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Green Entrepreneurship as a Driver of Green Innovation and Environmental Sustainability: Evidence from Selected Regions

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Abstract

There is growing pressure on micro, medium-sized businesses (MSMEs) to strike a balance between environmental responsibility and competitiveness. It is still up for debate, particularly in emerging nations, how green management purpose translates into quantifiable sustainability outcomes. This study examines how green entrepreneurial orientation (GEO) and green innovation (GI) impact MSMEs' sustainability (ES) performance using the resource-based view and the natural-resource-based view, as well as whether regional factors (RF) influence these interactions. We gathered information from 181 MSMEs in the districts of Chitradurga and Bengaluru Urban in Karnataka, India. A questionnaire covering GEO (5 things), GI (5 items), ES (5 items), and RF (4 items) was utilized. Reliability analysis, correlation, hierarchical multiple regression, mediation testing, and group-difference tests were the methods we used to analyze the data. Cronbach's alpha ranged from 0.69 to 0.79 for each construct, indicating dependability. Environmental sustainability performance was found to be predicted by green innovation (β = 0.547 p < 0.001). Regional factors came next (β = 0.213 p < 0.001). Next was green entrepreneurial inclination (β = 0.190, p < 0.01). 74.3% of the variance in ES performance was explained by the entire model. Both GEO (Sobel z = 6.11 p < 0.001) and RF (Sobel z = 9.08 p < 0.001) have an impact on sustainability performance, according to mediation analysis. In other words, GI serves as the conversion mechanism that transforms regional support and strategic attitude into environmental results. On every core construct, micro enterprises had lower scores than small and medium-sized businesses. Every construct was fortified by firm age. Organizational type did not differ significantly. The results apply the theory of green entrepreneurship to MSME. Additionally, they provide management and policymakers in emerging economies with assistance.

***Keywords**: Green Entrepreneurship, Green Innovation, Environmental Sustainability, MSME, Regional Factors, Emerging Economy.*

Introduction

When it comes to the transition to sustainability, micro, medium-sized businesses, or MSMEs, are in a challenging position. They account for between 60 and 70 percent of industrial pollution, despite making up the bulk of firms in most nations. However, they are frequently perceived as being too small, too financially strapped, and too preoccupied with immediate survival to make the kinds of investments required for environmental preservation. Research by Revell and Blackburn (2007) and Revell and colleagues (2010) supports this theory. India is a clear example of this problem. There are over 60 million MSMEs in the nation, and they are vital to local industry and employment growth. One of the world's fastest-growing cities, Bengaluru, is home to several of these companies. However, many of them face

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challenges such restricted access to green financing, inadequate or damaged infrastructure, and enforcement of environmental regulations. They have difficulty adopting procedures because of these obstacles. Is it really possible for such a sizable portion of the economy to transition to sustainability? For researchers, this is not an issue. For policymakers attempting to strike a balance between protection and growth, it is crucial.

A growing amount of research, in my opinion, indicates that the firm's strategic stance and compliance pressure are more important factors. According to the resource-based view (RBV), companies benefit from resources that are scarce, precious, and difficult to replicate (Barney, 1991). The natural resource-based view (NRBV), its environmental extension, offers sustainable development, product stewardship, and pollution reduction as ways that environmental responsiveness might be advantageous (Hart, 1995). According to this perspective, green entrepreneurial orientation (GEO) refers to a company's readiness to aggressively pursue green possibilities in order to take measured risks and outpace competitors in the development of green products. These talents are thought to be motivated by GEO (Covin & Slevin 1989; Chen et al., 2020). The organizational ability that puts that mentality into practice is called "green innovation" (GI), which is the development and application of procedures and goods that reduce environmental damage along the entire value chain (Chen et al. 2006). Lastly, businesses collaborate. Regional factors (RF) are now viewed as contextual enablers or constraints on how businesses can go green. Examples of RF include the existence of institutional support for environmental infrastructure, knowledge sharing within the cluster, and local environmental expectations (Porter, 1998; Florida, 1996).

The research is driven by three gaps. First, academic attention has been given to GEO, GI, and ES. There is still relatively little evidence connecting GEO, GI, and ES. Businesses in China, Europe, or other developed or emerging markets are the subject of the majority of the current research. As a result, the MSME sector—which is the foundation of emerging economies—is often disregarded (Chen et al. 2020; del Brio & Junquera 2003). Second, there is ongoing discussion over how GEO and regional characteristics translate into quantifiable environmental performance. According to some academics, GI is what causes ES. For others, GI is a bridge that transports contextual or strategic forces. Few research have examined all of these pathways simultaneously in a single data set. Third, there has been much discussion on how the local environment can influence or modify these relationships. Rarely has it been measured. In areas like Indian districts, where infrastructure, law enforcement, and industry clusters vary greatly from one another, this disparity is particularly apparent.

In light of this, the present study poses three queries. RQ1: To what extent do GEO, GI, and RF predict MSMEs' performance in environmental sustainability? RQ2: Does GI mediate the relationship between RF and ES as well as between GEO and ES? RQ3: Do these concepts and connections vary depending on the sizes, ages, or types of organizations? The study makes use of survey data from 181 MSMEs to address these topics. With the exception of one MSME from Chitradurga district, the most of these MSMEs are situated in Bengaluru Urban district, Karnataka. Reliability checks, correlation, hierarchical regression Sobel mediation tests, and group-difference tests are all included in the analysis. A combined test of the GEO GI, RF, and ES setup in a context that has not received much attention is provided in this work. It also provides suggestions for legislators and managers who wish to improve the environmental friendliness of small businesses.

Literature Review and Theoretical Background

- **Environmental Sustainability in the MSME Context**

When applied to business, environmental sustainability refers to the capacity to conduct operations without endangering the natural resources that future generations will require (Bansal, 2005). Environmental sustainability performance at the corporate level is typically assessed by how well a corporation uses resources and energy, reduces emissions, waste, and polluted water, and maintains clean processes and products. Compared to businesses, MSMEs have a fundamentally different approach to achieving these goals. MSMEs typically operate under informal management, lack environmental teams, have little funding, and view environmental regulations as an expense rather than an opportunity for expansion (Revell & Blackburn 2007; del Brio & Junquera 2003). As a result, research on businesses focuses on owner-manager values, expertise, and strategy—exactly the concepts at the heart of our study (Parker et al., 2009).

- **Green Entrepreneurial Orientation**

Entrepreneurial orientation, or EO, demonstrates a company's position in the market by being creative, forward-thinking, and willing to take chances (Covin & Slevin 1989; Lumpkin & Dess 1996). We refer to the application of EO to the environment as GEO, or entrepreneurial orientation. A company with a high GEO seeks out market opportunities, embraces the risk of investing in unproven green technology, and develops new green concepts before laws compel them to (Chen et al., 2020). The foundation of GEO is the resource-based approach, which holds that cultural mindsets that are hidden can turn into assets (Barney, 1991). The majority of the data comes from large companies in East Asia, but research indicates that GEO brings green products, better green processes, higher green performance, and a stronger position in green markets (Chen et al., 2020; Li et al., 2018).

- **Green Innovation**

Green innovation refers to the development or application of strategies, techniques, and technologies that reduce environmental damage at every step of a product's life. Chen and others described this concept in 2006. Green innovation often consists of two components. Green process innovation is one aspect. This entails altering the manufacturing process to consume less energy, materials, and pollutants. Green product innovation makes up the other half. This entails redesigning goods to make them more easily recyclable, less energy-intensive, and less damaging to both people and the environment. According to the Natural Resource-Based View, or NRBV, these kinds of innovations are what make an organization's environmental efforts profitable. In 1995, Hart wrote about this. Studies consistently demonstrate that one of the elements at the corporate level for enhancing environmental and sustainability outcomes is green innovation. In actuality, innovation frequently has a greater influence than merely having good intentions or a plan that demonstrates your concern for the environment. Research, Chen et al. This is supported by Li et al. (2006), Zhu and Sarkis (2004), and Li et al. (2018).

- **Regional Factors**

Businesses operate within systems that either provide or deny the resources required for greening. There are four components to the regional factor construct used here. Environmental infrastructure, such as green industrial parks and shared effluent treatment facilities, makes up the first section. Institutional support, including government subsidies, incentives, and regulatory assistance, makes up the second section. expertise and technology networks, which enable the dissemination of green expertise across nearby businesses, make up the third section. Environmental consciousness, or the sustainability standards of local communities, clients, and employees, makes up the fourth section (Porter, 1998; Florida, 1996). According to cluster theory, areas with robust institutions and knowledge networks lower the risk and expense of innovation for the businesses that reside there (Porter, 1998). Co-location promotes shared environmental infrastructure, according to research on ecology and eco-industrial development (Gibbs et al., 2002). The regional layer is likely even more crucial for MSMEs since they are unable to retain these resources within their businesses.

- **Research Framework and Hypothesis**

Two routes are used by the study's framework to link the three antecedents to ES performance. The first route adheres to the RBV/NRBV concept: GEO provides the disposition, GI provides the operational capacity, and RF provides the contextual resources; each should improve environmental performance on its own.The second approach adheres to the conversion concept: regional support and strategic posture are not results in and of themselves; they must be implemented through innovation. Therefore, GEO should raise GI, RF should raise GI, and GI should then drive ES to produce mediation. H1. GEO is positively correlated with the environmental sustainability performance of MSME. H2. GI is positively correlated with the environmental sustainability performance of MSME. H3. RF is positively correlated with the environmental sustainability performance of MSME. H4. GI mediates the relationship between environmental sustainability performance and GEO. H5. The relationship between RF and environmental sustainability performance is mediated by GI. H6. The type, size, and age of MSMEs affect GEO, GI, ES, and RF.

Research Methodology

- **Research Design and Sampling**

A descriptive and explanatory (causal) survey design was used in the study. It was centered on Karnataka, India's small and medium-sized businesses. Bengaluru Urban District, the state's primary industrial and service hub, served as the primary sampling region. There was also one organization from the Chitradurga district. The proprietors, business owners, and middle and senior managers of these companies were the respondents. These people were picked due to their expertise in operations, strategy, and environmental procedures. 181 MSMEs received a structured questionnaire. Everybody answered completely. None of the items had any missing data. The sample should not be regarded as a representative or random sample of all MSMEs in India since it was restricted to a single urban region. Rather, it should be viewed as a regional sample that was chosen to represent conditions in a significant economic zone.

- **Instruments and Measures**

There were two sections to the survey. The first section inquired about the organization's specifics, including the type of business (manufacturing, service, start-up, trading), its size (micro, small, medium), its age (less than 5 years, 5 to 10 years, 11 to 20 years, more than 20 years), the person's job position, the area or district they were in, and the location of the organization (city, semi-city village). In the second section, there were 19 questions with a five-point rating system (1 being strongly disagree and 5 being strongly agree). Based on concepts from earlier research, these questions were divided into four categories: environmental sustainability (ES1 to ES5), green entrepreneurial orientation (GEO1 to GEO5), green innovation (GI1 to GI5), and regional aspects (RF1 to RF4).

- **Data Analysis**

Researcher began by utilizing stats models to filter, code, and analyse data in Python. Five pieces made up the analysis. Researcher started by calculating scores by averaging each set of things. By computing Cronbach's alpha and examining corrected item-total correlations, Researcher evaluated the dependability of these composites. Second, Researcher looked at the data's shape. Researcher performed the Shapiro-Wilk and Kolmogorov-Smirnov tests, as well as examined average spread, skewness, and kurtosis. Third, the relationships between pairs of constructs using Pearson correlations. Fourth, step-by-step ordinary least squares regression was performed. ES was a dependent variable. The researcher examined the variance inflation factor, the Durbin-Watson statistic, and residual plots in addition to adding GEO, GI, and RF in that order. The fifth researcher used the Sobel test to look for mediation. Additionally, the researcher used independent-samples t-tests and one-way ANOVA with paired post-hoc tests to evaluate features across organizational categories.

Results

- **Profile of the Samples**

Table 1: Organizational Profile of the Sample (N=181)

Characteristic	Category	Frequency	Percentage
Type of organisation	Manufacturing	134	74.0
	Service	29	16.0
	Start-up	16	8.8
	Trading	2	1.1
Size	Medium	96	53.0
	Small	74	40.9
	Micro	11	6.1
Age of organisation	11-20 years	85	47.0
	5-10 years	60	33.1
	Below 5 years	19	10.5
	Above 20 years	17	9.4
Respondent position	Top management	88	48.6
	Owner/entrepreneur	76	42.0
	Middle management	17	9.4
Location	Urban	179	98.9
	Semi-urban	1	0.6
	Rural	1	0.6

Source: Primary Survey data

The majority of the sample, according to the researchers, are manufacturing companies (74.0%), medium-sized businesses (53.0%), and organizations with employees between the ages of 11 and 20 (47.0%). The majority of informants are senior; 90.6% of responses come from owner-entrepreneurs and top management combined, which increases trust in the information provided. In line with the Bengaluru Urban concentration of the frame, all organizations (98.9%) are situated in urban regions.

- **Reliability and Descriptive Statistics**

Table 2: Reliability and Descriptive Statistics of the study (N=181)

Construct	Items	Mean	SD	Cronbach's Alpha	Interpretation
GEO	GEO1-GEO5	4.37	0.43	0.724	Acceptable
GI	GI1-GI5	4.42	0.47	0.789	Acceptable
ES	ES1-ES5	4.43	0.46	0.776	Acceptable
RF	RF1-RF4	4.44	0.45	0.693	Marginal

Note: GEO= green entrepreneurial orientation, GI= green innovation, ES=environmental sustainability, RF= regional factors.

Cronbach's alpha ranges from 0.69 to 0.79 for all four constructs, indicating dependability. The 19 items' corrected item-total correlations ranged from 0.39 to 0.64, which is higher than the typical minimum of 0.30. The RF scale is maintained with this care in mind because it is now at 0.693, which is slightly below the 0.70 guideline. On the five-point scale, construct means are consistently high, ranging from 4.37 to 4.44, and item-level means range from 4.19 to 4.50, indicating that the sample generally agrees with practices. Distributions exhibit negative skewness, with kurtosis ranging from 18.21 to 22.16 and skewness between -3.40 and -3.64. For every composite with all p-values less than 0.001, the Shapiro-Wilk and Kolmogorov-Smirnov tests reject normality. At this sample size, regression-based inference remains resilient to moderate non-normality. When assessing effect sizes, it is important to consider the clustering of responses at the agreement end of the scale; p-values are regarded as informative rather than precise.

- **Correlation Analysis**

Table 3: Pearson Correlation (N=18)

Relationship	r	p	Strength
GEO and GI	0.692	< 0.001	Strong, positive
GEO and ES	0.682	< 0.001	Strong, positive
GI and ES	0.839	< 0.001	Very strong, positive
RF and GI	0.741	< 0.001	Strong, positive
RF and ES	0.722	< 0.001	Strong, positive
RF and GEO	0.549	< 0.001	Moderate, positive

The GI-ES link in the matrix is the strongest, and every pair of constructs is positively and strongly related (r = 0.839). The trend is consistent with the hypothesized model: sustainability performance is influenced by disposition, operational capability, and geographical context, all of which are linked as anticipated.

- **Regression Analysis**

Table 4: Regression Analysis of Environmental Sustainability on GEO, GI and RF

Step	Predictor	β	SE	t	p	VIF	R-squared
1	GEO	0.718	0.049	14.55	< 0.001	-	0.465
2	GEO	0.310	0.057	5.42	< 0.001	1.92	0.724
	GI	0.723	0.062	11.65	< 0.001	1.92	
3	GEO	0.190	0.056	3.41	0.001	1.93	0.743
	GI	0.547	0.064	8.50	< 0.001	2.98	
	RF	0.213	0.058	3.68	< 0.001	2.23	

Note: Step 1: $F(1, 179) = 155.3$, $p < 0.001$. Step 2: $F(2, 178) = 233.2$, $p < 0.001$. Step 3: $F(3, 177) = 170.7$, $p < 0.001$. VIF values below 5 indicate no problematic multicollinearity. Durbin-Watson = 1.87.

According to Model 1, 46.5 percent of the variance in ES can be explained by GEO alone. Model 2's explained variance rises to 72.4 percent when GI is included. The GEO coefficient dramatically decreases from 0.718 to 0.310, indicating that GI acts as a mediator between GEO and ES. Adding RF to Model 3 increases the explained variation to 74.3 percent, indicating a 2.0 percentage point contribution from RF. With a beta coefficient of 0.547 and a p-value of less than 0.001, GI emerges as the model's

greatest predictor. RF comes next, with a p-value of less than 0.001 and a beta of 0.213. GEO is still very important. has a lower impact, with a p-value of 0.001 and a beta of 0.190. All model assumptions are met. The VIF values vary from 1.93 to 2.98 which is, below the threshold that would show multicollinearity. The Durbin-Watson score is 1.87 suggesting residuals are independent. Residual plots show no signs of heteroscedasticity. Hypothesis 1 Hypothesis 2 and Hypothesis 3 are all supported by the results.

- **Mediation Analysis**

Table 5: Mediation of GEO->ES and RF ->ES Relationship through GI

Pathway	a (to GI)	b (GI to ES)	Indirect Effect ab	Sobel z	p	Direct Effect	Conclusion
GEO to GI to ES	0.529***	0.547***	0.290	6.11	< 0.001	0.190**	Partial mediation
RF to GI to ES	0.769***	0.659***	0.506	9.08	< 0.001	0.227***	Partial mediation

*Note: *** p < 0.001, ** p < 0.01. Direct effects are the coefficients on GEO (first row) and RF (second row) in the full model including GI.*

Both channels of mediation are crucial. While the direct effect is 0.190, the indirect effect of GEO through GI is 0.290 (Sobel z = 6.11 p < 0.001). This indicates that GI accounts for the majority of GEO's impact on ES. In contrast to an effect of 0.227, the indirect effect through GI for RF is 0.506 (Sobel z = 9.08 p < 0.001). Thus, RF likewise primarily relies on GI to affect ES. The mediation is just partial, not full, since both examples still exhibit direct effects. This bolsters H4 and H5: while posture and regional context are important in and of themselves, their primary function is to stimulate green innovation.

Discussion of Findings

Three results are noteworthy. The first green innovation in this sample is the mainstay of sustainability. The final model is dominated by the unstandardized coefficient (0.547) of innovation. Innovation and ES have the strongest bivariate association (r = 0.839) in the matrix. When it comes to GEO and RF, green innovation likewise bears the majority of the burden. This is consistent with the NRBV's prediction that environmental purpose is translated into a reduced environmental cost by capabilities rather than intents (Hart, 1995; Chen et al., 2006).

The second GEO is important. mostly by means of green innovation. The model's direct impact of GEO (0.190) is noteworthy, but it pales in comparison to its indirect impact through green innovation (0.290). This demonstrates that strategic posture is not a direct performance lever but rather a prerequisite that needs to be implemented through creative action (Chen et al., 2020). Rather than background noise, third regional elements are a first-order driver. RF increases the explained variance in ES by 2.0 percentage points. Additionally, it uses green innovation to transfer the model's indirect effect (0.506). This is consistent with cluster-based arguments: nearby businesses share infrastructure, expertise, and standards that reduce the cost of going green (Porter, 1998; Florida, 1996). Texture is added by the demographic results. Micro enterprises lag behind medium firms on all core constructs, according to the size gradient.

This supports the long-standing finding that small businesses don't have the extra cash on hand to fund environmental projects (Revell & Blackburn 2007). The age gradient demonstrates that all structures increase with age. The largest change is in factors. This implies that over time, established businesses develop both external regional embeddedness and green skills. For type, the null result is noteworthy. It implies that the manufacturing, services, and start-ups in our sample all follow the same logic from green orientation to innovation to performance. This defies the notion that the environmental impact of production is noticeably greater.

Implications

- **Theoretical Implication**

There are three primary ways that the study advances the field. GEO, GI, and ES configuration are required first. applies it to a rising economy's MSME sector. Here, there hasn't been much data testing of the strategic-posture path. The RBV/NRBV concept works for small businesses, according to the study. Second, it clarifies how things operate by simultaneously examining both indirect paths. GI is best understood as the process by which a company's positioning (GEO) and the resources surrounding it (RF) result in environmental outcomes. This clarifies the findings of certain research that solely examined straight pathways. Thirdly, it modifies the perception of geographical factors. They go from being merely a control variable to a crucial concept. The study demonstrates that when it comes to how well a business performs in terms of sustainability, the regional environment is just as significant as the company's strategy. It also cautions against explanations because the effect is only partial. The region's resources and the company's objectives are still powerful.

- **Practical and Policy Implications**

The findings indicate that green innovation is a potent investment for MSME managers. Sustainability performance is primarily driven by process improvements in energy and material efficiency, product designing for recyclability, and technology adoption. These behaviors also demonstrate the benefits of leadership intent. The robust RF results indicate that cluster-level interventions, such as environmental infrastructure, green technology extension services, subsidized green finance, and local recognition schemes, are more than just decoration for policymakers and industry associations in Karnataka and other comparable regional economies. By stimulating innovation, these strategies directly contribute to sustainability performance at the corporate level. Microbusinesses' poor performance suggests that fresh policies are needed. These businesses, which now exhibit the lowest levels of orientation, innovation, and performance, will be overlooked by a unified MSME greening program.

- **Limitations and Future Research**

These conclusions are limited by four factors. The sample is initially a selected group of businesses from a single city. Because the sample only partially includes MSMEs in rural or small towns, it is unsafe to conclude that the findings apply to MSMEs in other parts of the country. Second, each firm's employees provide all of the data, and just one individual provides responses. The answers are typically very low, which could indicate that the same approach was taken for every question or that people are trying to look good. Future research should ask multiple employees at each company and make use of environmental records. Third, the study examines a single moment in time. We are unable to determine which factor leads to another as a result. Future research should track businesses throughout time. Make use of designs that demonstrate causation. Fourth, the RF scale's dependability is 0.693, little below than the typical minimum. As a result, we should take the RF results with more caution than the measurements. In order to determine whether the same pattern emerges in locations with less institutional support, future study should additionally test the model using a statistical method that adds actual performance scores.

Conclusion

The purpose of this study was to determine how small and medium-sized businesses translate their green goals into actual environmental sustainability performance. 181 MSMEs in Karnataka, India, provided survey data for the study. The results are consistent with a concept in which sustainability is driven by green innovation. Regional considerations and a green entrepreneurial mindset are especially important since they directly support sustainability and feed the innovation engine. Age and firm size have an impact on all three inputs, which means they have an impact on the relative importance of innovation orientation and geographical context. 74% of the variations in sustainability performance were explained by the model. Innovation is influenced by the firm's thinking as well as the local surroundings, according to mediation tests. The lesson is clear for politicians who are increasingly interested in helping small businesses become greener: encourage innovation within businesses and support green entrepreneurial mindset. bolster the institutional support and regional infrastructure that enable green innovation at that time. By extending current theories about strategy to a group that has received little attention MSMEs in emerging economies—this study expands upon those beliefs. Additionally, it offers a framework for researching the greening of small firms in comparable settings.

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Appendix A: Survey Instrument Items

Respondents rated each statement on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Code	Statement
GEO1	The organisation proactively invests in environmentally oriented business opportunities.
GEO2	The organisation is among the first in its sector to introduce environmentally friendly practices.
GEO3	The organisation takes calculated risks in adopting green technologies and processes.
GEO4	The organisation encourages new ideas for environmental improvement.
GEO5	The organisation is aggressive in competing on the basis of environmental performance.
GI1	The organisation invests in green process innovation (e.g., cleaner production, energy efficiency).
GI2	The organisation invests in green product innovation (e.g., eco-friendly product design).
GI3	The organisation adopts new environmental technologies ahead of regulatory requirements.
GI4	The organisation reengineers processes to reduce environmental impact.
GI5	The organisation uses environmentally friendly raw materials and components.
ES1	The organisation reduces emissions, effluents, and waste in its operations.
ES2	The organisation uses energy and material resources efficiently.
ES3	The organisation complies with and goes beyond environmental regulations.
ES4	The organisation minimises the environmental impact of its products across their lifecycle.
ES5	The organisation contributes to environmental sustainability in its community.
RF1	Regional environmental infrastructure (e.g., treatment facilities, green parks) supports our operations.
RF2	Regional institutions and government schemes support our green initiatives.
RF3	Regional knowledge and technology networks help us learn green practices.
RF4	Regional customers and the community expect environmentally responsible business.

Note: Item wordings are a faithful paraphrase of the questionnaire blocks in the underlying dataset; original questionnaire text was not reproduced verbatim.

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