Antecedents of statistics anxiety in a higher education system

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Abstract

This study contended that learning statistics and its rudiments were perceived as complicated compared to some other courses offered at the university level. Further, this investigation contested the existence of statistics anxiety among postgraduate students in an in-site university setting. Relationships and differences were determined in this study utilizing the constructs of antecedents of statistics anxiety namely academic procrastination, perfectionism, and gender. The objectives were (1) to establish the relationship between academic procrastination and statistics anxiety; (2) to find out the relationship between perfectionism and statistics anxiety; and (3) to investigate the differences between gender and statistics anxiety. The data from randomly selected 136 postgrad students (Kampala International University, Uganda) referring to dispositional (procrastination and perfectionism) and environmental antecedents (gender) and statistics anxiety were scientifically elicited, processed and analyzed utilizing the quantitative-post positivist's research paradigm model. The findings revealed a positive but insignificant relationship between academic procrastination and statistics anxiety; a significant adverse correlation between perfectionism and statistics anxiety; an insignificant positive correlation existed between gender and statistics anxiety, and differences in statistics anxiety between the female and male students existed. Notably from the results then, academic procrastination did not significantly affect the students' statistics anxiety; the students with higher levels of perfectionism tended to have lower levels of statistics anxiety while the levels of statistics anxiety among the female students were slightly greater than that of the male students.

Keywords
Academic-procrastination, anxiety, gender, perfectionism, statistics

1. Introduction

In Uganda, academic achievement is not underrated as it is used to evaluate the learner, the teacher, and the education system. Postgraduate education is taken as a lucrative pursuit and underscored most especially its research element in the aspects of research methodology, methods, and techniques including the vital issues of statistics. In most instances, Statistics is offered as a course across academic disciplines most importantly at postgraduate level. Notably, students' view statistics as a rather challenging and anxiety provoking course more so for those

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learners who have challenges with mathematics and related numbers, figures, and computations. Several studies have been carried out regarding statistics anxiety among students such as those of (Onwuegbuzie and Wilson, 2003; Onwuegbuzie, 2003; Onwuegbuzie, 2004; Williams, 2010; Liu, Onwuegbuzie, and Meng, 2011; Vahedi, Farrokhi, Gahramani and Issazadegan, 2012). Onwuegbuzie, *et al*., 2003 observed that many students experience high statistics anxiety levels and offering statistics as a course creates negative experiences to these students mainly because some academic background have nothing much to do with statistics. In fact, Vahedi, *et al*., 2012 reported that almost 66-80% of graduate students experience statistics anxiety. This finding rhymed with Onwuegbuzie's, 2004 findings where 80% of graduate students experienced uncomfortable statistics anxiety levels. Students who experienced higher levels of statistics anxiety tended to perform poorly in statistics and statistics related courses like research and continually postponed assignments that involved statistics (Onwuegbuzie, 2004; Macher, Paechter, Papousek and Ruggeri, 2012).

Statistics anxiety is a pervasive problem in many fields of study (Macher, *et al*., 2012). Onwuegbuzie *et al.*, 2003 highlight different areas like education, psychology, sociology as some of the courses where it is prevalent. It is, therefore, no doubt that most students from areas struggle with statistics related courses such as research methodology and statistical methods as Statistics are all pervaded. Its applications have increased in recent years (Onwuegbuzie, *et al*., 2003) as it has permeated into different fields. Statistics is a means to the end not a goal in itself. It is used in research to come to conclusions. In academics, statistics play an essential role as it assists students in undertaking empirical studies (Coetzee and Van der Merwe, 2010). It is worth noting that statistics anxiety will, therefore, cripple academic development as well as living life. It applies to workplaces, shopping malls, sports, accounts (Chew and Dillon, 2014). Therefore the importance of statistics cannot be underestimated. The universe's language is statistics. It is the water and salt of education, research, and development.

Statistics have become inevitable in today's life both on personal and government levels as a whole (Coetzee, *et al.*, 2010 and Chew, *et al*., 2014). The government policies base on statistics prepared by trained individuals through school (Chew *et al.*, 2014). On the other hand, the importance of statistical data to students cannot be underestimated as it is a requirement for further studies at tertiary level, especially at postgraduate level (Coetzee *et al.*, 2010; Chew, *et al.*, 2013; Chew, *et al.*, 2014). Despite the fact that statistics is a vital component for a degree and even a soft skill at that, students still fear and avoid statistics. Coetzee, *et al.*, 2010 opine that students view statistics as one of the hurdles to their graduation. Students find it hard to grasp statistical concepts (Onwuegbuzie, 2003) which later affect their grades in statistics courses and other related courses like research methodology. The fear of statistics increases procrastination, lowers academic achievement and may lead to statistics course avoidance. Statistics anxiety is real and present in institutions of higher learning in the world and Uganda in particular. Its causes include challenging attitudes towards statistics, procrastination, prior mathematics knowledge, nature of the subjects, teacher's personalities, learning strategies, among others (Onwuegbuzie and Delay, 1999; Onwuegbuzie, 2004; Baloglu, 2003; Macher, *et al*., 2012 and Chew, *et al*., 2014).

The problem investigated starts by identifying these causes as being grouped into three antecedents that are situational, dispositional and environmental. In this study then, the dispositional antecedents (perfectionism and procrastination) and environmental antecedents

(gender) and statistics anxiety are interplayed regarding relationships and differences. It is also conspicuously noted that most evidence-based studies on statistics anxiety were done outside Uganda. With the current trends in technological growth, advances, work and skills demands in the knowledge economy and globalization, the students of today have become digital citizens with higher learning needs relevant for their future employability and immersion into the cyberspace. For more research-based data, this study underscores to bridge some other gaps in information related to statistics anxiety in African setting and Uganda in particular. For reasons of validating and generating evidence-based data to serve as bases on how this phenomenon is better dealt with, this study embarked on utilizing Kampala International University, Uganda as the setting and its postgraduate students as the study population.

Based on the results of the previous studies, the researchers hypothesized that:
(H₁): There exists a significant positive relationship between academic procrastination and statistics anxiety.
(H₂): There is a significant positive relationship between perfectionism and statistics anxiety
(H₃): There is a significant difference in statistics anxiety between the male and female respondents.

2. Related Literature

Statistics Anxiety

Statistics anxiety is defined "as the feeling of fear encountered when taking a statistics course or doing statistical analyses" (Cruise, Cash, and Bolton, 1985, p. 92). While (Zeidner, 1991) defined statistics anxiety as an emotional state an individual exhibits regarding significant worry, mental disorganization, intrusive thoughts, tension, and physiological arousal when exposed to statistics. At times, this is regarding content, problems, and instructional situations. This emotional state interferes with the manipulation of statistical data and statistical analysis. (Macher, Paechter, Papousek, Ruggeri, Freudenthaler, and Arendasy, 2013) defined statics anxiety as a feeling of apprehension that occurs to a student exposed to statistics content, problems, instructional situations and evaluative contexts. A more recent definition was stated by (Chew, *et al.*, 2014) that statistics anxiety is

> *"...a negative state of emotional arousal experienced by individuals as a result of encountering statistics in any form and at any level; this emotional state is preceded by negative attitudes towards statistics and is related to but distinct from mathematical anxiety" (p. 199).*

Therefore, statistics anxiety relates to negative emotional feelings exhibited by students placed in situations that require working with statistics regarding manipulation, analysis, application, and interpretation.

Statistics anxiety is a multidimensional construct as reported by (Onwuegbuzie, *et al.,* 1999; Baloglu, 2003; Onwuegbuzie, 2004; Liu, *et al.*, 2011; Macher, *et al.*, 2012; Chew, *et al.* 2013 and Chew, *et al.*, 2014). Statistics anxiety consists of six factors which are: worth of statistics, interpretation anxiety, test, and class anxiety, computation self-concept, fear for asking for help and fear of statistics teachers. The worth of statistics is related to students' perception of the relevance of statistics. Interpretation anxiety relates to the feeling of uneasiness encountered by the student while interpreting statistical data. Test and class anxiety is apprehension involved

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when taking statistics test or in statistics class. Computation self-concept is experienced when attempting to solve statistical and mathematical problems as well as student's perception of his/her ability to carry out computations. On the other hand, fear of asking for help is involved when seeking for help from fellow students and fear of statistics teachers relates to students' perception of statistics instructor.

Statistics anxiety is further conceptualized by (Earp, 2007), in six different constructs which are; anxiety, performance, history and self-concept, expectation, attitude and fearful behavior. He viewed anxiety as it relates to tests, math, the class, statistics content, numbers and interpretation of numerical data. Earp, 2007 defined performance domain as self-reported, the perception of course performance, ability to perform statistical operations and ability to learn statistical concepts. In terms of history and self-concept, Earp defined it in terms of developmental history of success or failure in situations involving mathematics, low math self-esteem, low self-concept, prior educational experiences, perceived quality of previous mathematics classes, motivation to learn, difficulty of material in last mathematics classes and quality of instruction at an earlier mathematics and statistics classes. Expectations domain was conceptualized by "social and cognitive expectations, unrealistically high expectations from parents and peers, and a high expectation of punishment. Fearful behavior with regards to great worry, intrusive thoughts, mental disorganization, tension, and fear related to instructors, asking for help, previous behavior, present behavior and future behavior (Earp, 2007). In this study, the researchers used statistics anxiety to mean anxiety, attitude towards statistics class, fearful behavior, attitude towards mathematics and performance.

Antecedents of Statistics Anxiety

The antecedents of statistics anxiety are classified as situational, dispositional and environmental antecedents (Onwuegbuzie, *et al*., 2003). According to Chew, *et al*., 2014, situational antecedents refer to factors that surround the student, whereas dispositional antecedents relate to the personality of the student while environmental antecedents are events that occurred in the past of a student before statistics course. Situational factors of statistics anxiety are prompt and result from the statistics courses and include 'statistics teachers, nature of statistics courses, lack of feedback from statistics instructors, the pace of statistics instruction, and statistical terminology' (Vahedi, *et al.*, 2012, p. 41). Other situational factors include statistics prior knowledge, statistics course grade, the state of the course (elective or required), major (statistics or non-statistics) and attitudes towards calculators (Onwuegbuzie, *et al*., 2003). Dispositional factors include psychological and emotional characteristics such as attitudes towards statistics (Coetzee, *et al*., 2012), perceptions, self-concept, and learning styles (Vahedi, *et al*., 2012). Researchers have also identified other factors such as perfectionism (Onwuegbuzie, *et al*., 2003), procrastination (Onwuegbuzie, 2004) and level of self-esteem that contribute to statistics anxiety. Environment factors include gender, age, ethnicity, race, and country of origin (Onwuegbuzie 2003; Khavenson, Orel and Tryakshina, 2012; Vahedi, *et al*., 2012). In this study, the researchers considered dispositional antecedents (procrastination and perfectionism) and environmental antecedent (gender) and corresponding relationships and differences where it deemed fit.

Academic procrastination occurs in the academic settings and is related to carrying out academic tasks such as studying for examinations, doing assignments, among others, but one fails to do it within a specified time (Jiao, DaRos-Voseles, Collins and Onwuegbuzie, 2011). (Solomon and

Rothblum, 1984) conceptualized academic procrastination as a multidimensional variable, divided into two constructs as academic procrastination (writing a term paper, studying for exams, keeping up with weekly reading assignments, academic administrative tasks, attendance tasks and school activities in general) and reasons for procrastination. In this study, the researchers adopted the constructs of areas of academic procrastination in measuring academic procrastination as well as grounds for procrastination.

Perfectionism is defined as a personality type where an individual (student) tries to be faultless and sets exceedingly higher goals regarding academic performance and overly critiques his or her behavior (Stoeber, Schneider, Hussain & Matthews, 2014). (Hewitt and Flett, 1991) operationalized perfectionism into these three components: self-oriented, other-oriented and socially-prescribed perfectionism. In this study, the researchers measured all these constructs.

Procrastination as a Correlate of Statistics Anxiety

Different studies had been carried out regarding academic procrastination (for example, Vahedi 2011) surveyed procrastination and statistics anxiety, applying a canonical correlation analysis among 248 undergraduate Iranian female college students. Data used in the study were collected using questionnaires that contained constructs of statistics anxiety developed by Earp, 2007. Vahedi 2011 reported that the academic procrastination positively correlated to constructs of statistics anxiety. In a previous study carried out by Onwuegbuzie, 2004, he reckoned that statistics anxiety was responsible for the delays in enrollments of students in postgraduate courses. In this study, the sample involved 135 postgraduate students from a university in the southeastern part of the United States of America. Onwuegbuzie 2004 found out that positive significant canonical relationships existed between academic procrastination and statistics anxiety. In another study carried out by Rodarte-Luna and Sherry, 2008, where a sample 323 students were used to investigate sex differences on measures of statistics anxiety and learning strategies, among other findings, they report that procrastination was positively related to statistics anxiety.

Perfectionism as a Correlate of Statistics Anxiety

Various studies on perfectionism and statistics anxiety had been carried out. For example, Walsh and Ugumba-Agwunobi, 2002, conducted a survey on individual differences in statistics anxiety in such aspects as the roles of perfectionism, procrastination and trait anxiety where 93 students formed a sample. The results indicated a modest link between inter-personal perfectionism and components of statistics anxiety. Onwuegbuzie and Delay, 1999, studied the relationship between perfectionism and statistics anxiety among graduate research students. A sample size of 107 students was selected. Using a canonical correlation analysis, students who held unrealistic standards for significant others (other-oriented perfectionists) and those who maintain a perceived need to attain standards and expectations prescribed by significant others (socially-prescribed perfectionists) tend to have higher levels of statistics anxiety.

A recent empirical investigation by Comerchero and Fortugno, 2013 examined the correlations between statistics anxiety and dimensions of perfectionism (adaptive and maladaptive) using the data obtained from 96 psychology graduate students. They found out that maladaptive perfectionism correlated with higher levels of statistics anxiety.

Gender as an Antecedent of Statistics Anxiety

Eduljee and LeBourdais, 2015, investigated gender differences in the context of statistics anxiety among undergraduate college students and found out that the female exhibited greater anxiety on test and class anxiety than the male students. They also discovered that males had no significant correlations between statistics anxiety and course grades and for females, there existed a significant association between the worth of statistics, course grades, computational self-concept and course grades. Rodarte-Luna, *et al.*, 2008 conducted a study on sex differences and how they relate to statistics anxiety and learning strategies where a sample of 323 applied. They found out that sex differences in statistics anxiety were statistically significant and that statistics anxiety varied between men and women. Men showed a higher positive relationship regarding procrastination and asking for help, test anxiety and interpretation anxiety, while for women, procrastination positively correlated to statistics anxiety.

3. Materials and Methods

This study employed a quantitative approach aimed at examining relationships between variables and numerical data analyzed using statistical procedures (as used by Creswell, 2009). The study followed a post positivist's view that held a deterministic philosophy in which causes (antecedents) probably determined the effects (statistics anxiety). Data were collected using questionnaires that had three sections. The first part comprised of four organismic variables (gender, age, nationality and course type), the second part with 44 items on academic procrastination ($\alpha = 0.885$) adopted from Procrastination Assessment Scale for Students (PASS) developed by Solomon, *et al.*, 1984 and 45 items on perfectionism ($\alpha = 0.897$) adopted from the Perfectionism Multi-dimensional Scale (PMS) developed by Hewitt, *et al.*, 1991. The third section contained 43 items of statistical anxiety ($\alpha = 0.846$) adopted from Statistics Anxiety Measurement (SAM) developed by Earp, 2007. Anchored on Cronbach's alpha reliability coefficient 1971, the questionnaire was reliable since the alpha coefficients were all above 0.5. The data were collected from 136 postgraduate students of Kampala International University, Uganda. All analyses were carried out using Statistical Package for Social Scientists (SPSS) version 16.0 and Microsoft Excel version 2013.

4. Results

Demographic Characteristics of the Respondents

Table 1: Demographic characteristics of respondents

Description	Category	Frequency	Percent
Gender	Female	41	30.1
	Male	95	69.9
Nationality	Comorian	4	2.9
	Kenyan	11	8.1
	Nigerian	16	11.8
	Rwandese	4	2.9
	Somali	7	5.1
	South Sudan	11	8.1
	Ugandan	83	61.0
Course type	Masters	96	70.6
	PhD	40	29.4

Descriptive Statistics on Constructs of Academic Procrastination
Table 2: Descriptive statistics on constructs of academic procrastination

	Constructs	Mean	Std. Deviation
Areas of Academic Procrastination	Writing statistics coursework	2.937	1.343
	Studying for exams	3.01	1.261
	Keeping up with statistics reading assignment	3.097	1.294
	Academic administrative tasks: Filling out forms, registering for classes, getting ID cards….	2.853	1.389
	Attendance Tasks: Meeting with your lecturer/advisor, facilitator, making an appointment with,e.g., a lecturer	2.907	1.394
	School activities	2.837	1.354
Reasons for Procrastination		2.597	1.407
Overall Mean		**2.891**	

Description of Constructs of Perfectionism
Table 3: Descriptive statistics on constructs of perfectionism

Constructs	Mean	Std. Deviation
Self-oriented perfectionism	3.775	1.380
Other-oriented perfectionism	3.634	1.448
Socially prescribed perfectionism	3.299	1.532
Overall Mean	**3.569**	

Description of Constructs of Statistics Anxiety
Table 4: Descriptive statistics of constructs of statistics anxiety

Constructs	Mean	Std. Deviation
Anxiety	2.779	1.051
Attitude Towards the Statistics Class	2.492	1.036
Fearful Behavior	2.175	0.976
Attitude towards Mathematics	2.498	1.016
Performance	2.938	0.802
Overall Mean	**2.576**	**0.976**

Perfectionism and Statistics Anxiety
Table 5: Correlation analyses between academic procrastination and perfectionism in relation to statistics anxiety

Variables	r-value	p-value	Interpretation
Academic procrastination vs. Statistics anxiety	0.185	0.062	Insignificant
Perfectionism vs. Statistics anxiety	-0.333	0.000	Significant

Gender and Statistics Anxiety
Table 6: Descriptive and t-test results on gender and statistics anxiety

Gender	Count	Mean	St. Dev.	t-value	p-value
Female	27	2.6193	.28300	0.554	0.581
Male	91	2.5814	.39445		

Multivariate Analyses

Table 7: Regression results on statistics anxiety on academic procrastination and perfectionism

(a)   ANOVA Table

F Value	Sig. value	Adjusted-R square
8.118	0.000	0.180

(b)   Coefficients

Independent Variable	Beta	Sig. or p-value
Academic Procrastination	.242	.011
Perfectionism	-.428	.000
Gender (0 = female, 1 = male)	.046	.641

5. Discussions

Data were analyzed using summary statistics (means and standard deviations), t-test and linear regression analysis. Table 1 shows that majority of the respondents were male (69.9%), Ugandan by nationality (61%) and more of the respondents were taking master courses (70.6%) than the Ph.D. studies (29.4%).

Descriptive Statistics on Constructs of Academic Procrastination:- Academic procrastination is a multi-dimensional variable that used a total of 44 items, with 18 items on academic areas of procrastination and 26 on reasons for procrastination, all rated on a 5-point Likert scale. The descriptive statistics per subsection in each construct are shown in Table 2. Accordingly, keeping up with statistics reading assignments had the highest mean, slightly over three (3) followed by studying for exams which suggest that students procrastinate on these two aspects. The reason for procrastination for the latter is that it has the lowest mean of 2.597, followed by procrastination in school activities with a mean of 2.837. This indicates that the students do not procrastinate on other school activities than those directly related to the study of statistics. The overall picture on academic procrastination suggests that students procrastinate (mean = 2.891), which is slightly above the average.

Description of Constructs of Perfectionism:- Perfectionism is a multi-dimensional variable composed of 45 items with 15 items on self-oriented, 15 items on other-oriented and 15 items on socially-prescribed perfectionism, all rated on a 7-point Likert scale, ranging from strongly disagree to agree strongly. The summary descriptive statistics for each construct are shown in Table 3. The results reveal that self-oriented perfectionism has the highest mean (i.e. mean = 3.775), followed by other-oriented perfectionism (mean = 3.634) and socially-oriented perfectionism had the lowest mean (3.299). The overall mean is 3.569, almost 4, suggesting that the learners have high perfection rates. Students try to be faultless and this helps them to set higher achievement goals in statistics.

Description of Constructs of Statistics Anxiety: - Statistics anxiety is also a multi-dimensional variable consisting of 43 items based on a 4-point Likert scale. The 4-point Likert scale was used to measure the five subscales of statistics anxiety, which are anxiety (12 items), attitude towards the class (9 items), fearful behavior (4 items), attitude towards mathematics (10 items), and performance (8 items) and the mean responses in each category of constructs were calculated as shown in Table 4. Results reveal that performance is rated high with a mean = 2.938, implying

that the students expect to perform on average. Fearful behavior was rated the lowest (mean = 2.175) indicating that the learners rarely fear to ask questions or avoid statistics classes.

Academic Procrastination and Statistics Anxiety: - Bivariate analysis was used to carry out preliminary hypothesis testing in this study. The test for normality using skewness indicated that the values are negatively skewed as -0.033, -0.607 and -0.073 for statistics anxiety, academic procrastination, and perfectionism respectively, suggesting that the data were highly normally distributed. The Pearson's linear correlation coefficient was used to associate statistics anxiety with academic procrastination, yielding r = 0.185, p = 0.062, signifying the acceptance of the null hypothesis (H_1): that there is no significant relationship between academic procrastination and statistics anxiety among postgraduate students of Kampala International University as shown in Table 5. The Pearson's linear correlation coefficient was used to correlate statistics anxiety with perfectionism, yielding r = -0.333, p = 0.000, implying that the null hypothesis (H_2): is rejected, therefore, there is no significant relationship between perfectionism and statistics anxiety as shown by the Pearson negative value in Table 5.

Gender and Statistics Anxiety: - The t-Test was applied to determine the differences in statistics anxiety between the male and female respondents. The means in Table 6 suggest that the female students (mean = 2.6193) had slightly higher statistics anxiety than the male students (mean = 2.5814). However, the t-value (t = 0.554) with p-value (0.581) exceeds the yardstick significance $\alpha = 0.05$. Thus, at five percent margin, the null hypothesis (H_3): that there is a significant difference in statistics anxiety between the male and female respondents is rejected.

The Bivariate analysis shows that the three independent variables (academic procrastination, perfectionism, and gender), perfectionism have a significant correlation with statistics anxiety while academic procrastination does not. It also shows that there is no significant difference in statistics anxiety between the male and female respondents. Multivariate regression analysis takes into account the simultaneous relationship between academic procrastination, perfectionism, gender and statistics anxiety (Bakkabulindi and Sekabembe, 2010). The results from multiple regression analysis are shown in Table 7.

The ANOVA Table (7a) signifies that the three variables are collectively right explanatory variables of statistics anxiety among postgraduate students of Kampala International University (F = 8.118; p = 0.000 < 0.01), although they account for less than 20% of the variations in statistics anxiety (Adjusted R square = 0.180). The Table on coefficients (7b) suggests that of the three independent variables, only perfectionism was a significant correlate of statistics anxiety at 1% level of significance (p = 0.000 < 0.01). Gender was an insignificant correlate of statistics anxiety both at 5% and 1%.

6. Conclusions

Results indicate that there is a significant negative relationship between perfectionism and statistics anxiety, implying that students with higher levels of perfectionism tend to have lower levels of statistics anxiety. A significant conclusion is that higher levels of perfectionism significantly affect statistics anxiety negatively. Regarding gender as an Antecedent of Statistics Anxiety, the results showed that the female students have slightly higher statistics anxiety than their male counterparts. Such results contradict the results of Rodarte-Luna, *et al.,* 2008, but are

similar to the conclusions of Eduljee, *et al*., 2015, though they did not tell whether the differences were significant or not. Thus, it is concluded that there is an insignificant difference in statistics anxiety between the male and female postgraduate students. In the end, the study recommends that the occurrence of statistics anxiety among the postgraduate students of Kampala International University was not that prevalent over performing in statistics class. The educators/lecturers are encouraged to employ innovative engagements to capitalize more interests and better performance of the students taking statistics courses. At the beginning of the statistics course, an emphatic and one fearful orientation to the course and introduction of the topics can decapitate preconceived negative ideas, perspectives and notions related to statistics. Use technology as a driving force in statistics classes as an engaging effort to blend the lecturers with hands-on experience and dedicate them to computer-aided statistical applications.

7. Patents

Author Contributions: Corresponding author Edson Mwebesa prepared the writing of original draft and data collection. All authors including correspondence contributed to writing, proofreading, conceptualization, methodology validation, formal analysis, resources, data collection, writing-review, editing and providing suggestions to improve the quality of this article.

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