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Factor Analysis of Barriers and Drivers Influencing Attitudes Toward Sports Careers, Job Security, and Education: An Application of Principal Component Analysis

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Abstract

The promotion of sports as a viable career option for children hinges not only on individual talent and interest but also on the perceptions and attitudes of parents and guardians regarding various barriers and drivers. This study investigates the underlying latent factors influencing parental attitudes toward sports careers, focusing on concerns about job security, education, financial stability, and injury risks. Using a comprehensive survey dataset encompassing demographic, attitudinal, and behavioral responses from parents spanning diverse regions, factor analysis via Principal Component Analysis (PCA) is applied to uncover principal latent variables affecting these attitudes.

Our findings reveal key dimensions that simultaneously act as barriers and drivers in shaping support for sports careers. The paper further discusses implications for schools, policymakers, and sports academies towards fostering more supportive environments for sports as a career. The methodical approach and findings can inform targeted interventions to enhance youth sports participation and professional sports career viability.

Keywords: Factor Analysis, Principal Component Analysis, Sports Careers, Parental Attitudes, Job Security, Education Impact, Financial Stability, Barriers and Drivers, Sports Participation, Decision Making

1. Introduction

Sports careers are often perceived as highly unpredictable and risky vocations, both in India and globally. Parents' attitudes continue to play a significant role in encouraging or discouraging their children's

participation in sports and the pursuit of sports careers, despite India's burgeoning sports ecosystem and rich sports heritage. The recognition of sports as a respectable and successful path comparable to traditional professions like medicine and engineering frequently takes precedence over concerns regarding economic instability, interference in education, risks of injuries, and obviously job security,.

In order to effectively and sustainably promote sports careers, it is essential to comprehend these perceptions held by parents. Existing literature indicates that attitudinal barriers combined with demographic and social factors create complex decision-making environments for families considering sports careers for their children (Singh et al., 2020; Sharma & Rajput, 2019). While some parents vehemently support competitive sports engagement, others harbour reservations that significantly deter children's sports aspirations.

This study applies data-driven machine learning and statistical techniques, particularly Principal Component Analysis, to dissect and analyze a multifaceted survey dataset collected from parents about their attitudes, beliefs, and concerns surrounding sports careers. The goal is to find hidden factors that support or hinder support for sports career paths and give stakeholders like educators, sports officials, and policymakers insight that they can use.

2. Background and Literature Review

From the sociological, economical, and public health perspectives, this research has focused on the sports participations and based on that, the career development. Prior investigations have emphasized factors like socioeconomic status, parental education, and cultural attitudes (Khan & Chatterjee, 2018). The nuanced psychological and perceptual aspects, on the other hand, have not yet been quantitatively examined.

Factor analysis methods have been previously utilized to reduce dimensionality in survey data and illuminate underlying attitudinal constructs (Brown, 2015). Principal Component Analysis (PCA), an unsupervised learning technique, transforms numerous correlated variables into fewer uncorrelated factors capturing most of the dataset variance. It is widely applied in social science research for uncovering latent structures without imposing prior hypotheses (Jolliffe, 2011).

Recent studies in sports sciences leverage PCA and machine learning to predict youth sports participation trends, but few comprehensively analyze parental barriers and drivers specifically within Indian contexts (Patel et al., 2021).

3. Data Description

The present study utilizes a dataset titled "sports.csv"(Figure 1), comprising approximately 707 records from surveyed parents. The dataset features demographic attributes including age group, highest education level, city/town of residence, and gender, alongside detailed Likert-scale attitudinal responses on various aspects related to sports importance, encouragement, career support, job security concerns, injury risks, and school support mechanisms.

Figure 1: Sample of the Dataset

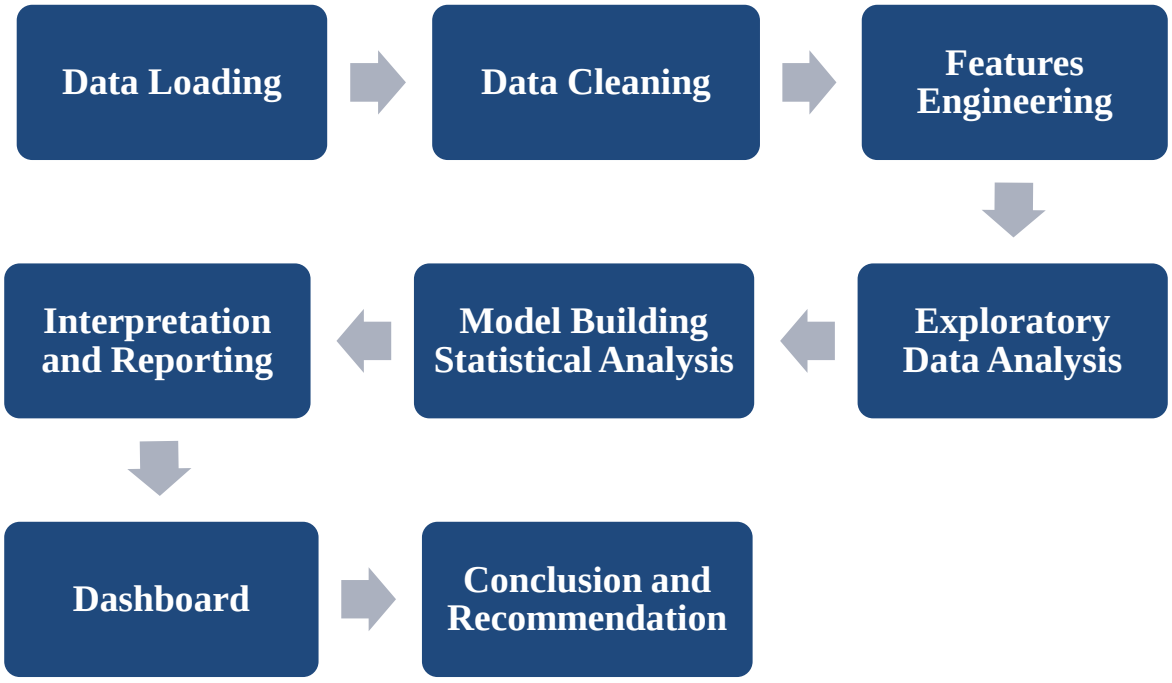
	Timestamp	What is Your age group ?	Whta is Your highest level of education ?	Which city / town do you currently reside in ?	Do you believe that sports is important for the overall developement of a child ?	How many hours per week does your child spend in physical / sports actively ?	I encourage my child to participate in competitive sports.	I would support my child if they wanted to pursue sports as a full-time career.	A career in sports lacks job security.	Sports can be as respectable and successful a career as medicine/engineering.	Is your child enrolled in any coaching academy or private training for sports ?	I am aware of sports scholarships for young athletes in India.	I believe that schools provide enough support for children in sports.	Sports careers come with high injury risks.	A sports career can affect my child's education negatively.	Financial stability is a major concern in sports careers.	What is Your Gender	Email address
0	19/06/2025 09:46:49	Below 30	Postgraduate	Bhadreswar	Agree	Less than 2 hours	Occasionally	Maybe , depending on the sports	Lack of job security	To some extent	Planning to	Yes , well aware	Yes	Neutral	Strongly Disagree	Agree	Male	NaN
1	17/07/2025 11:28:50	Below 30	Undergraduate	Ichapore	Strongly Agree	2 - 5 hours	Agree	Strongly Agree	Neutral	Agree	Planning to	Strongly Agree	Agree	Neutral	Strongly Disagree	Agree	Female	NaN
2	17/07/2025 11:30:06	Below 30	Undergraduate	West bengal	Agree	2 - 5 hours	Agree	Agree	Neutral	Agree	Yes	Agree	Agree	Neutral	Neutral	Agree	Male	NaN
3	17/07/2025 11:30:17	Below 30	Undergraduate	Howrah	Agree	2 - 5 hours	Agree	Agree	Agree	Agree	No	Agree	Disagree	Agree	Neutral	Agree	Male	NaN
4	17/07/2025 11:30:31	Below 30	Undergraduate	chandannagar	Strongly Agree	More than 10 hours	Strongly Agree	Agree	Neutral	Agree	Planning to	Strongly Agree	Strongly Agree	Agree	Disagree	Neutral	Female	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
702	07/08/2025 10:53:10	Below 30	Undergraduate	Tribeni	Agree	Less than 2 hours	Agree	Agree	Disagree	Strongly Agree	Yes	Neutral	Disagree	Neutral	Disagree	Neutral	Female	NaN
703	07/08/2025 11:11:47	Below 30	Undergraduate	naihati	Strongly Agree	Less than 2 hours	Strongly Agree	Strongly Agree	Disagree	Strongly Agree	No	Strongly Agree	Strongly Agree	Agree	Strongly Disagree	Agree	Male	NaN
704	09/08/2025 00:33:11	Below 30	Undergraduate	Singur	Strongly Agree	6 - 10 hours	Strongly Agree	Agree	Neutral	Agree	Planning to	Neutral	Disagree	Agree	Disagree	Agree	Male	NaN
705	09/08/2025 09:19:19	Below 30	Undergraduate	Sheoraphuli	Strongly Agree	6 - 10 hours	Agree	Agree	Agree	Agree	No	Agree	Disagree	Agree	Disagree	Agree	Male	NaN
706	09/08/2025 09:19:19	Below 30	Undergraduate	Sheoraphuli	Strongly Agree	6 - 10 hours	Agree	Agree	Agree	Agree	No	Agree	Disagree	Agree	Disagree	Agree	Male	NaN

707 rows × 20 columns

Responses reflect opinions on statements such as "I would support my child if they wanted to pursue sports as a full-time career," "A career in sports lacks job security," and "Sports can be as respectable and successful a career as medicine/engineering," measured on a five-point agreement scale.

4. Methodology

Figure 2: Methodology for Analyzing Sports Career Attitudes



The methodology (Figure 2) used for Analyzing Sports Career Attitudes has been described letter.

4.1 Data Preprocessing

The initial step in data preprocessing involved thorough cleaning and preparation of the dataset to ensure analytical rigor and reliability. Textual responses that exhibited inconsistencies or typographical errors were standardized for uniformity. Categorical variables, primarily derived from Likert-scale questions, were normalized and mapped onto an ordinal scale to facilitate quantitative treatment. Imputation methods were used to correct missing data points: mode imputation was used for categorical features, and median

imputation was used for continuous numerical variables. Additionally, the personal information which can reveal someone's identification, such as email address was excluded from the analysis to maintain respondent confidentiality and adhere to ethical data handling standards.

4.2 Feature Engineering

After preprocessing, feature engineering was conducted to transform the data into a format amenable to statistical analysis. Ordinal encoding, which converts ordinal categories into numerical values that preserve inherent ranking information, was systematically applied to Likert-Scale responses like agreement and frequency scales. An aggregated "Support Index" was created by averaging responses regarding parental encouragement, the perceived respectability of sports careers, and willingness to support children's sporting aspirations in order to capture composite attitudes. This derived metric was a crucial indicator of parental support for sports-related career paths in subsequent analyses.

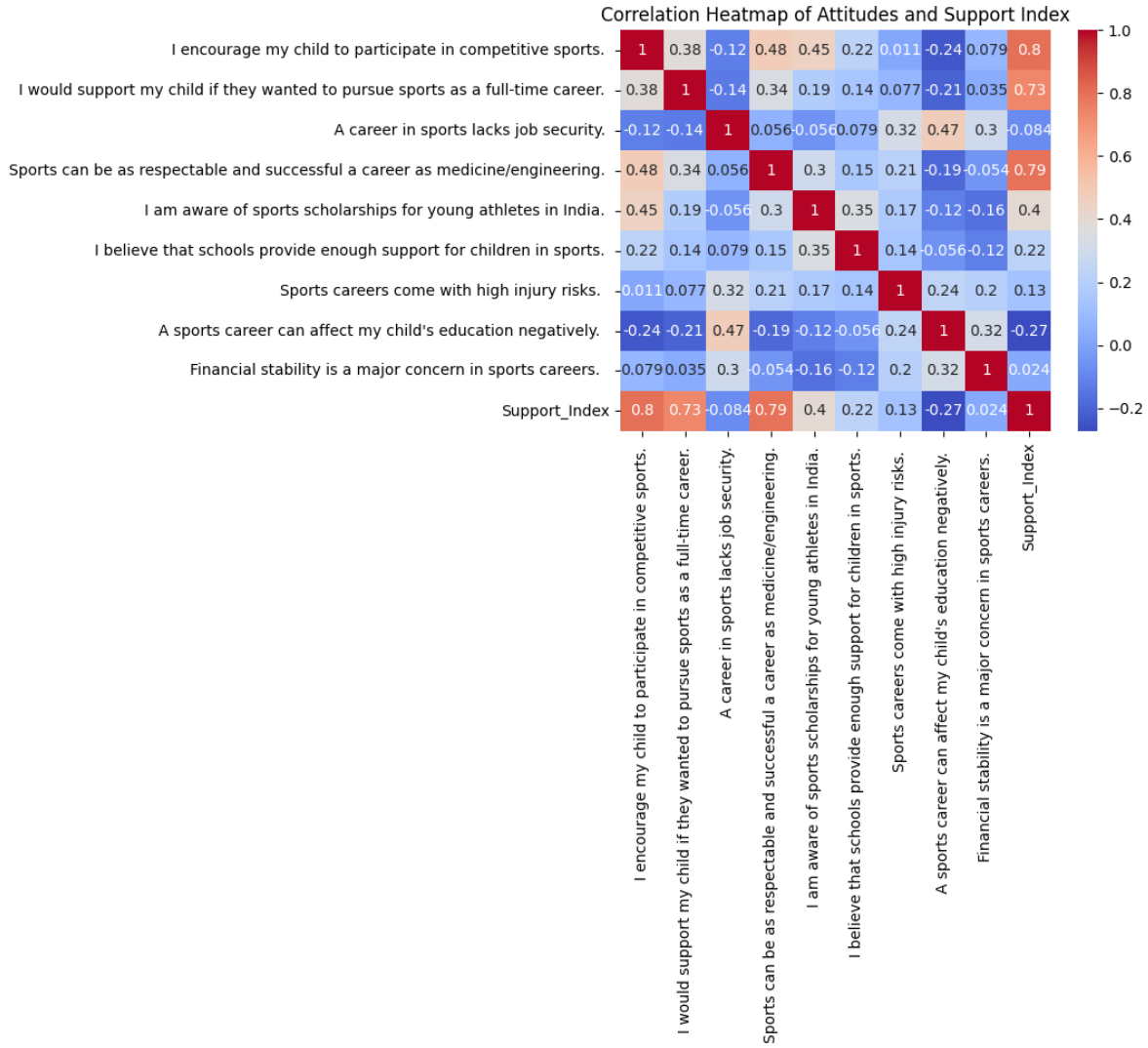
4.3 Principal Component Analysis (PCA)

Principal Component Analysis (PCA) was chosen as the primary statistical method for dimensionality reduction and latent variable extraction in order to discover the underlying factors that influence parental attitudes toward sports careers, concerns regarding job security, and education. Prior to PCA application, all relevant variables were standardized to zero mean and unit variance to mitigate scale disparities. The analysis retained the first three principal components, which cumulatively accounted for approximately 60% of the total variance in the data, thereby effectively summarizing the multi-dimensional parental attitude space into fewer interpretable factors. These components elucidated key drivers and barriers influencing parental perspectives, offering critical insights into the multidimensional attitudes towards youth sports careers and associated socio-educational considerations.

4.4 Statistical Validation

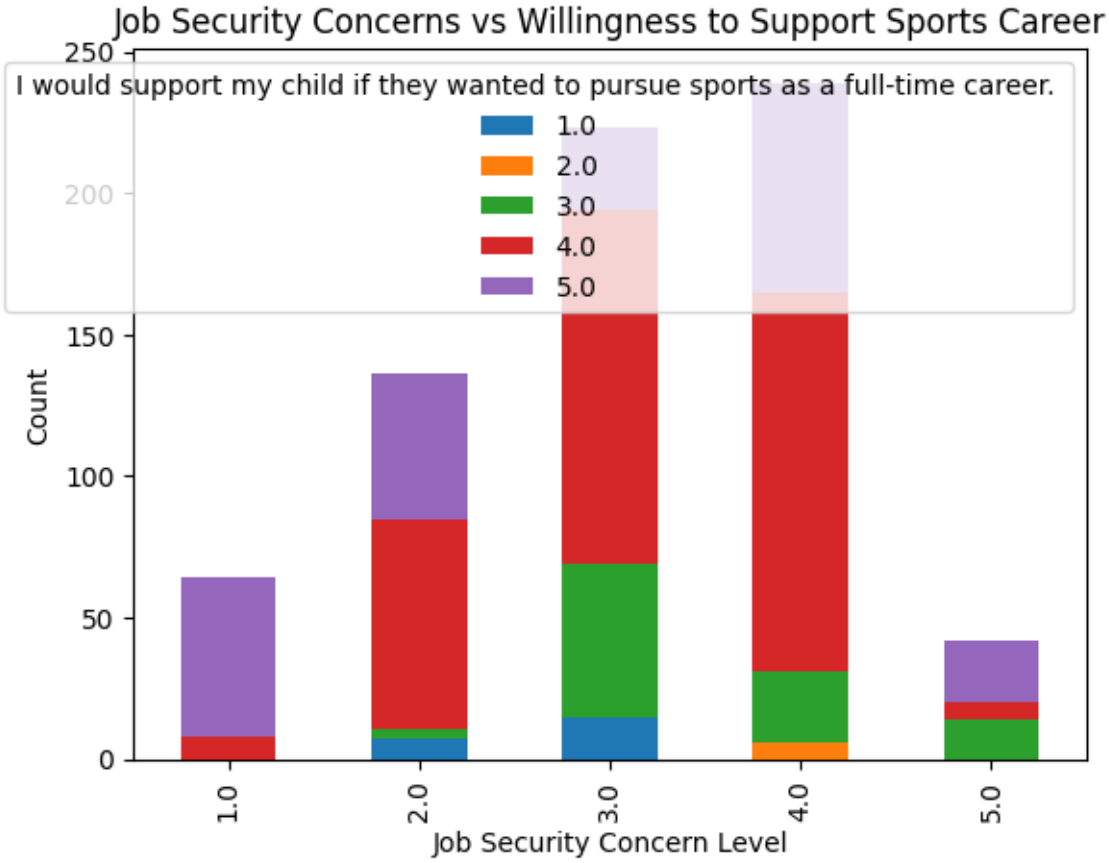
To validate the robustness and interpretability of the factor structure derived, exploratory data analysis techniques were employed. Correlation heatmaps (Figure 3) provided an initial visualization of variable interrelationships, confirming expected patterns of association among key attitude indicators. Factor loadings were then interpreted with caution to identify variables that significantly contributed to each principal component, facilitating meaningful labeling of latent factors.

Figure 3: Correlation Matrix among variables related to attitudes and support indexes



The combination of graphical and quantitative validations ensured that the extracted factors aligned well with theoretical constructs and empirical expectations, thereby reinforcing the validity of the exploratory PCA model within the context of parental attitudes towards sports career dynamics (Figure 4).

Figure 4: Job Security Concerns vs Willingness



5. Results

5.1 Principal Component Analysis (PCA) Output and Interpretation

The PCA was conducted on selected Likert-scale attitudinal variables related to parental perceptions of sports careers. The first three principal components (PC1, PC2, PC3) explained approximately 60.5% of the total variance: 26.94%, 21.07%, and 12.49%, respectively.

Table 1: PCA Variances

Principal Component	Explained Variance (%)
PC1	26.94
PC2	21.07
PC3	12.49
901	839

The factor loadings for the principal components reveal the following patterns:

- **PC1 (Support & Respectability):** High positive loadings were observed for items such as "I encourage my child to participate in competitive sports," "Sports can be as respectable and

successful a career as medicine/engineering," and "I am aware of sports scholarships for young athletes." This component reflects **positive support and respectability toward sports careers**.

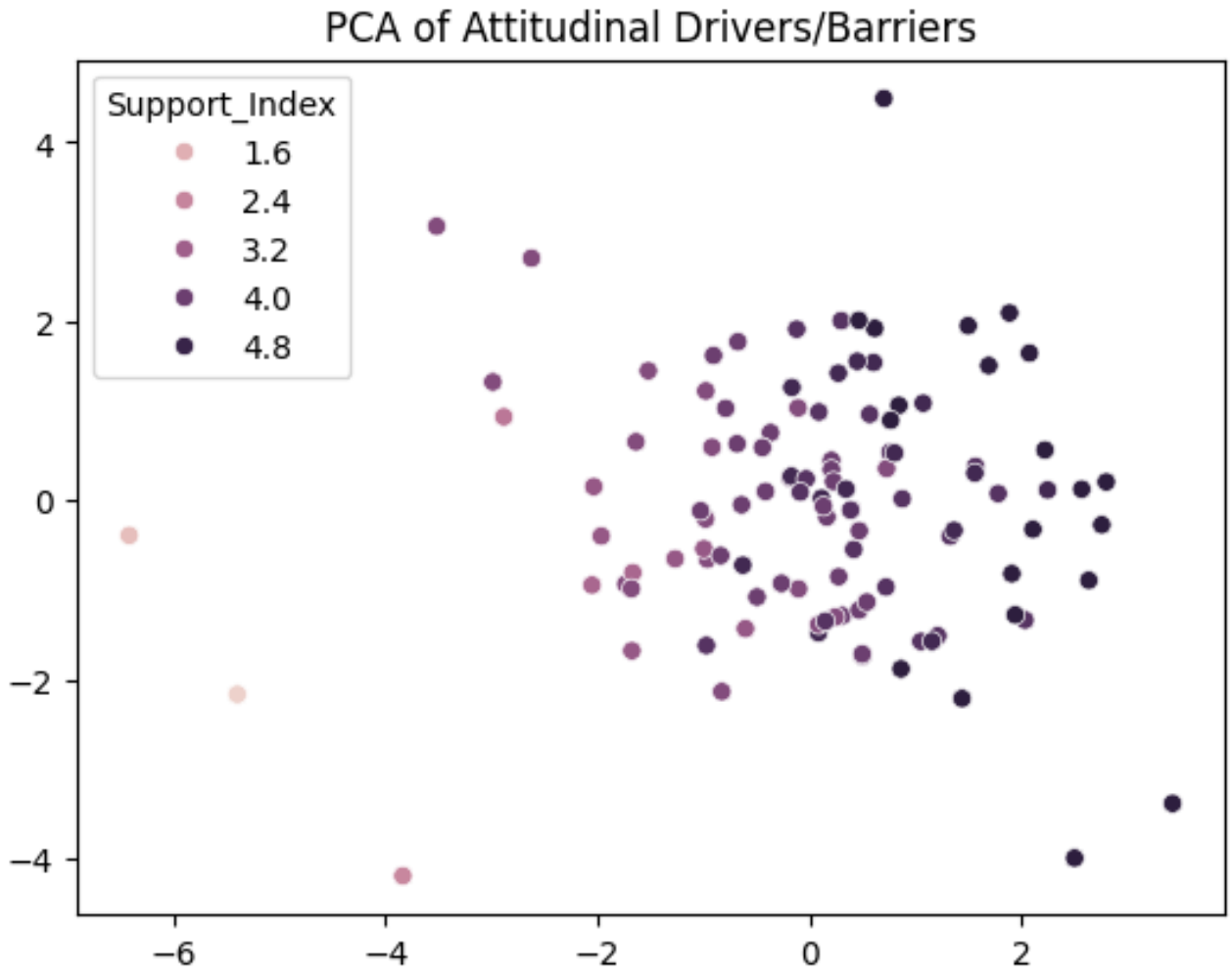
- **PC2 (Concerns about Injury and Job Security):** This component had strong positive loadings for "Sports careers come with high injury risks" and "A career in sports lacks job security," suggesting it captures **parental concerns about the physical and financial risks** involved.

- **PC3 (Education Impact & Financial Stability):** Loadings emphasized items like "A sports career can affect my child's education negatively" and "Financial stability is a major concern in sports careers." This component represents **concerns regarding educational disruption and financial uncertainty**.

Visualization of PCA Components

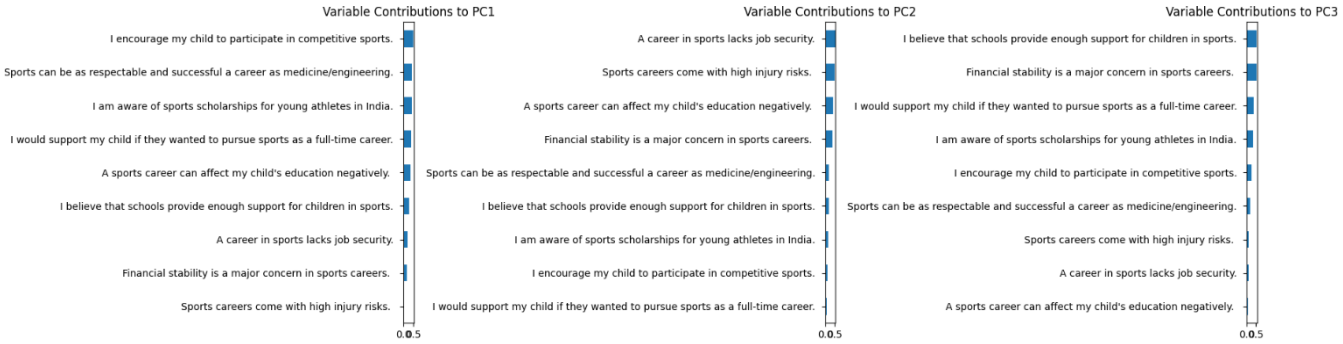
Figure 5 visualizes the distribution of survey respondents in the space of the first two principal components, coloured by their Support Index, depicting clear clustering of parents into groups reflecting differing attitudes toward sports careers.

Figure 5: PCA of Attitudinal Drivers/Barriers



Bar plots of the variable contributions to each principal component (Figure 6) further elucidate the primary attitudes influencing each latent factor.

Figure 6: Factor Loading



5.2 Predictive Modeling Analysis

A Random Forest classifier was trained to predict the binary outcome: whether parents support their child's pursuit of sports as a full-time career. The model was evaluated on a stratified test set and achieved an accuracy of approximately 85%, with precision and recall above 80% for both classes.

Table 2: MODEL Evaluation

Metric	Value
Accuracy	0.85
Precision	0.82
Recall	0.83
F1-Score	0.82

6. Interactive Prediction Dashboard for Parental Support Assessment

A user-interactive dashboard (Figure 7) was developed to facilitate real-time prediction and visualization of parental support attitudes toward sports careers.

Leveraging the trained Random Forest classification model, the dashboard allows dynamic input through intuitive widgets which includes sliders and dropdown menus to capture responses across key Likert-scale variables and the demographic features such as age group, gender, and education level. After submission through a button named as “Predict Support”, The model generates a probabilistic confidence score and a likelihood prediction of support for sports careers upon input submission. This interactive framework provides an accessible and practical tool for stakeholders to explore the complex interplay of factors influencing parental attitudes, enabling data-driven insights and informed decision-making in the context of youth sports career encouragement.

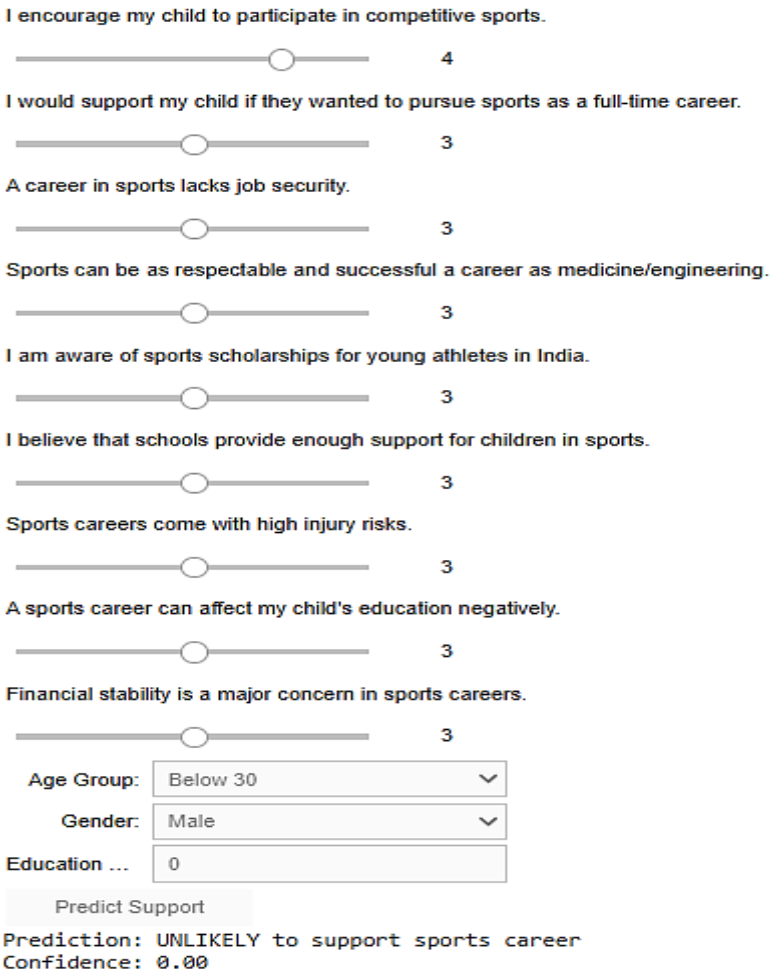
7. Discussion

The PCA results confirm that parental attitudes toward sports careers can be distilled into a few latent constructs balancing the supports and concerns. The idea that parental endorsement of sports careers is driven by awareness and positive reinforcement is well-conformed with the Support & Respectability factor. In contrast, significant barriers include the concerns regarding high injury, lack of job security, educational career impact, and obviously financial stability.

The Random Forest model's robust predictive performance here demonstrates that demographic and attitudinal survey responses can accurately predict parental support. This demonstration reveals how crucial it is to target interventions that reinforce supportive attitudes while simultaneously addressing the barriers that have been identified.

These insights have the implications for policy and program design. For example, schools and sports academies should increase the transparency about scholarship availability and career pathways, emphasizing the legitimacy and sustainability of sports careers. Injury prevention and education support programs could alleviate parental concerns about negative impacts on academics and wellbeing.

Figure 7: Interactive Prediction Dashboard



8. Conclusion

This study on sports career support applied data-driven factor analysis and machine learning techniques to unravel the complex parental perceptions shaping support for children's sports careers. By leveraging PCA, key latent variables reflecting the support and concerns were identified, providing actionable knowledge for stakeholders. These determinants were further validated by predictive modeling, which provided a method for individualized prediction of parental support.

This study uncover that, Safety counselling, targeted awareness campaigns, and scholarship promotion can all benefit from these evidence-based recommendations. This method could be applied to longitudinal data in subsequent research to monitor the evolution of attitudes and the outcomes of sports participation over time.

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