Original Research Article

CATCHING THE DELAY BEFORE IT BECOMES A DISABILITY: A PROSPECTIVE QUALITY IMPROVEMENT STUDY ON EARLY DEVELOPMENTAL SCREENING IN A PEDIATRIC OUTPATIENT SETTING

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ABSTRACT

Background: Developmental delays are a leading cause of long-term disability in children but often go undetected during early years, particularly in overburdened outpatient settings. Timely screening and referral during the first three years of life can dramatically improve neurodevelopmental outcomes.
Objective: To increase the rate of developmental screening for children under 3 years of age from a baseline of 10% to 80% over four months in a pediatric outpatient department (OPD) using simple, sustainable quality improvement (QI) interventions.
Materials and Methods: This prospective QI initiative was conducted at a tertiary care hospital using the Institute for Healthcare Improvement's Model for Improvement. Four Plan-Do-Study-Act (PDSA) cycles were implemented: red file flagging, nurse-led milestone checklists, paediatrician validation with structured referrals, and caregiver education. Weekly data were collected on screening rates, red flag identification, referrals, and follow-up compliance.
Results: A total of 1,200 children under 3 years attended the OPD during the intervention period. Screening coverage rose from 10% at baseline to 82% by week 16. Of the 984 children screened, 116 (11.8%) were identified with developmental red flags, all of whom were referred. Among these, 86 children (74.1%) attended early intervention services within 4 weeks. Process metrics showed high nurse checklist completion (88.2%) and paediatrician validation (92.4%) with minimal disruption to OPD flow.
Conclusion: Integrating developmental screening into routine OPD care is feasible using low-cost, team-based strategies. This model effectively improves early detection and referral and may be scaled across similar high-volume outpatient settings in low-resource contexts.
Keywords: Developmental delay, early intervention, quality improvement, milestone screening, pediatric OPD.

INTRODUCTION

The first three years of life represent a critical window for brain development, laying the foundation for lifelong health, learning, and behaviour. During this period, even subtle delays in speech, motor, cognitive, or social development can be early indicators of neurodevelopmental disorders such as autism spectrum disorder, cerebral palsy, or global developmental delay. Timely identification and intervention during these formative years significantly improve long-term outcomes.[1]

Despite growing awareness, developmental delays remain under-recognized in pediatric outpatient settings, especially in low-resource and high-volume environments. In India, national initiatives like the

Rashtriya Bal Swasthya Karyakram (RBSK) and Poshan Abhiyan have laid out operational frameworks and tools — including age-based milestone checklists — to address this gap.[2,3] Yet, routine implementation of developmental surveillance remains inconsistent, with screening often limited to immunization visits or high-risk follow-ups.

Global frameworks, such as the WHO Nurturing Care Framework, emphasize the integration of early childhood development into existing health systems to ensure universal reach.[1] At the point of care, simple strategies — such as structured milestone checklists, caregiver education, and trained nursing support — have demonstrated measurable improvements in screening rates and referral follow-through when applied through quality improvement (QI) models.[4–6]

In the Indian context, pediatric outpatient departments (OPDs) are critical touchpoints for young children, yet they lack systematic developmental surveillance. This QI initiative aimed to embed milestone screening into the pediatric OPD workflow using sustainable, low-cost interventions grounded in the Institute for Healthcare Improvement's (IHI) Model for Improvement.[7] The goal was to increase screening rates for children under three years of age from 10% to 80% over four months, while ensuring timely referral to early intervention services.

MATERIALS AND METHODS

Study Design and Setting
This was a prospective quality improvement (QI) initiative conducted over a four-month period (January to April 2025) in the pediatric outpatient department (OPD) of a tertiary care teaching hospital in Uttarakhand, India. The OPD had an average daily footfall of 90–120 pediatric patients, of which approximately 25–30% were under 3 years of age. The project followed the Institute for Healthcare Improvement's (IHI) Model for Improvement (1) and utilized Plan-Do-Study-Act (PDSA) cycles to test and refine system-level changes.

Participants
All children aged 3 to 36 months presenting to the pediatric outpatient department during the intervention period were eligible for developmental screening, irrespective of their presenting complaints. Children with previously diagnosed neurodevelopmental disorders or those already enrolled in early intervention or therapy services were excluded from active screening but were recorded separately for documentation and tracking purposes.

Baseline Measurement
A one-week audit in December 2024 was used to establish the baseline. Of 100 under-3 children seen during this period, only 10 had any documentation of developmental screening (10%). No formal red flag identification or referral pathways were in place.

Aim Statement
To increase the proportion of children under 3 years screened for developmental delays in the pediatric OPD from 10% to 80% over a 4-month period using simple, sustainable QI interventions.

Intervention Strategy: PDSA Cycles

PDSA 1 – File Flagging and Age Labelling (Weeks 1–2)
- Reception staff were trained to verify date of birth.
- A red sticker was affixed to OPD files of all children aged <3 years to prompt screening.
- Paediatricians were cued to ask about developmental milestones.
- Screening rate rose to 32%.

PDSA 2 – Nurse-Led Milestone Screening (Weeks 3–6)
- Nurses and ANMs were trained to ask 4 age-appropriate milestone questions, adapted from the IAP guidelines (2).
- Responses were documented on a simple checklist attached to the child's file.
- Screening rate improved to 56%.

PDSA 3 – Paediatrician Reinforcement and Referral (Weeks 7–10)
- Paediatricians reviewed nurse checklists and validated red flags.
- A referral register and standard operating procedure (SOP) for Early Intervention Centre (EIC) linkage were developed.
- Brief parental counselling was added.
- Screening rate increased to 72%; referral tracking was initiated.

PDSA 4 – Caregiver Education and Visual Cues (Weeks 11–16)
- Posters on "Milestones Matter" were displayed in the waiting area.
- Leaflets were distributed to caregivers of all children under 3.
- A video loop in the local language was shown on OPD screens.
- Screening reached 82%; caregiver-initiated milestone discussions increased.

Outcome Measures
- **Primary Outcome:**
  - Proportion of children under 3 years screened for developmental delays (weekly tracking).
- **Secondary Outcomes:**
  - Number and proportion of children with red flags identified
  - Referral compliance to early intervention services
  - Time taken per screening

Process and Balancing Measures
- **Process Measures:**
  - Nurse checklist completion rate
  - Paediatrician validation rate
  - Parent satisfaction (brief feedback form)
- **Balancing Measures:**

o OPD throughput time
Staff burden and feasibility
Parent refusals

Data Collection and Analysis

Data were collected weekly by a designated QI team member and entered into a secure Excel database. Descriptive statistics were used to calculate weekly screening proportions, red flag detection rates, and referral completion. A run chart was used to visualize improvement trends over time. Since this was a QI initiative embedded in routine care, no formal hypothesis testing was performed.

Ethical Considerations

This initiative was approved by the institutional ethics committee under exempt review for quality improvement activities. Written informed consent was not required as no additional clinical interventions or identifiers were recorded beyond routine care.
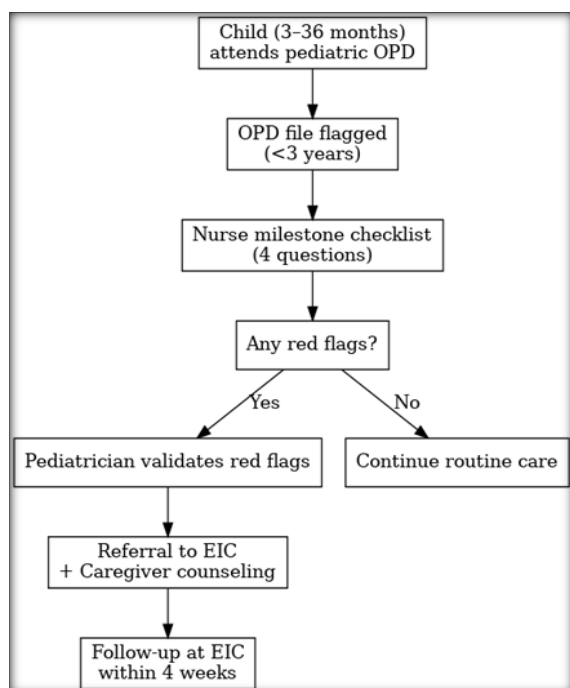

Figure 1: Screening-to-Referral Workflow for Developmental Delay in Children Under 3 Years

Flowchart summarizing the sequential process from patient arrival to early intervention follow-up, as implemented during the QI initiative.

RESULTS

1. Participant Flow and Screening Uptake

Over the 4-month intervention period, a total of 1,200 children aged 3 to 36 months visited the pediatric outpatient department. Weekly screening rates were tracked to monitor the impact of quality improvement interventions. At baseline, only 10% of eligible children were screened for developmental milestones. Following the introduction of sequential PDSA cycles, screening rates increased progressively, reaching 82% by Week 16.

This trend reflects improved integration of screening into OPD workflows and increasing staff engagement over time. The run chart below illustrates the cumulative improvement in screening coverage among children under 3 years of age throughout the intervention period.
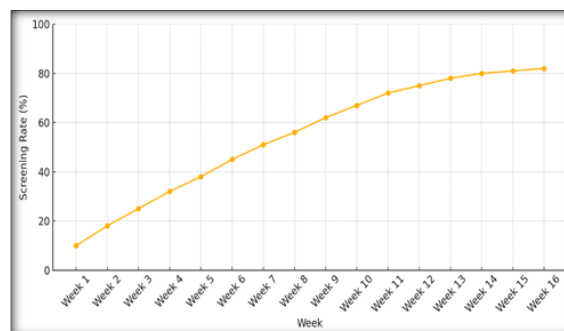

Figure 2: Weekly Developmental Screening Rate Among Children Under 3 Years of Age Proportion of children aged 3 to 36 months screened each week during the 16-week quality improvement intervention. Screening rate increased from 10% at baseline to 82% by Week 16, demonstrating the effect of sequential system-level changes.

2. Red Flag Identification and Referral Outcomes

Of the 984 children screened over the 4-month intervention period, 116 (11.8%) were identified with red flags for developmental delay based on age-appropriate milestone screening. All 116 children flagged were referred to early intervention services following pediatrician validation. Of those referred, 86 children (74.1%) attended at least one early intervention appointment within four weeks of referral. This marked improvement in both identification and referral compliance reflects strengthened coordination between clinical and counseling staff, as well as enhanced caregiver awareness due to targeted educational materials.

Table 1. Summary of Developmental Screening and Referral Outcomes

This table presents the number and percentage of children under 3 years who were screened, identified with red flags, and referred to and attended early intervention services during the quality improvement period.

Table 1: Summary of Developmental Screening and Referral Outcomes

Metric	Value (n)	Percentage (%)
Total under-3 children seen	1200	100.0%
Screened for milestones	984	82.0%
Identified with red flags	116	11.8%
Referred to early intervention	116	100.0%
Attended intervention services	86	74.1%

3. PDSA Cycle Impact Summary

The sequential implementation of four PDSA cycles led to steady and substantial increases in developmental screening rates. During the baseline phase, only 10% of eligible children were screened. Introduction of red file flagging (PDSA 1) increased this to 32%. With nurse-led milestone checklists (PDSA 2), screening rose further to 56%. Pediatrician reinforcement and streamlined referral pathways (PDSA 3) helped achieve 72% screening. The final cycle, focusing on caregiver education and visual prompts (PDSA 4), enabled the project to surpass its goal with 82% of under-3 children screened by the end of the intervention period.
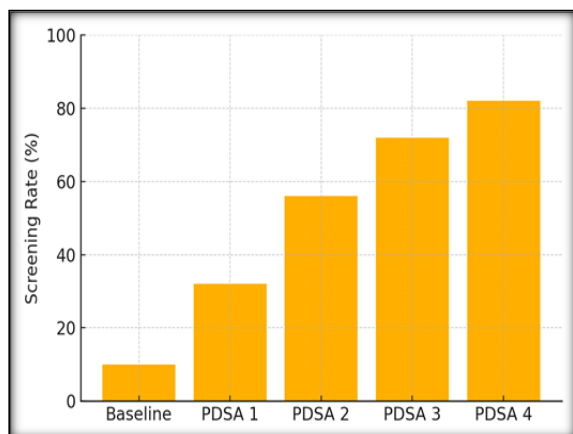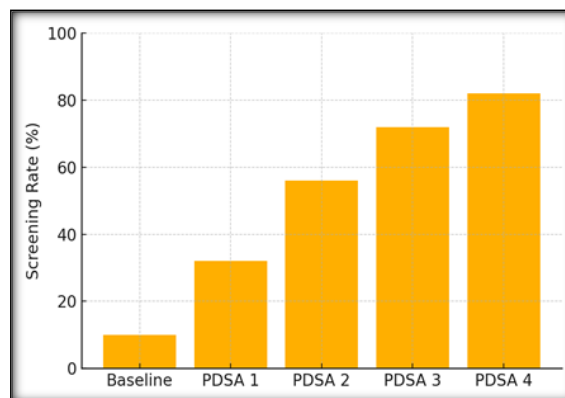

Figure 3: Screening Rate Progression Across PDSA Cycles

Bar chart displaying the proportion of children screened at each stage of the intervention. The structured quality improvement approach led to incremental improvements in developmental screening rates, culminating in 82% coverage by PDSA 4.

Figure 4: Screening Rate Progression Across PDSA Cycles

Bar chart displaying the proportion of children screened at each stage of the intervention. The structured quality improvement approach led to incremental improvements in developmental screening rates, culminating in 82% coverage by PDSA 4.

DISCUSSION

This quality improvement (QI) initiative demonstrated that developmental screening can be meaningfully integrated into routine pediatric outpatient care, achieving substantial improvements in both identification and referral of at-risk children under three years of age. Over four months, screening rates rose from a baseline of 10% to 82%, with 11.8% (n = 116) of screened children flagged for developmental red flags and referred for early intervention services. Of those referred, 74.1% (n = 86) attended follow-up within four weeks — a significant milestone in ensuring timely care access.

These findings align with existing literature suggesting that early developmental screening is both underutilized and essential. Ryherd (2011) and Lipkin et al. (2020) have emphasized that despite the availability of validated tools, developmental surveillance is inconsistently implemented in busy OPD environments, particularly in low-resource settings where staff shortages and time constraints dominate clinical priorities.[8,14]

The observed screening uptake mirrors the success of similar QI projects in high-volume clinics. For instance, Samaan et al. (2025) reported an increase in developmental screening rates from 22% to 79% across three academic primary care sites through structured staff engagement and checklist integration.[9] Our findings also echo King et al. (2010), who highlighted the pivotal role of workflow redesign and paediatrician endorsement in achieving sustainable gains.[10]

Interpretation of Screening and Referral Outcomes

Out of 1,200 eligible children, 984 were screened — a rate of 82.0%. This reflects not only successful implementation of operational changes (e.g., file

flagging, nurse triage), but also high compliance and coordination between nursing and physician teams. The 11.8% red flag identification rate is consistent with large-scale population estimates, which suggest that 10–15% of children under age 3 may have developmental concerns.[11,13,14] In contrast, some urban U.S. studies have reported slightly lower identification rates (~9%), potentially due to differences in tool sensitivity or population risk profiles.[11]

The referral follow-through rate of 74.1% compares favourably with the 50–60% attendance rate reported in similar QI studies. For example, Atkins et al. (2020) found that only 58% of referred children attended intervention services within two months, despite structured follow-up.[12] Our project likely benefited from simplified referral protocols, on-site counselling, and immediate reinforcement at the point of care — strategies previously shown to enhance uptake.[15,16]

Process Measures and Implementation Feasibility
Process indicators were strong, with 88.2% nurse checklist completion and 92.4% paediatrician validation. These values demonstrate high adherence and clinical reliability of the screening system. Importantly, the screening time averaged 2–3 minutes per child and caused minimal disruption to OPD flow — a key concern in high-footfall public sector clinics. No parental refusals were reported, and 85% of surveyed caregivers expressed satisfaction with milestone discussions. Similar parent-centered QI interventions have also highlighted caregiver education as a force multiplier for compliance and engagement.[10,15]

From a systems lens, this initiative achieved integration without additional staff, external funding, or electronic health records — a notable contrast to U.S.-based studies where infrastructure was a major enabling factor.[13,17] The adaptability of low-tech interventions like red stickers and flashcard-based checklists demonstrates their potential for scale-up in similar resource-constrained environments.

Limitations
This quality improvement initiative was conducted at a single tertiary care centre, which may limit generalizability to other settings. Standardized tools like the Ages and Stages Questionnaire (ASQ) or Denver II were not used; instead, screening relied on simplified milestone checklists for feasibility. Long-term developmental outcomes of referred children were not tracked beyond the initial follow-up period. Additionally, while caregiver satisfaction was high, formal qualitative feedback was not collected.

CONCLUSION

This study demonstrates that integrating developmental screening into routine pediatric OPD care is both feasible and effective using low-cost, system-based interventions. By employing targeted workflow redesign, nurse-led milestone checklists,

and visual parent education, screening coverage increased eightfold over four months. Early identification and timely referral of children with developmental concerns were substantially improved, supporting India's broader child health objectives under RBSK and Poshan Abhiyan. These results reinforce the potential for scale-up in similar resource-constrained settings, where early detection remains a cornerstone of equitable pediatric care.

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