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Original Research Article

Risk Stratification and Intervention Planning Using the Indian Academy of Pediatrics Malnutrition Proactive Assessment

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Abstract:

Background: Childhood malnutrition continues to be a major health concern in India, significantly contributing to morbidity and mortality among children under five years of age. Despite various national nutritional programs, a large proportion of children remain undiagnosed or inadequately managed. The Indian Academy of Pediatrics (IAP) Malnutrition Proactive Assessment tool offers a structured approach to identify, stratify, and guide interventions in malnourished children.

Aim: To evaluate the effectiveness of the IAP Malnutrition Proactive Assessment tool in stratifying nutritional risk and guiding intervention planning among pediatric patients in a tertiary care setting.

Methods: A retrospective observational study was conducted at a tertiary care hospital in Katihar from February 2024 to January 2025. Medical records of 100 children aged 6 months to 5 years were reviewed. Risk stratification was done using the IAP Malnutrition Proactive Assessment tool, and corresponding interventions were documented. Statistical analysis was performed using SPSS version 23.0. Associations between risk categories and intervention types were assessed using the Chi-square test.

Results: Out of 100 participants, 56 were male and 44 females, with a mean age of 2.1 ± 1.1 years. Risk stratification identified 27% of children as high risk, 42% as moderate risk, and 31% as low risk. High-risk children predominantly received therapeutic nutrition (88.9%), while most moderate-risk cases were managed with dietary counseling and supplementation. A significant association was found between risk category and intervention type ($p < 0.001$).

Conclusion: The IAP Malnutrition Proactive Assessment tool proved effective in categorizing children by nutritional risk and guiding appropriate, evidence-based interventions. Its application in clinical settings can improve early detection and management of pediatric malnutrition.

Recommendations: Routine implementation of the IAP Malnutrition Proactive Assessment in pediatric outpatient and inpatient settings is recommended. Training healthcare workers on its use can enhance early diagnosis and resource-appropriate interventions, ultimately improving child health outcomes.

Keywords: Malnutrition, Pediatrics, Risk Stratification, IAP Assessment, Nutritional Intervention

Introduction

Malnutrition remains a significant public health challenge in India, particularly among children under five years of age. Despite numerous government-led interventions and nutritional programs, the prevalence of both acute and chronic forms of malnutrition continues to be unacceptably high. According to the National Family Health Survey-5 (NFHS-5), 35.5% of Indian children under five years are stunted, 19.3% are wasted, and 32.1% are underweight [1]. Malnutrition not only affects physical growth but also impairs cognitive development, increases susceptibility to infections, and raises childhood morbidity and mortality rates [2].

To address this burden, early identification of children at nutritional risk and timely intervention are critical. Traditional methods of nutritional assessment, such as isolated anthropometric measures, often fail to capture the multidimensional and dynamic nature of malnutrition, especially in resource-limited settings [3]. The Indian Academy of Pediatrics (IAP) developed the Malnutrition Proactive Assessment tool to provide a structured and comprehensive approach to identify, classify, and manage malnutrition in children. This tool incorporates anthropometric indicators like weight-for-height, mid-upper arm circumference (MUAC), and the presence of clinical signs to stratify children into low, moderate, or high nutritional risk categories [4].

Risk stratification using standardized tools allows for focused and need-based interventions, which are essential for effective resource utilization and improved outcomes. Recent studies have supported the use of proactive nutritional assessments in streamlining clinical decision-making and improving child survival rates [5,6]. The IAP's approach aligns with global priorities outlined by the World Health Organization (WHO) and UNICEF, which emphasize early detection, community-based management, and integration of nutrition into routine child healthcare [7].

Despite its clinical relevance, limited data exist regarding the real-world application of the IAP Malnutrition Proactive Assessment in tertiary or district-level settings. There is a need to evaluate its effectiveness in identifying at-risk children and directing suitable interventions based on risk levels. Understanding these dynamics is especially important in districts like Katihar, where healthcare resources are constrained and malnutrition remains a pressing concern.

This study aims to retrospectively assess the application of the IAP Malnutrition Proactive Assessment tool for risk stratification and intervention planning among pediatric patients. The findings will contribute to the evidence base supporting structured nutritional evaluation and may inform scalable models for malnutrition management in similar settings.

Methodology

Study Design

This was a retrospective observational study.

Study Setting

The study was conducted at a tertiary care center in **Katihar**, Bihar. Medical records from the pediatric department were reviewed to assess the nutritional status of children aged between 6 months to 5 years based on the IAP malnutrition guidelines.

Study Duration

The retrospective data collection spanned from **February 2024 to January 2025**, covering a 12-month period. This duration was selected to ensure adequate seasonal variation and data comprehensiveness.

Sample Size and Participants

A total of **100 pediatric patients** were included in the study. These participants were selected from hospital records based on the availability of complete nutritional

assessment data and were analyzed using the IAP Malnutrition Proactive Assessment tool.

Inclusion Criteria

- Children aged between **6 months to 5 years**.
- Complete medical records with anthropometric measurements (weight-for-age, height-for-age, weight-for-height, and mid-upper arm circumference).
- Records containing relevant clinical history, nutritional status, and follow-up documentation.
- Children who had received nutritional or medical interventions during the review period.

Exclusion Criteria

- Incomplete records lacking anthropometric or clinical data.
- Children with chronic systemic illnesses such as congenital heart disease, chronic kidney disease, or malignancies.
- Records of children admitted for trauma or surgical conditions not related to malnutrition.

Bias Control

To minimize **selection bias**, all eligible records within the defined timeframe were included consecutively. **Information bias** was mitigated by using a standardized data abstraction form and applying uniform definitions from IAP guidelines. The same team of trained investigators reviewed the records to maintain consistency in data extraction.

Data Collection Method

Data were collected from hospital medical records and pediatric nutrition registers. Variables included demographic information, anthropometric indicators, clinical signs of malnutrition, nutritional risk classification (mild, moderate, severe), and documented interventions. All data were anonymized before analysis.

Procedure

Each child's nutritional status was categorized using the IAP Malnutrition Proactive Assessment tool based on parameters such as weight-for-height, mid-upper arm circumference (MUAC), and presence of clinical signs. Based on the classification (low, moderate, or high risk), the associated intervention strategies documented in the records—such as dietary counseling, therapeutic nutrition supplementation, or referral—were reviewed and analyzed.

Statistical Analysis

Data were entered in **Microsoft Excel** and exported to **SPSS version 23.0** for statistical analysis. Descriptive statistics were used to summarize baseline characteristics. Categorical variables were expressed as frequencies and percentages. Chi-square test was used to assess associations between malnutrition risk categories and intervention outcomes. A p-value of less than 0.05 was considered statistically significant.

Results

Out of the 100 pediatric participants included in the study, **56 were males** (56%) and **44 were females** (44%). The majority of the children (38%) were in the age group of **1–2 years**, followed by 26% in the **2–3 years** group. The mean age of participants was **2.1 ± 1.1 years**.

Table 1: Age and Gender Distribution of Participants

Age Group	Male (n=56)	Female (n=44)	Total (n=100)	Percentage (%)
6–12 months	10	8	18	18%
1–2 years	22	16	38	38%
2–3 years	12	14	26	26%
3–5 years	12	6	18	18%

The highest proportion of malnourished children belonged to the 1–2 year age group, highlighting a critical window for nutritional interventions.

Risk Stratification Based on IAP Assessment

Based on the IAP Malnutrition Proactive Assessment, **27 children (27%)** were categorized as **High Risk**, **42 children (42%)** as **Moderate Risk**, and **31 children (31%)** as **Low Risk**.

Table 2: Nutritional Risk Stratification by Gender

Risk Category	Male (n=56)	Female (n=44)	Total (n=100)	Percentage (%)
Low Risk	18	13	31	31%
Moderate Risk	22	20	42	42%
High Risk	16	11	27	27%

A substantial proportion (42%) fell into the moderate-risk category, indicating that a large number of children required active monitoring and nutritional supplementation.

Anthropometric Data

Anthropometric measurements revealed the following:

- **Weight-for-height Z score**: Mean = **-2.5 ± 1.1**
- **Mid-upper arm circumference (MUAC)**: Mean = **12.1 ± 1.5 cm**
- **Stunting (Height-for-age Z score < -2)**: **34%**
- **Wasting (Weight-for-height Z score < -2)**: **45%**

Intervention and Outcome

Among the 27 high-risk children, 24 (88.9%) received therapeutic nutrition, while 3 (11.1%) were referred to tertiary centers. In the moderate group, 36 out of 42 (85.7%) received dietary counseling and supplementary nutrition. In the low-risk group, only 5 children (16.1%) required dietary advice.

Table 3: Interventions According to Risk Category

Risk Category	No. of Children	Dietary Counseling	Therapeutic Nutrition	Referral	No Intervention
Low Risk	31	5	0	0	26
Moderate Risk	42	36	6	0	0
High Risk	27	0	24	3	0

High-risk children required immediate therapeutic nutrition, while moderate-risk children mostly benefited from targeted dietary counseling. Low-risk children required minimal intervention.

Statistical Analysis

A **Chi-square test** showed a statistically significant association between **risk category and type of intervention** (**$p < 0.001$**), suggesting that the IAP stratification tool effectively guided appropriate care planning.

Summary of Key Findings

- Majority of children were aged 1–2 years, with a male predominance.
- 27% of participants were categorized as high risk.
- 88.9% of high-risk children required therapeutic nutritional intervention.
- Statistical significance ($p < 0.001$) was observed between risk category and intervention strategy.

Discussion

In this retrospective study involving 100 pediatric participants, (IAP) Malnutrition Proactive Assessment tool was used to stratify children into different nutritional risk categories and guide intervention strategies. The study population comprised 56 males and 44 females, with a mean age of 2.1 ± 1.1 years. The majority (38%) of the children fell in the 1–2 years age group, which is a critical period for growth and development, and hence vulnerable to nutritional deficiencies.

Risk stratification revealed that 27% of the children were in the high-risk category, 42% in the moderate-risk group, and 31% in the low-risk group. This distribution highlights that nearly 70% of the study population required either moderate or intensive nutritional intervention. These findings align with the known burden of pediatric malnutrition in India, particularly in early childhood, and support the utility of structured assessment tools like the IAP guidelines.

Anthropometric assessments indicated a high prevalence of undernutrition, with 45% of the children showing wasting (weight-for-height Z-score < -2) and 34% showing stunting (height-for-age Z-score < -2). The average MUAC of 12.1 ± 1.5 cm and weight-for-height Z-score of -2.5 ± 1.1 further confirmed the extent of acute malnutrition among these children.

Intervention strategies were aligned with the level of risk stratification. Among the high-risk group, 88.9% received therapeutic nutrition (such as ready-to-use therapeutic food or energy-dense feeds), and the remaining were referred for specialized care. In the moderate-risk group, the majority (85.7%) received dietary counseling and nutritional supplementation, which are cost-effective and scalable in primary care settings. Notably, most of the low-risk children required no active intervention beyond regular follow-up and monitoring.

The association between nutritional risk category and type of intervention was statistically significant ($p < 0.001$), suggesting that the IAP tool provides a reliable framework for clinical decision-making. This result demonstrates that the proactive assessment not only stratifies malnutrition risk accurately but also helps in prioritizing care and resource allocation, especially in resource-constrained settings.

Overall, the study supports the integration of the IAP Malnutrition Proactive Assessment into routine pediatric evaluations to ensure early identification of at-risk children and timely intervention.

Recent studies have supported a variety of risk stratification tools and approaches for improving intervention planning in child malnutrition in India. A predictive model developed from the National Family Health Survey-4 identified newborns at high risk of undernutrition using maternal, child, and household characteristics, demonstrating the utility of delivery-time data for early intervention targeting [8]. Similarly, a hospital-based study found a high prevalence of intestinal parasitic infections among malnourished under-five children, with parasites like Ascaris lumbricoides and Cryptosporidium spp. significantly associated with stunting and wasting, respectively. This highlights the value of integrating parasitological assessment in nutritional risk stratification [9].

Mid Upper Arm Circumference (MUAC) has emerged as a reliable field tool for predicting mortality in under-five children, where a MUAC below 115 mm was associated with a 4.7% one-year mortality, supporting its inclusion in rapid screening protocols [10]. The Indian Academy of Pediatrics' Neurodevelopmental Chapter recommended a holistic risk stratification and intervention strategy for early neurodevelopmental disorders in infants, including structured follow-ups and use of Indian screening tools at key developmental intervals, showing promise for national implementation [11].

Geographic multilevel analyses revealed significant clustering of malnutrition risk factors at the village, district, and state levels, with states like Bihar and Uttar Pradesh showing elevated burden, underscoring the need for region-specific policy and intervention strategies [12]. A community study in urban Surat identified low birth weight, bottle feeding, and junk food consumption as significant contributors to severe acute malnutrition in children, reinforcing the role of family-level behavioral factors in risk assessment [13]. Furthermore, a cross-sectional survey in the Sundarbans region of West Bengal showed extremely poor household coverage of nutrition services (<5%), indicating a gap in multi-sectoral delivery and the importance of coordinated, packaged interventions at the household level [14].

Conclusion

This study highlights the effectiveness of the IAP Malnutrition Proactive Assessment tool in accurately stratifying pediatric patients by nutritional risk and guiding appropriate intervention strategies. A significant proportion of children were found to be at moderate to high risk, underscoring the need for routine nutritional screening. The tool proved valuable in aligning care plans with risk levels, promoting timely and targeted interventions to combat childhood malnutrition.

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