with an additional e-mail reminder sent to non-respondent students two weeks later. Individuals who completed either of the surveys had the option to enter a random drawing for one of twenty-five \$20 gift cards.

A 23-item web-based survey constructed using Qualtrics (Provo, Utah) was utilized for both cohorts. Both surveys included the *Perceived Stress Scale* (PSS) screening tool to assess pharmacy student stress. The

PSS is a widely used and validated psychological instrument and considered one of the psychometric “gold standards” for measuring stress.<sup>20,21</sup> More specifically, the PSS measures the degree to which situations in one’s life are determined as stressful. There are ten questions based on a 0- to 4-point scale asking about feelings and thoughts during the last month to measure perceptions of stress. A value out of 40 total points determines the severity of an individual’s stress; a lower score (0–13) indicates low stress, a mid-range score (14–26) equals moderate stress, and a higher score (27–40) indicates high stress.<sup>22</sup>

The surveys also included demographic questions as well as queries regarding their current lifestyle (e.g., sleep, exercise, work hours, extracurricular hours) and food or housing insecurity concerns. To adequately assess food and housing insecurity, two questions were asked on how often they were worried or stressed about having sufficient funds to buy nutritious meals or pay rent/mortgage in the last 12 months. Likert responses of “always,” “usually,” or “sometimes” were considered food or housing insecure, while “rarely” or “never” were considered food or housing secure. Responses for food and housing insecurity were converted to dichotomous “yes” or “no” values for analyses. While the questions related to food and housing insecurity were self-developed, they demonstrated high criterion validity with the 6-item short-form Food Security Survey Module (USDA) and the Veteran’s Homelessness Screening Clinical Reminder (HSCR) tool, respectively.<sup>23-25</sup> The survey and all study procedures and were approved and deemed exempt from further review via ethics review by the Institutional Review Board (IRB) at Touro University (IRB#P-0321).

Descriptive statistics were used to summarize the demographics. Categorical data were reported as frequency and percentages, while continuous data were reported as means  $\pm$  standard deviation. Pearson’s chi-squared and Fisher’s exact tests were used for comparisons of categorical data, while Student’s *t*-tests and Wilcoxon rank-sum tests were used for comparisons of continuous and ordinal data, respectively.

Multivariate linear and logistic analyses were conducted to examine the impact of the pandemic on student stress (PSS scores) and food or housing insecurity while controlling for other factors. More specifically, the multivariate models were run controlling for student age, gender, race, marital status, didactic versus experiential place in the program, and school. Indicators (dummy variables) were created for each categorical variable used in the model, while age was left as a continuous variable. Confidence intervals were calculated for the indicator variable related to the pandemic, along with overall goodness of fit measures for the models ( $r^2$  for multivariate linear and *c* statistics for multivariate logistic regression). There was no evidence of collinearity in the multivariate models, as variance inflation factors did not exceed 2.0. *P* values of  $<0.05$  were considered statistically significant for all statistics. All Statistical analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC).

## 3. Results

### 3.1. Participants

Each survey reached approximately 1500 PharmD students across the participating pharmacy programs. The 2019 survey had a response rate of 15.9%, with a total of 278 usable responses included in the final analysis of this study. In comparison, the 2021 survey administered during COVID-19 had a response rate of 9.2%, with a total of 138 usable responses. The demographic data of these participants are summarized in [Table 1](#). While pre-COVID-19 surveyed students were slightly older ( $29.9 \pm 4.7$  vs.  $27.7 \pm 4.2$ ,  $p \leq 0.001$ ) and less likely to be Hispanic (12.2% vs. 29.7%,  $p < 0.001$ ), other demographic factors were similar.

Inclusion criteria consisted of Doctor of Pharmacy students at one of the participating schools: 1) Keck Graduate Institute, 2) Larkin University College of Pharmacy, 3) Long Island University Arnold & Marie Schwartz College of Pharmacy and Health Sciences, 4) Medical College of Wisconsin School of Pharmacy, 5) Touro University California College

**Table 1**  
Characteristics of U.S. PharmD Programs Pre- and During- COVID-19.

	Pre-Covid-19	During-Covid-19	P-value
Current age, Mean ± S.D., years	N = 278 29.92 ± 4.68	N = 138 27.65 ± 4.22	<0.001
Female, n (%)	188 (67.6)	97 (70.3)	0.582
Race, n (%)	(N = 276)	(N = 129)	
Asian	130 (46.8)	44 (31.9)	0.016
White	58 (20.9)	35 (25.4)	0.161
Hispanic	34 (12.2)	41 (29.7)	<0.001
Middle Eastern	22 (7.9)	4 (2.9)	0.065
Other	34 (12.2)	5 (3.6)	0.008
Sexual orientation, n (%)	(N = 276)	(N = 138)	
Heterosexual	246 (89.1)	124 (89.9)	0.676
Gay or bisexual	11 (3.9)	11 (8.0)	0.085
Decline/other	19 (6.8)	3 (2.2)	0.027
Marital Status, n (%)	(N = 278)	(N = 138)	
Single	197 (70.8)	102 (73.9)	0.515
Married/living with partner	65 (23.4)	31 (22.5)	0.834
Other/declined	16 (5.8)	5 (3.6)	0.350

of Pharmacy, and 6) University of Charleston School of Pharmacy, with internet access who were part of an e-mail listserv for current students. Exclusion criteria included students under the age of 21, and pharmacy students not currently enrolled in the PharmD program (e.g., master’s or Ph.D. program students).

3.2. Stress, food or housing insecurities, and lifestyle

3.2.1. PSS scores

The mean PSS scores were comparable between the 2019 survey (20.0 ± 6.3) and the 2021 survey (19.7 ± 6.2), (p = 0.610), respectively (Table 2). No statistically significant differences were found between the two cohorts in response to the 10-item PSS questionnaire (Table 2). Further, no trends were apparent when examining the distribution of the Likert response for the individual components of the PSS (Table 3).

Additionally, no significant differences in food (53.2% vs. 51.4%, p = 0.731) or housing (45.0% vs. 47.1%, p = 0.680) insecurity were seen (Table 3). Further, no significant lifestyle changes were reported over the past 12 months with regards to average hours of exercise, work (paid position), or extracurricular activities (community service, organizations, leadership) per week. However, statistically significant differences were noted in hours of sleep. More specifically, pre-COVID-19 pharmacy students reported getting significantly less sleep relative to COVID-19 students (7.1 ± 1.10 vs. 7.4 ± 1.11 h, p = 0.0232) with a smaller percentage reporting good or fairly good sleep overall relative to COVID-19 students (53.6% vs. 68.8%, p = 0.012), respectively.

3.2.2. Multivariate results

No significant differences in PSS (p = 0.687), food insecurity (p = 0.807), or housing insecurity (p = 0.865) were noted in the multivariate models after controlling for age, gender, race, marital status, didactic vs. experiential, and school (Table 4).

4. Discussion

The overall objective of this study was to examine changes in perceived stress levels as well as reported levels of food or housing insecurity in pharmacy students related to the COVID-19 pandemic. Results from comprehensive surveys administered across multiple pharmacy schools in Spring 2019 and Spring 2021 found no statistical differences for the three primary outcome variables in either unadjusted or adjusted results. In addition, no significant differences were noted when results were stratified between didactic and experiential students. However, a significant increase in the amount of sleep was reported in the COVID-19 cohort relative to the pre-COVID-19 cohort. The study’s outcomes may be attributed to the following reasons: the transition from

**Table 2**  
Perceived Stress Score (PSS).

		Pre-Covid-19	During-Covid-19	P-Value
Perceived Stress Score (PSS)		(N = 278)	(N = 138)	
Mean ± standard deviation		20.0 ± 6.3	19.7 ± 6.2	0.6101
In the last month, how often have you been upset because of something that happened unexpectedly?	Never	15 (3.61)	2 (0.48)	0.0556
	Almost never	37 (8.89)	27 (6.49)	0.0959
	Sometimes	137 (32.93)	62 (14.9)	0.4027
	Fairly often	65 (15.63)	37 (8.89)	0.4438
	Very often	24 (5.77)	10 (2.40)	0.6269
In the last month, how often have you felt you were unable to control the important things in your life?	Never	19 (4.57)	6 (1.44)	0.3150
	Almost never	51 (12.26)	31 (7.45)	0.3201
	Sometimes	109 (26.20)	55 (13.22)	0.8989
	Fairly often	69 (16.59)	25 (6.01)	0.1237
	Very often	30 (7.21)	21 (5.05)	0.1950
In the last month, how often have you felt nervous or “stressed”?	Never	5 (1.20)	2 (0.48)	0.7943
	Almost never	23 (5.53)	9 (2.16)	0.1180
	Sometimes	63 (15.14)	41 (9.86)	0.3675
	Fairly often	85 (20.43)	44 (10.58)	0.7859
	Very often	102 (24.52)	42 (10.10)	0.2067
In the last month, how often have you felt confident about your ability to handle your personal problems?	Never	2 (0.48)	2 (0.48)	0.4726
	Almost never	22 (5.29)	14 (3.37)	0.4460
	Sometimes	120 (28.85)	56 (13.46)	0.6152
	Fairly often	90 (21.63)	51 (12.26)	0.3525
	Very often	44 (10.58)	15 (3.61)	0.1723
In the last month, how often have you felt that things were going your way?	Never	4 (0.96)	2 (0.48)	0.9933
	Almost never	37 (8.89)	16 (3.85)	0.6213
	Sometimes	157 (37.74)	77 (18.51)	0.8956
	Fairly often	63 (15.14)	35 (8.41)	0.5411
	Very often	17 (4.09)	8 (1.92)	0.8978
In the last month, how often have you found that you could not cope with all the things that you had to do?	Never	20 (4.81)	6 (1.44)	0.2588
	Almost never	78 (18.75)	47 (11.30)	0.2088
	Sometimes	107 (25.72)	54 (12.98)	0.8994
	Fairly often	54 (12.98)	17 (4.09)	0.0697
	Very often	19 (4.57)	14 (3.37)	0.2395
In the last month, how often have you been able to control irritations in your life?	Never	4 (0.96)	1 (0.24)	0.5291
	Almost never	30 (7.21)	16 (3.85)	0.8058
	Sometimes	136 (32.69)	61 (14.66)	0.3642
	Fairly often	88 (21.15)	52 (12.50)	0.2207
	Very often	20 (4.81)	8 (1.92)	0.5923
In the last month, how often have you felt that you were on top of things?	Never	10 (2.40)	6 (1.44)	0.7078
	Almost never	67 (16.11)	26 (6.25)	0.2253
	Sometimes	117 (28.13)	50 (12.02)	0.2514
	Fairly often	73 (17.55)	50 (12.02)	0.0358
	Very often	11 (2.64)	6 (1.44)	0.8496
In the last month, how often have you been	Never	15 (3.61)	4 (0.96)	0.2507

(continued on next page)

**Table 2** (continued)

		Pre-Covid-19	During-Covid-19	P-Value
angered because of things that were outside your control?	Almost never	58 (13.94)	38 (9.13)	0.1283
	Sometimes	127 (30.53)	59 (14.18)	0.5715
	Fairly often	58 (13.94)	31 (7.45)	0.7078
	Very often	20 (4.81) (N = 278)	6 (1.44) (N = 138)	0.2588
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	Never	28 (6.73)	10 (2.40)	0.3463
	Almost never	57 (13.70)	38 (9.13)	0.1077
	Sometimes	120 (28.85)	56 (13.46)	0.6152
	Fairly often	49 (11.78)	23 (5.53)	0.8076
	Very often	24 (5.77)	11 (2.64)	0.8188

**Table 3**

Comparisons of Lifestyle and Food and Housing Insecurities for U.S. PharmD Programs Pre- vs. During- COVID-19.

Comparisons	Pre-Covid-19 N = 278	During-Covid-19 N = 138	P-value
	(N = 273)	(N = 136)	
Food insecurity (usually/always/sometimes), n (%)	148 (53.2)	71 (51.4)	0.731
Housing insecurity (usually/ always/sometimes), n (%)	125 (45.0)	65 (47.1)	0.680
	(N = 274)	(N = 130)	
Avg. minutes of exercise per week during past 12 months, mean $\pm$ SD	1.10 $\pm$ 1.67	1.37 $\pm$ 1.67	0.145
Daily sleep Mean $\pm$ SD, hours	7.1 $\pm$ 1.10 (N = 276)	7.4 $\pm$ 1.11 (N = 138)	0.0232
Avg. hours of work (paid position) per week during past 12 months, mean $\pm$ SD	8.80 $\pm$ 8.01 (N = 265)	9.70 $\pm$ 9.26 (N = 126)	0.305
Avg. hours of extracurricular activities (community service, organizations, leadership) per year during past 12 months, mean $\pm$ SD	93.9 $\pm$ 459	58.7 $\pm$ 163	0.405

in-class to online learning, which enabled students more autonomy and “control,” decreases in commute time, resulting in increased sleep, and the resilience and zeal of pharmacy students to complete their pharmacy education. These findings suggest that while self-reported stress, food insecurity, and housing insecurity remained elevated in pharmacy students, no direct relationship was found between the changes associated with COVID-19 and the reported measures.

The COVID-19 pandemic profoundly impacted the graduate program education system in the U.S., introducing many new and unprecedented stressors, which include a rapid shift to e-learning, mental stress from the pandemic, and isolation from classmates and peers due to social distancing requirements. Despite these multi-faceted challenges, the study at hand demonstrated comparable levels of stress and food and housing insecurity levels in a multi-school survey conducted pre-pandemic and mid-pandemic among pharmacy students. While the

finding of no significant differences among the three primary outcome variables may appear surprising, it does align with select pharmacy student literature.<sup>12,15</sup> For example, a survey conducted in May 2020 among pharmacy students failed to report significant changes in stress associated with COVID-19.<sup>12</sup> In addition, a study conducted among pharmacy students during high stakes performance-based exams found significantly lower stress levels during the pandemic relative to pre pandemic levels.<sup>15</sup> In contrast, other studies have suggested an overall negative impact on mental health among pharmacy students due to the pandemic.<sup>11,13</sup> However, it should be noted that e-learning associated with the pandemic was accompanied by self-reported higher student grades in one of these studies.<sup>11</sup> A study focusing on graduate pharmacy students also suggested a negative effect of the pandemic on student wellness.<sup>16</sup> Lastly, it bears mention that studies conducted on other health professional students, mainly medical and nursing students, have also supported the notion of increased stress related to COVID-19.<sup>8-10</sup>

The absence of notable changes in stress among pharmacy school students between pre and pandemic cohorts could be attributed to several mitigating factors. First, the transition to remote learning may have allowed students to feel increased autonomy as the burden of commute time and campus requirements were now relieved.<sup>26</sup> Previous literature has noted that students commuting less may use this reclaimed time for studying, sleeping, or recreation, correlating with greater well-being.<sup>26</sup> Additionally, the students in the 2021 (COVID) analytical cohort reported an increase in mean sleep compared to those surveyed in 2019 (pre-COVID). This increase in sleep hours may translate to being better rested students and, therefore, an independent reduction in stress levels. Another aspect that should be considered is that prior to the onset of COVID-19, pharmacy students' perceived stress was already elevated compared to the general population.<sup>27</sup> While the COVID-19 pandemic undoubtedly introduced a considerable number of new stressors, it's possible that since pharmacy students were already operating at a high-stress threshold prior to the pandemic, the addition of COVID-19 stressors on the students' perception of stress was not as impactful as initially expected. Another suggested coping mechanism for emotional well-being among pharmacy students is personal resilience. More specifically, the determination of students to complete their pharmacy education may have been a motivational factor and thus may have kept students driven and focused regardless of the pandemic.<sup>28</sup>

This study also demonstrated students' perceptions of food and housing insecurity remained comparable pre-COVID-19 and during COVID-19. U.S. unemployment rates increased drastically from 3.8% in February 2020 to 13.0% in May 2020.<sup>29</sup> At the onset of the pandemic, there were significant concerns surrounding widespread job losses and the possible food and housing insecurity issues related to these losses. However, this study did not show a difference in student-reported food or housing insecurity from spring 2019 to spring 2021. The results from this survey also failed to demonstrate a significant difference in the average number of hours worked at a paid position per week, signaling that most pharmacy students likely did not suffer from job income loss. This may be attributed to pharmacy staff being declared essential workers, enabling students who were working in pharmacies to retain their employment status.<sup>30-34</sup> Additionally, in March 2020, the federal government passed the Coronavirus Aid, Relief and Economic Security (CARES) Act, allocating approximately \$14 billion in emergency funding to the Higher Education Emergency Relief Fund [36]. Following the CARES Act was the Higher Education Emergency Relief Fund II (HEERF II), authorized in December 2020 by the Coronavirus Response and

**Table 4**

Multivariate Results. Models controlling for age, gender, race, marital status, school of pharmacy, and didactic vs. experiential.

Outcome Measure	Beta Coefficient or Odds Ratio for Pandemic Effect (reference = pre-pandemic)	P-value	95% Confidence Interval	Model fit
PSS	0.33	0.687	-1.16-1.76	$r^2 = 0.141$
Food Insecurity	0.935	0.807	0.55-1.58	c statistic = 0.66
Housing Insecurity	0.956	0.865	0.57-1.60	c statistic = 0.65

Relief Supplemental Appropriations Act (CRRSAA). The HEERF II provided over \$80 billion for educational and student support.<sup>35</sup> With various amounts of relief aid from the federal government as well as being able to maintain their employment status at pharmacies, students' perception of financial stress may have been eased and thus contributed to the lack of significant differences noted in food or housing insecurity pre-pandemic and during the pandemic.

This study is not without limitations. First, the survey response rate in both surveys was lower than anticipated. However, the response rates for the study were comparable to other recent pharmacy student surveys.<sup>12,15</sup> Secondly, administrative challenges resulted in one school participating only in the pre-COVID survey and another school participating only during the COVID-19 survey. However, multi-variate results were adjusted for schools. Additionally, food and housing insecurities may be underreported in the study as it did not consider factors other than cost. The surveyed cohorts during the pandemic may have also been biased as students whose stress levels were significantly affected by the COVID-19 pandemic may not have had the capacity or desire to complete the survey. Lastly, surveys may introduce recall bias since certain parts of the questionnaire such as the food and housing insecurity survey required students to rely on memory to recollect their experiences and perceptions in the 12 months. Despite these limitations, the study did have many strengths including the surveying of multi-schools, the utilization of a global "gold standard" tool for measuring stress, the testing of confounding factors when conducting analyses, and the use of the same questionnaire for both the pre and during-COVID surveys.

## 5. Conclusion

This study investigated the changes in perceived stress and food or housing insecurity associated with the COVID-19 pandemic in pharmacy students. Although it may be perceived that COVID-19 would have placed a greater burden on the stress levels and food or housing insecurity of pharmacy students in the U.S., this study suggests otherwise. These findings are consistent with literature looking into the impact of COVID-19 on stress levels in smaller numbers of pharmacy students from single institutions. These results may assist policymakers and stakeholders during future pandemics regarding the development of long-term pandemic preparedness plans. While this study highlighted the flexibility and adaptability of pharmacy school students during an unprecedented challenge, future research on Doctor of Pharmacy students' perceived stress and food or housing insecurity during stable times may be warranted.

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## Declaration of Competing Interest

The authors have declared no potential conflicts of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rcsop.2023.100391>.

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