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Factors Affecting Students' Pro-Environmental Behavior and a Communication Program for a Green University Campus

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ABSTRACT

This study examined the factors that shape pro-environmental behavior among students at Ho Chi Minh City University of Technology and Engineering and translated the empirical findings into a pilot communication program for a greener campus. A mixed-method design was used. Qualitative discussion and expert review refined the measurement scales, and a quantitative survey collected 400 valid student responses. The data were processed with descriptive statistics, reliability testing, exploratory factor analysis, and partial least squares structural equation modeling. The validated model retained five external-impact items, three level-of-interest items, four awareness items, four attitude items, five behavioral-intention items, and five pro-environmental-behavior items. Results showed that attitude had the strongest positive effect on behavioral intention ($\beta = 0.205$, $p < 0.001$), followed by level of interest ($\beta = 0.174$, $p = 0.001$) and awareness ($\beta = 0.152$, $p = 0.003$), while external impact was not significant. Behavioral intention positively affected actual behavior ($\beta = 0.149$, $p = 0.002$). The theoretical novelty is positioned modestly as a Vietnamese technical-university case study and as an applied attempt to convert quantitative behavioral evidence into targeted campus communication activities. The proposed Green Up UTE program is therefore presented as a research-informed intervention framework, not as an evaluated campaign outcome.

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1. Introduction

Environmental degradation and climate change have turned individual environmental responsibility into an urgent educational issue. Universities are not only spaces where young people acquire professional knowledge but also living laboratories where daily behaviors related to waste, energy, water, and mobility are formed. In technical universities, this issue becomes even more relevant because students will later design, operate, and manage technologies that directly affect natural resources and industrial emissions. Therefore, understanding how students think about environmental protection and how their intention is translated into action is essential for building a sustainable campus culture.

The behavioral literature suggests that environmental action is rarely produced by knowledge alone. The Theory of Planned Behavior argues that intention is a direct antecedent of behavior and is shaped by attitude, subjective norms, and perceived behavioral control [1]. The Theory of Reasoned Action also emphasizes the role of attitude and social influence in forming behavioral intention [2]. However, studies on pro-environmental behavior frequently report an intention-action gap: people may know what should be done, yet fail to act when the behavior is inconvenient, unsupported, or not reinforced by their social

context [3]. Environmental behavior studies further show that values, norms, attitude, perceived responsibility, and contextual conditions can jointly shape environmentally significant behavior [4]-[7].

Several studies have examined environmental awareness and behavior among students. These findings are useful, but each campus has its own culture, facilities, communication channels, and student habits. Ho Chi Minh City University of Technology and Engineering (HCM-UTE) has a large, diverse student population, a technical orientation, and visible campus environmental facilities such as waste bins, green corridors, cafeteria zones, laboratories, and student gathering spaces. Observations from the study show that students differ considerably in their awareness, concern, attitude, and daily practices. Some students from environment-related programs such as Environmental Engineering Technology or Renewable Energy demonstrate strong awareness, while students in less directly connected disciplines may lack sufficient practical knowledge to apply sustainable practices in daily life.

The research gap addressed in this paper is not the absence of behavioral theories, but the limited explanation of how familiar constructs can be operationalized in a Vietnamese technical-university setting and converted into specific communication actions. Many studies stop at identifying factors affecting intention or behavior; fewer studies explicitly connect statistical findings with a campus communication framework that can be implemented by student organizations and university units.

This paper therefore has two objectives. First, it evaluates the influence of four factors — level of interest, awareness, attitude, and external impact — on students' behavioral intention and actual pro-environmental behavior. Second, it proposes a communication program that uses the empirical results to strengthen student concern, attitudes, and practical participation. The contribution of the paper is practical and context-specific: it presents HCM-UTE as a Vietnamese technical-university case and demonstrates how survey evidence can be translated into a proposed Green Up UTE communication intervention. The rest of this paper is organized as follows. Section 2 describes the research model, questionnaire design, sample, and data analysis methods. Section 3 presents the measurement and structural model results, discusses their implications, and outlines the proposed communication program. Section 4 concludes the paper and suggests future development directions.

2. Materials and Methods

2.1. Research Context and Model

The research was conducted at HCM-UTE, located at 01 Vo Van Ngan Street, Thu Duc Ward, Ho Chi Minh City, and is recognized as a leading technical training institution in southern Vietnam. Its student body spans fifteen faculties and training units including Printing and Media, Economics, Chemical and Food Technology, Information Technology, Electrical and Electronics Engineering, Mechanical Engineering, Construction, Foreign Languages, high-quality programs, and international programs.

The proposed model contains four independent constructs, one mediating construct, and one dependent construct. The independent constructs are level of interest, awareness, attitude, and external impact. Behavioral intention is the mediator, and actual pro-environmental behavior is the dependent construct. Level of interest reflects how often students follow environmental information, worry about issues such as climate change and plastic waste, and actively search for solutions. Awareness reflects students' understanding of actions such as saving water, using public transport, and sorting waste. Attitude captures students' positive evaluation of environmental protection as a personal and community responsibility. External impact represents family influence, school or government policies, reward mechanisms, peer discussion, and media exposure. The dependent behavior includes purchasing green products, joining environmental activities, saving resources, using eco-friendly transport, and encouraging others to act.

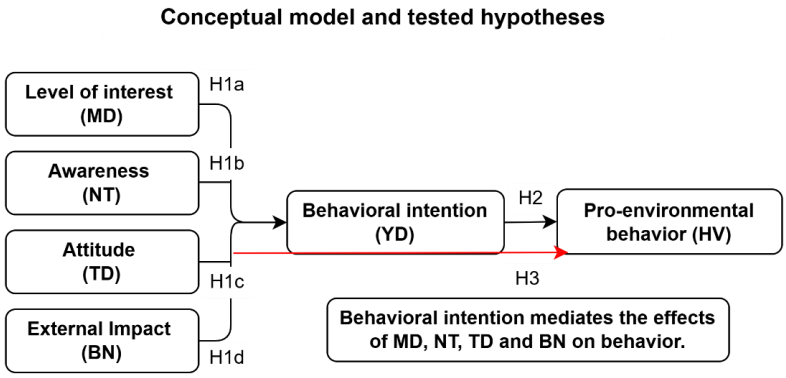

Figure 1. *Conceptual model and tested hypotheses.*

Figure 1 and Table 1 explicitly show the expected paths from level of interest, awareness, attitude, and external impact to behavioral intention, and from behavioral intention to actual pro-environmental behavior. The indirect-effect hypotheses examine whether intention mediates the relationships between the four antecedents and actual behavior.

Table 1. *Clearly stated research hypotheses.*

Hypothesis	Expected relationship
H1a	Level of interest has a positive effect on behavioral intention.
H1b	Awareness has a positive effect on behavioral intention.
H1c	Attitude has a positive effect on behavioral intention.
H1d	External impact has a positive effect on behavioral intention.
H2	Behavioral intention has a positive effect on actual pro-environmental behavior.
H3a	Behavioral intention mediates the relationship between level of interest and behavior.
H3b	Behavioral intention mediates the relationship between awareness and behavior.
H3c	Behavioral intention mediates the relationship between attitude and behavior.
H3d	Behavioral intention mediates the relationship between external impact and behavior.

2.2. Theoretical Foundations

The study draws on three theoretical frameworks. The Theory of Reasoned Action (TRA) proposed by Ajzen and Fishbein holds that an individual's attitude toward a behavior and subjective norms from reference groups jointly determine behavioral intention [2]. In the context of environmental protection, students whose peers and instructors exhibit pro-environmental attitudes are more likely to adopt similar behaviors. The Theory of Planned Behavior (TPB) extended TRA by adding perceived behavioral control as a third predictor of intention [1]. In the context of environmental protection, students whose peers and instructors exhibit pro-environmental attitudes are more likely to adopt similar behaviors, but they may not act if facilities are inconvenient or unclear.

The Knowledge-Attitude-Practice (KAP) model provides a complementary lens: gains in environmental knowledge can shift attitudes, and shifted attitudes can support practice change, although this chain is not automatic and can be blocked by social or structural barriers [8]. The added theoretical references strengthen the manuscript by positioning the model within broader pro-environmental behavior literature, including environmentally significant behavior [4], psycho-social determinants of pro-environmental behavior [5], intervention design for encouraging pro-environmental behavior [6], and the attitude–behavior relationship [7].

2.3. Instrument, Sample, and Data Collection

The questionnaire was developed from theoretical concepts and previous studies on environmental behavior, then refined through qualitative discussion and expert consultation. The preliminary scale included 28 observed variables distributed across six constructs.

To address the reviewer's comment on questionnaire development, the qualitative refinement stage is clarified as follows. Student discussion participants mainly commented that some statements were too long, some items sounded abstract, and several items should be rewritten using language closer to students' daily campus experience. Expert consultation focused on construct coverage, item clarity, and alignment with the HCMUTE context. Based on these comments, the authors shortened several statements, clarified the scope of "external impact" into family, school/government policy, rewards, peer discussion, and media exposure, and retained the six-construct structure for quantitative testing.

The formal questionnaire contained three parts: an introduction and confidentiality statement; demographic questions on gender, cohort, faculty, and commonly used media platforms; and measurement statements using a five-point Likert scale. For most items, the anchors ranged from 1 (strongly disagree) to 5 (strongly agree). For interest-oriented items, the scale reflected degree of interest or frequency of attention, with anchors ranging from 1 (not at all interested) to 5 (very interested).

The questionnaire operationalized six latent constructs using items adapted from established TPB- and pro-environmental-behavior literature, with minor wording adjustments to fit the Vietnamese campus context. Level of interest was initially measured by four items (MD1–MD4) reflecting students' frequency of following environmental information, interest in prominent issues (e.g., climate change, air pollution, plastic waste), and proactive searching for solutions; MD3 (personal concern about reducing one's negative impact) was removed after the outer-loading assessment. Attitude (TD1–TD4) captured students' evaluative beliefs that environmental protection is an individual responsibility, a wise choice, effective at the individual level, and important for health and community wellbeing. Awareness (NT1–NT4) assessed practical understanding of everyday actions (resource saving), the environmental benefits of public transport, and the importance/necessity of waste source separation. External impact comprised family influence (BN1), school/government policy influence (BN2), incentive mechanisms aligned with training/social-work points (BN4), peer discussion effects (BN5), and media exposure (BN6); BN3 (school-based environmental knowledge/activities) was excluded due to a weak loading. Behavioral intention (YD1–YD5) measured intentions to learn and apply environmental measures, increase public-transport use, participate in environmental activities, change daily habits, and seek/share environmental information. Finally, pro-environmental behavior (HV1–HV5) represented self-reported actions, including green purchasing, participation in university/local activities, conserving electricity and water and sorting waste at source, using eco-friendly transport, and encouraging others to act.

2.4. Sample and Data Collection

Convenience sampling was used because it allowed the researchers to reach students across faculties through online distribution and direct networks. The questionnaire was distributed via Google Forms and disseminated through faculty groups, social media channels, and student clubs. The final dataset contained 400 valid responses. This sample size exceeded the common exploratory factor analysis rule that the sample should be at least five times the number of observed variables and is also sufficient for structural equation modeling in an exploratory campus study [9].

For external readers, HCMUTE cohort labels indicate admission years: K24, K23, K22, K21, and K20 correspond to the 2024, 2023, 2022, 2021, and 2020 admission cohorts, respectively. In the 2024–2025 academic year, these groups broadly represent first- to fifth-year or extended-study students. K19 and K18 refer to earlier cohorts and appeared only in small numbers.

Secondary data were collected from academic articles, legal documents, university information, and environmental communication cases. Primary data were collected through a Google Forms survey between April and June 2025. Data were processed using IBM Statistical Package for the Social Sciences 20.0 for descriptive statistics, Cronbach's alpha, and exploratory factor analysis, and Smart Partial Least Squares 4.0 for the measurement and structural model.

2.5. Data Analysis Criteria

Reliability was evaluated using Cronbach's alpha and item-total correlations. Cronbach's alpha values above 0.6 were accepted for exploratory research, while item-total correlations above 0.3 indicated that the observed variables were consistent with their constructs. Exploratory factor analysis was assessed using the Kaiser-Meyer-Olkin index, Bartlett's test of sphericity, factor loadings, Eigenvalues, and total variance extracted. The measurement model was examined using outer loadings, composite reliability, average variance extracted, and discriminant validity. In PLS-SEM, outer loadings above 0.7 indicate strong measurement quality; values between 0.4 and 0.7 may be considered depending on theoretical relevance and the effect on reliability [10], [11].

For convergent validity, average variance extracted values of at least 0.5 were considered acceptable. For discriminant validity, the heterotrait-monotrait ratio was used; values below 0.85 indicate adequate construct separation. The structural model was evaluated through variance inflation factor values, coefficients of determination, effect sizes, and bootstrapping. Variance inflation factor values below 5 show that multicollinearity is not a serious concern. Hypotheses were accepted when p-values were below 0.05.

3. Results and Discussion

3.1. Respondent Profile and Communication Channels

The sample included 400 students. Male students accounted for 195 responses (49%), female students for 149 responses (37%), and students selecting another gender category for 56 responses (14%). The largest cohort group was K21 with 111 students (28%), followed by K22 with 100 students (25%), K24 with 82 students (20%), and K23 with 74 students (19%). The remaining responses came from K20, K19, and K18. The sample also covered fifteen faculties and training units including Printing and Media, Economics, Chemical and Food Technology, Information Technology, Electrical and Electronics Engineering, Mechanical Engineering, Construction, Foreign Languages, high-quality programs, and international programs, with Printing and Media (14%) and Economics (13%) being the most represented. This disciplinary diversity is important because pro-environmental behavior on campus is not restricted to students with an explicit environmental curriculum, and comparing across programs reveals whether attitudes and behaviors cluster around specific fields.

The survey recorded multiple responses for media platforms commonly used by students, resulting in 852 platform selections. Facebook and TikTok were the most frequently selected platforms, with 292 selections each. Instagram followed with 149 selections, YouTube with 95, and Threads with 24. This finding is important for the communication component of the study because a campaign that relies only on posters or formal announcements would likely miss the media habits of students.

Mean scores provide a useful behavioral diagnosis. Level of interest recorded the highest construct mean (4.06), showing that students generally pay close attention to environmental information and are motivated to seek solutions. Attitude was also positive overall (Mean = 3.88). However, awareness (Mean = 3.54), behavioral intention (Mean = 3.59), and actual behavior (Mean = 3.60) were lower. This pattern suggests that students are not indifferent, but the gap between interest and daily practice signals that additional communication and facility support are needed.

3.2. Reliability, Factor Structure, and Measurement Model

The initial Cronbach's alpha analysis showed acceptable reliability for all six constructs which are shown in Table 2. The alpha values were 0.679 for level of interest, 0.814 for attitude, 0.780 for awareness, 0.845 for external impact, 0.825 for behavioral intention, and 0.814 for pro-environmental behavior. All item-total correlations were above 0.3, indicating that the items were internally consistent enough for further analysis.

Exploratory factor analysis then confirmed that the independent variables were grouped into four factors as predicted. The Kaiser-Meyer-Olkin index for the independent variables was 0.796 and Bartlett's test was significant ($p < 0.001$), with total variance extracted of 58.363%. For the mediating variable, the Kaiser-Meyer-Olkin index was 0.844 and total variance extracted was 58.895%. For the

dependent variable, the Kaiser-Meyer-Olkin index was also 0.844 and total variance extracted was 57.399%.

The original measurement-quality table has been moved from the Methods section to the Results section, as recommended by the reviewer, because it reports empirical results rather than methodological criteria.

Table 2. *Validated constructs and measurement quality.*

Construct	Final items	Cronbach alpha	Composite reliability	Average variance extracted
External impact	5	0.829	0.877	0.588
Pro-environmental behavior	5	0.814	0.869	0.571
Level of interest	3	0.645	0.808	0.584
Awareness	4	0.780	0.857	0.600
Attitude	4	0.813	0.877	0.642
Behavioral intention	5	0.825	0.877	0.587

Source: Summarized from the research SmartPLS 4.0 results.

The partial least squares measurement model required two item adjustments. The external-impact item BN3, which referred to school-based environmental knowledge and activities, had an outer loading of 0.664. The level-of-interest item MD3, which referred to reducing personal negative impact in everyday life, had an outer loading of 0.688. Because both were below the preferred 0.7 threshold, the draft removed them and reran the model. After removal, all retained outer loadings were above 0.7, ranging from 0.702 to 0.836.

Discriminant validity was also acceptable. The heterotrait-monotrait ratios among constructs were all below 0.85, with values ranging from 0.079 to 0.285. The fact that the largest ratio was far below the threshold confirms that the constructs were not simply measuring the same idea under different labels.

3.3. Structural Model and Hypothesis Testing

Before hypothesis testing, multicollinearity was examined. All variance inflation factor values were below 5, indicating that the structural estimates were not distorted by serious collinearity. The coefficient of determination for behavioral intention was 0.108, with an adjusted value of 0.098. The coefficient of determination for actual pro-environmental behavior was 0.022, with an adjusted value of 0.020.

These R^2 values are low and should be interpreted cautiously. They indicate that the model identifies statistically significant psychological paths but explains only a modest proportion of behavioral intention and actual behavior. Student behavior is likely also affected by unmeasured factors such as campus facility convenience, bin labeling, time constraints, peer norms, habits, and the perceived effort required to act.

Table 3. *Key Structural Path Results.*

Path	Beta (β)	*t* statistic	*p* value	*f* square (f^2)	Result
External impact → Intention	-0.064	1.058	0.290	0.005	Not supported
Level of interest → Intention	0.174	3.437	0.001	0.033	Supported
Awareness → Intention	0.152	2.927	0.003	0.024	Supported
Attitude → Intention	0.205	3.692	< 0.001	0.044	Supported
Intention → Behavior	0.149	3.152	0.002	0.023	Supported

Source: Summarized from the research bootstrapping and effect-size tables.

Bootstrapping results in Table 3 showed that attitude was the strongest predictor of behavioral intention (β = 0.205, p < 0.001, f^2 = 0.044). Level of interest also had a significant positive effect on intention (β = 0.174, p = 0.001, f^2 = 0.033), followed by awareness (β = 0.152, p = 0.003, f^2 = 0.024). External impact did not significantly affect intention (β = -0.064, p = 0.290, f^2 = 0.005). Behavioral intention had a significant positive effect on actual pro-environmental behavior (β = 0.149, p = 0.002, f^2 = 0.023).

The mediation results were selective. The indirect paths from level of interest to behavior through behavioral intention and from attitude to behavior through behavioral intention were significant. The indirect path through awareness did not reach significance, and external impact showed no indirect effect. This pattern reinforces the design principle that factual awareness should be combined with motivational framing, personal relevance, and visible opportunities to act.

3.4. Linking Survey Results to the Green Up UTE Program

To translate the empirical results into an actionable intervention, the Green Up UTE program was designed to align message strategies and activity formats with the statistically supported determinants. Because attitude exerted the strongest effect on intention (β = 0.205, p < 0.001), campaign content should emphasize personal relevance, health co-benefits, campus pride, and professional responsibility. Given the significant role of level of interest (β = 0.174, p = 0.001), communication should remain frequent and emotionally engaging, leveraging short-form storytelling and challenge reminders. Awareness also contributed to intention (β = 0.152, p = 0.003), indicating the need for practical, instructional micro-content (e.g., bin-label guidance, QR quizzes, and simple infographics). In contrast, external impact was not significant, suggesting that generic pressure is insufficient; instead, external cues should be redesigned as immediate, peer-visible signals through team-based challenges, public recognition, and student ambassadors. Since intention predicted behavior (β = 0.149, p = 0.002), each communication touchpoint should end with a clear, low-effort action. Finally, channel selection should match student media habits (Facebook as the information hub and TikTok as the challenge platform), while the low R^2 values indicate that communication should be paired with facility support and iterative evaluation.

3.5. Proposed Green Up UTE Communication Program

The Green Up UTE program is presented as a proposed intervention framework, not as an implemented or evaluated communication campaign. Its purpose is to translate the statistical findings into a practical communication design that could be piloted in a later phase and evaluated with pre-/post-campaign data.

The proposed pilot program targets students aged 18 to 24 across faculties and uses a multi-channel approach. Facebook functions as the main information hub for campaign announcements, activity details, and community updates. TikTok is used for short videos, peer storytelling, and challenge-based participation. Instagram supports visual reminders and photo-based engagement, while YouTube can host longer recap videos or educational clips. Offline activities connect online exposure with campus practice through exhibitions, waste-sorting games, workshops, and talk shows.

The proposed Green Up UTE pilot is structured as a four-phase sequence. The Launch phase establishes the campaign identity and problem framing through coordinated announcements and visual assets. The Attraction phase builds emotional relevance and personal connection via peer stories and ambassador-led content. The Interaction phase converts awareness into commitment by coupling short online tasks (e.g., QR quizzes and challenges) with on-campus touchpoints and small incentives. The Diffusion phase sustains participation by reinforcing peer norms through workshops, talk shows, and team-based activities that encourage sharing and routine formation.

The program incorporates student environmental communication ambassadors from different faculties. Although external impact was not significant in the statistical model, the ambassador mechanism is not treated as generic external pressure. Instead, it is designed to make environmental action more visible, peer-led, and socially normal on campus.

3.6. Implementation Requirements and Evaluation Indicators

For the proposed program to work, communication should be paired with operational support. Waste-sorting communication will remain weak if bin labels are inconsistent, if there are too few bins in high-traffic areas, or if students cannot see where sorted waste goes after collection. Clear color-coded bin systems, icon-based labels, and short disposal guides posted at each bin cluster can reduce hesitation and make the desired behavior more intuitive.

Evaluation should not stop at counting likes or post reach. Digital metrics are helpful because they show campaign visibility and message resonance, but they do not prove behavioral change by themselves. A stronger evaluation plan combines online analytics with short surveys, direct observation, and event records. The proposed evaluation should compare pre-campaign and post-campaign measures and include a follow-up survey two to four weeks after the campaign ends.

Evaluation should extend beyond visibility indicators and triangulate four domains: (i) reach (impressions, views, email open rates), (ii) engagement (comments, shares, challenge entries, QR-quiz submissions), (iii) learning (quiz/mini-test scores and workshop feedback), and (iv) behavior (post-campaign self-reports corroborated by campus observation). Overall effectiveness should be tested through a baseline–post comparison of intention, awareness, and observed sorting accuracy, complemented by a 2–4-week follow-up to assess persistence.

3.7. Limitations and Future Research

This study has several limitations. First, the sample was collected through convenience sampling, so the results should be interpreted as an exploratory campus case rather than a statistically representative picture of all Vietnamese university students. Second, all behavioral measures were self-reported. Students may overreport desirable behaviors such as saving electricity or joining environmental activities because these actions are socially approved. Future studies should combine surveys with objective measures such as waste audits, energy-use records, or event participation logs. Third, the cross-sectional design captures relationships at one point in time and cannot prove long-term causal change.

Fourth, the model explained only a modest share of behavioral intention and actual behavior variance. This limitation is now stated explicitly to avoid over-interpreting the results. Future research should add constructs such as perceived behavioral control, campus infrastructure quality, social norms, environmental values, and habit strength. Finally, the proposed Green Up UTE program had not yet been implemented when the research was submitted. The next step is to run the pilot, collect pre-/post-campaign data, and refine the model based on observed campaign outcomes.

4. Conclusions

This study evaluated factors affecting students' pro-environmental behavior at Ho Chi Minh City University of Technology and Engineering and proposed a pilot communication program based on the findings. Using 400 valid responses from a demographically diverse student sample, the study confirmed that attitude, level of interest, and awareness positively affect behavioral intention, while external impact was not significant. Behavioral intention in turn significantly affected actual pro-environmental behavior. The validated measurement model achieved acceptable reliability, convergent validity, and discriminant validity after removing two weak observed variables from the initial 28-item scale.

The practical conclusion is that students should not be treated as passive receivers of environmental information. They already hold relatively high levels of interest and generally positive attitudes, but these have not fully translated into the everyday habits of sorting waste, conserving resources, and using greener transport. The proposed Green Up UTE program is designed to close this gap through a four-phase, multi-channel intervention that moves students from passive attention to active and visible participation.

Future studies should test the campaign with an experimental or quasi-experimental design comparing pre- and post-campaign measures of intention and behavior, extend the model with variables

related to facility convenience and perceived behavioral control, and explore whether findings replicate in other Vietnamese universities with different technical or disciplinary profiles.

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Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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