

# Evaluating the Utility of Mini-CEX as a Formative Assessment Tool for Paediatric Postgraduate Education: A Mixed-method Educational Interventional Study from Gujarat, India

HEMAL DAVE



## ABSTRACT

**Introduction:** The Mini Clinical Evaluation Exercise (mini-CEX) assesses doctor-patient interactions and clinical skills. Its use in Indian Postgraduate (PG) programmes is limited despite its effectiveness.

**Aim:** To evaluate the utility of the mini-CEX as a teaching, learning and formative assessment tool for paediatric PG education.

**Materials and Methods:** This mixed-method educational interventional study was conducted in Department of Paediatrics, Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat, India from April to June 2024 which included nine residents and ten faculty members. The mini-CEX proforma from the American Board of Internal Medicine (ABIM) was used to assess seven domains of doctor-patient interactions. Mini-CEX encounters included residents from all three years in both Outpatient Departments (OPD) and Inpatient Departments (IPD) settings. Feedback on this tool was collected through a questionnaire to understand its educational utility and feasibility. The study analysed residents' scores and satisfaction using statistical methods like Student's paired t-tests, alongside qualitative insights from open-ended questions.

**Results:** A total of 46 mini-CEX encounters were conducted, which showed significant improvements in both OPD and IPD settings. In the OPD, medical interviewing skills increased from 3.11 to 5.71 (p-value <0.001) and physical examination skills from 3.56 to 5.14 (p-value <0.001). In the IPD, medical interviewing skills rose from 3.67 to 4.86 (p-value=0.004) and counselling skills from 3.56 to 4.71 (p-value=0.002). Overall clinical competence improved from 4.44 to 5.29 (p-value=0.002). Residents' satisfaction with this tool increased from 5.44 to 8.50 and faculty satisfaction rose from 5.56 to 8.86 on a 9-point Likert scale. Each encounter averaged 17.64 minutes, with 4.76 minutes allocated for feedback. All residents felt motivated to improve their learning, with 2 (22.2%) strongly agreeing and 7 (77.8%) agreeing. Faculty believed the tool could help identify knowledge gaps in their PG residents and improve teaching methods, with 5 (55.6%) strongly agreeing, 3 (33.3%) agreeing and 1 (11.1%) agreeing to some extent.

**Conclusion:** Integrating the mini-CEX as a formative assessment tool could improve the Paediatric PG programme. While the mini-CEX proved feasible and acceptable, addressing time constraints and the need for greater commitment requires faculty development and effective change management strategies.

**Keywords:** Clinical competence, Feasibility studies, Feedback, Medical, Motivation, Workplace

## INTRODUCTION

In many Indian medical colleges, PG training prioritises summative assessments focused on knowledge acquisition rather than clinical skills [1]. The National Medical Commission (NMC) advocates for continuous formative assessments to ensure the holistic development of PG residents by evaluating a broad range of skills, including medical knowledge, patient care, procedural and academic skills, interpersonal skills, professionalism, self-directed learning and practical effectiveness [2]. An ideal Workplace-based Assessment (WPBA) involves direct observation of skills in a real-world setting followed by comprehensive feedback from faculty [3]. The mini-CEX is one such WPBA method, where a faculty member observes a student during a brief clinical encounter, assessing various skills and providing structured feedback [4,5].

At our paediatric PG programme in Gujarat, which admits three students annually, regular teaching methods may not efficiently identify gaps in clinical or communication skills or assess professionalism during doctor-patient interactions. Traditional case presentations lack direct observation of real-time patient history-taking or examinations, focusing more on cognitive and psychomotor domains while overlooking Attitude, Ethics and Communication (AETCOM) areas. Furthermore, there is no standardised feedback format akin to that of the mini-CEX tool.

Previous studies, including those by Goel A and Singh T, and by Magar S et al., demonstrated the feasibility of the mini-CEX and its complementary nature to traditional assessments in paediatric clinical settings [6,7]. Charokar K and Kapoor A further validate its acceptability and effectiveness as a formative assessment tool [8], while Khalil S et al., suggest its incorporation into PG paediatric residency evaluations [9].

Despite these recommendations, its use in Indian settings is limited for reasons that remain unclear. This study was conducted to sensitise faculty, assess feasibility and satisfaction, and evaluate the educational utility of the mini-CEX for PG training in our department, before considering its inclusion in our curriculum.

## MATERIALS AND METHODS

This mixed-method educational interventional study was conducted in the Paediatric Department of Parul Institute of Medical Sciences and Research, affiliated with Parul University in Gujarat, India from April to June 2024. Ethical approval was obtained from the Institutional Ethics Committee for Human Research, as documented in letter no. PUIECHR/PIMSR/00/081734/6911 dated 20<sup>th</sup> March 2024. Written informed consent was obtained from both residents and faculty members before their participation.

**Inclusion criteria:** All nine PG residents and 10 faculty members in the paediatrics department during the study were invited to

participate in conducting mini-CEX encounters and providing postintervention feedback.

**Exclusion criteria:** PG residents absent from the department during their scheduled mini-CEX encounters were excluded. One faculty member who joined after the study commenced did not conduct mini-CEX encounters but provided feedback due to prior experience with the tool. The investigator, a faculty member, refrained from participating in the postintervention feedback to avoid bias but conducted the mini-CEX encounters.

**Sample size:** A convenient sampling technique was used that included nine residents across all three Postgraduate Years (PGY)—three PGY3, three PGY2, and three PGY1 residents—and all 10 faculty members (ranging from professors to assistant professors) from the department.

To conduct a total of 46 mini-CEX assessments, author randomly selected 23 walk-in OPD patients and 23 IPD patients, ensuring that patient management was not affected. There was a 15-day gap between each encounter in a particular setting for each resident. The study utilised the mini-CEX tool developed by the ABIM for the formative assessment of core clinical skills [10]. Faculty members received training on how to use the tool through role-play of a mini-CEX encounter conducted by the study investigator. During the study, experienced faculty provided ongoing support to colleagues who were new to the mini-CEX tool. Each encounter was independently evaluated by a designated faculty member to ensure unbiased assessments. Randomisation employed software-generated random numbers to assign residents and faculty members to specific assessment codes, ensuring that the assessments were unbiased and systematic. This method provided a clear and fair mechanism for linking PG residents to their unique assessor faculty.

By using this tool, faculty members evaluated PG residents during direct observation encounters with patients and provided immediate feedback for potential improvement. Each resident was scored on a 9-point Likert scale across seven domains: medical interviewing skills, physical examination skills, humanistic qualities/professionalism, clinical judgement, counselling skills, organisation/efficiency, and overall clinical competence. Scores of 1-3 indicated a performance below the level expected for the training stage, 4-6 met expectations, and 7-9 were well above expectations [10]. It was decided, through consensus in the department, to assess all seven domains for each encounter. Postintervention feedback from faculty and PG residents was collected through anonymous questionnaires using a 5-point Likert scale. Medical education specialists reviewed the feedback form to ensure its face validity.

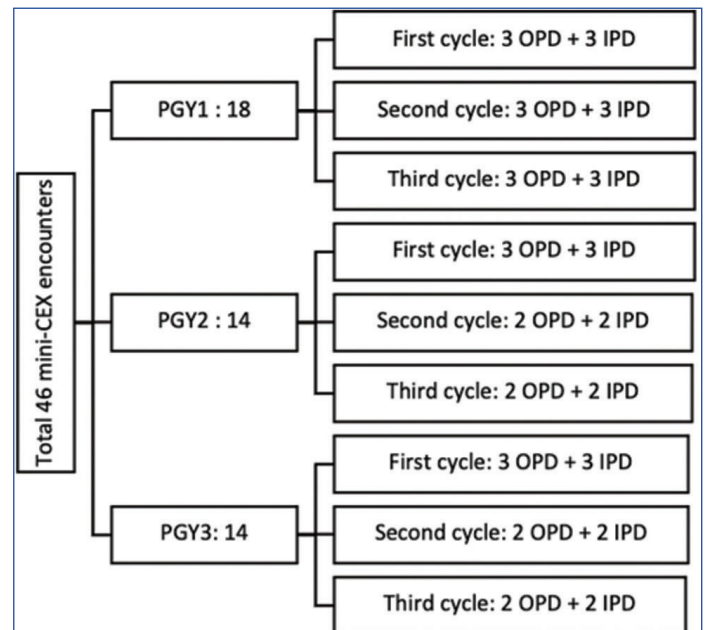
## STATISTICAL ANALYSIS

Continuous variables were expressed as means and standard deviations and analysed using IBM Statistical Package for the Social Sciences (SPSS) Statistics 29.0.2.0 with Student's paired t-tests ( $p$ -value  $<0.05$  considered significant). Descriptive statistics summarised categorical variables from the mini-CEX form and postintervention feedback. Qualitative insights from open-ended questions provided emerging themes regarding perceptions of the mini-CEX tool.

## RESULTS

During the study, a total of 46 (14+14+18) mini-CEX encounters were conducted for nine paediatric residents, as described in [Table/Fig-1]. For PGY1 (ages 24-28 years, two females and one male), all three participants completed their 18 encounters (9 OPD, 9 IPD). For PGY2 (ages 25-30 years, comprising two females and one male), only two out of three completed all encounters, as the male resident left for a district residency posting after the first encounter in both settings. Therefore, PGY2 residents also completed 14 encounters

(7 OPD, 7 IPD). For PGY3 (ages 26-32 years, all females), only two out of three completed all OPD/IPD encounters, as one resident went on maternity leave after the first encounter in both settings. Thus, collectively, PGY3 residents completed a total of 14 encounters (7 OPD, 7 IPD).



[Table/Fig-1]: Distribution of sample frames of mini-CEX encounters.

Regarding the faculty (ages 30-69 years, consisting of five professors, one associate professor, and four assistant professors), nine out of ten actively engaged in mini-CEX encounters, including the investigator. One faculty member (professor) joined after the study began but participated in the feedback on the mini-CEX tool, given their experience at a previous academic institution. This faculty member contributed to the feedback, but the author did not participate in the feedback process to avoid response bias.

The study showed significant improvements in mini-CEX scores across all domains in OPD settings, with medical interviewing skills increasing from  $3.11 \pm 1.45$  to  $5.71 \pm 1.11$  ( $p$ -value  $<0.001$ ) and physical examination skills from  $3.56 \pm 0.88$  to  $5.14 \pm 1.06$  ( $p$ -value  $<0.001$ ) [Table/Fig-2]. Similarly, in IPD settings, medical interviewing skills improved from  $3.67 \pm 1.73$  to  $4.86 \pm 1.68$  ( $p$ -value  $=0.004$ ), and counselling skills increased from  $3.56 \pm 1.24$  to  $4.71 \pm 1.70$  ( $p$ -value  $=0.002$ ). Overall clinical competence also rose from  $4.44 \pm 1.58$  to  $5.29 \pm 1.70$  ( $p$ -value  $=0.002$ ) [Table/Fig-3]. Residents' satisfaction levels with the mini-CEX tool, based on a 9-point Likert scale, increased from  $5.44 \pm 0.86$  (first encounter,  $n=18$ ) to  $8.50 \pm 0.52$  (last encounter,  $n=14$ ),  $p$ -value  $<0.001$ . Faculty satisfaction also improved from  $5.56 \pm 1.10$  (first encounter,  $n=18$ ) to  $8.86 \pm 0.36$

Domains assessed through mini-CEX	First cycle mini-CEX Encounter score (n=9) (Mean $\pm$ SD)	Third cycle mini-CEX Encounter score (n=7) (Mean $\pm$ SD)	One-sided p-value*
Medical interviewing skills	3.11 $\pm$ 1.45	5.71 $\pm$ 1.11	<0.001
Physical examination skills	3.56 $\pm$ 0.88	5.14 $\pm$ 1.06	<0.001
Humanistic qualities/professionalism	5.00 $\pm$ 0.71	6.00 $\pm$ 1.00	0.009
Clinical judgement	4.00 $\pm$ 1.00	5.14 $\pm$ 1.46	0.002
Counselling skills	3.44 $\pm$ 1.13	5.43 $\pm$ 1.13	0.007
Organisation/efficiency	4.67 $\pm$ 0.71	5.71 $\pm$ 1.11	0.002
Overall clinical competence	4.33 $\pm$ 0.71	5.57 $\pm$ 0.97	0.001

[Table/Fig-2]: Comparison of the mini-CEX scores between the first and last encounters in OPD settings.

\*Paired sample T test ( $n=7$ ).  $p$ -value  $<0.05$  is considered statistically significant

(last encounter, n=14), p-value <0.001. Each of the 46 mini-CEX encounters took an average of 17.64 minutes, with 4.76 minutes spent on feedback.

Domains assessed through Mini-CEX	First cycle mini-CEX encounter Score (n=9) (Mean±SD)	Third cycle mini-CEX Encounter Score (n=7) (Mean±SD)	One-sided p-value†
Medical interviewing skills	3.67±1.73	4.86±1.68	0.004
Physical examination skills	3.89±1.36	4.57±1.72	0.023
Humanistic qualities/ professionalism	4.56±0.72	5.14±1.21	0.023
Clinical judgement	4.44±1.01	5.14±1.34	0.023
Counselling skills	3.56±1.24	4.71±1.70	0.002
Organisation/efficiency	4.56±1.24	5.57±1.40	<0.001
Overall clinical competence	4.44±1.58	5.29±1.70	0.002

**[Table/Fig-3]:** Comparison of the mini-CEX scores between the first and last encounters in IPD settings.

†Paired sample t-test (n=7), p <0.05 is considered statistically significant

[Table/Fig-4,5] summarises the qualitative feedback from PG residents and faculty regarding their experiences with mini-CEX encounters. [Table/Fig-6,7] provides a description of the quantitative feedback from PG residents and faculty on their experiences with mini-CEX encounters.

#### Challenges faced during encounters:

- Performance anxiety due to faculty presence
- Difficulties examining and counselling patients with faculty observing
- Insufficient assessment time

#### Improvement suggestions for mini-CEX administration:

- Frequent OPD assessments for self-improvement
- Implement blinded assessments to reduce anxiety

**[Table/Fig-4]:** Thematic analysis of qualitative feedback from paediatric residents (n=9).

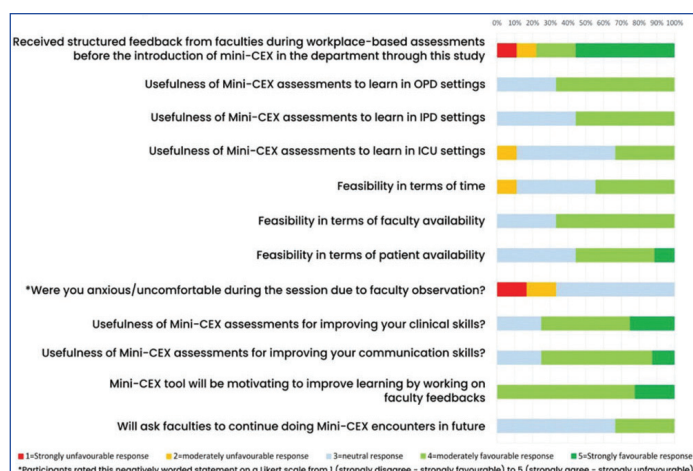
#### Challenges faced during encounters:

- Time constraints using this tool for Work-Place Based Assessments (WPBA)
- Residents' efforts to impress during faculty observations distort WPBA accuracy of this tool
- Lack of enthusiasm in residents and faculties

#### Improvement suggestions for mini-CEX administration:

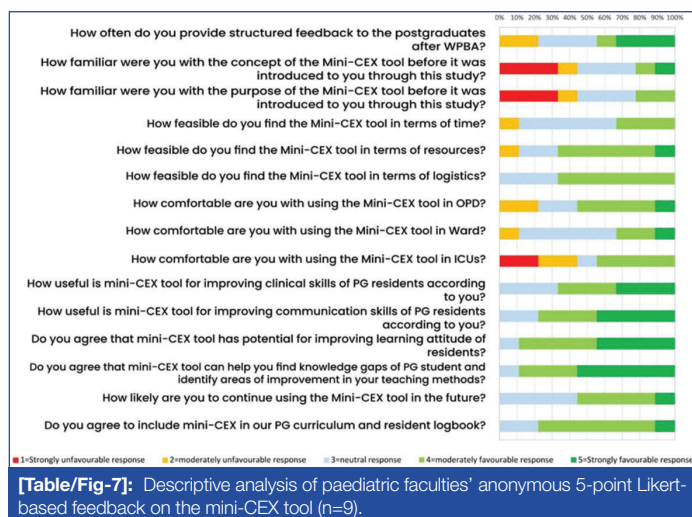
- Make mini-CEX a compulsory WPBA activity in the PG curriculum with a fixed schedule
- Adapt the format for different clinical settings (e.g., OPD, Ward, ICU).

**[Table/Fig-5]:** Thematic analysis of qualitative feedback from paediatric faculties (n=9).



**[Table/Fig-6]:** Descriptive analysis of paediatric residents' anonymous 5-point Likert-based feedback on the mini-CEX tool (n=9).

Before this study introduced the mini-CEX tool in the department, four out of nine faculty members reported in the feedback form that they regularly provided structured feedback to PG residents after WPBA {3 (33.3%) always, 1 (11.1%) often}. However, seven out of nine faculty members did not have a strong understanding of the



mini-CEX concept {3 (33.4%) not familiar, 1 (11.1%) slightly familiar, 3 (33.3%) moderately familiar}. Two faculty members were more familiar with it {1 (11.1%) very familiar, 1 (11.1%) extremely familiar}. Similarly, seven faculty members were unclear about the purpose of this tool {3 (33.4%) not familiar, 1 (11.1%) slightly familiar, 3 (33.3%) moderately familiar}, while two understood its purpose for WPBA (22.2%). Meanwhile, five (55.6%) of the nine PG residents stated that they always received structured feedback during WPBA before this study; 2 (22.2%) received it often, and 2 (22.2%) rarely or never received structured feedback.

All residents found the mini-CEX tool useful for improving clinical skills, with 2 (22.2%) rating it extremely useful, 4 (44.5%) very useful, 2 (22.2%) useful, and 1 (11.1%) somewhat useful. All faculty members agreed, with 3 (33.4%) finding it extremely useful, 3 (33.3%) very useful, and 3 (33.3%) useful. For improving communication skills, 1 (11.1%) of the residents found it extremely useful, 5 (55.6%) very useful, 2 (22.2%) useful, and 1 (11.1%) somewhat useful. Among faculty, 4 (44.5%) found it extremely useful, 3 (33.3%) very useful, and 2 (22.2%) useful.

PG residents found the mini-CEX tool very useful for learning in OPD {3 (33.3%)} and IPD {5 (55.6%)} settings. Three residents believed it would also be very useful in ICU settings if implemented. All felt motivated to improve their learning from faculty feedback, with 2 (22.2%) strongly agreeing and 7 (77.8%) agreeing. Faculty also recognised its potential for enhancing student learning attitudes, with 4 (44.5%) strongly agreeing, 4 (44.4%) agreeing, and 1 (11.1%) agreeing to some extent. Additionally, faculty believed the tool could help identify knowledge gaps in PG residents and areas for improvement in their own teaching methods, with 5 (55.6%) strongly agreeing, 3 (33.3%) agreeing, and 1 (11.1%) agreeing to some extent.

PG residents found mini-CEX encounters manageable within their schedules. Regarding time, 4 (44.5%) rated it as very feasible, 4 (44.4%) rated it as moderately feasible, and 1 (11.1%) rated it as somewhat feasible. Faculty availability was also reported to be favourable, with 6 (66.7%) finding it very feasible and 3 (33.3%) moderately feasible. Patient availability was rated as 1 (11.1%) extremely feasible, 4 (44.5%) very feasible, and 4 (44.4%) moderately feasible.

Faculty members also found the mini-CEX tool feasible but mentioned time constraints as a challenge: 3 (33.3%) rated it as very feasible, 5 (55.6%) rated it as moderately feasible, and 1 (11.1%) rated it as slightly feasible. They felt resources, such as assessor availability, were adequate: 1 (11.1%) rated it as extremely feasible, 5 (55.6%) as very feasible, 2 (22.2%) as moderately feasible, and 1 (11.1%) as slightly feasible. Most found the logistics, like scheduling, feasible: 6 (66.6%) rated it as very feasible and 3 (33.3%) as moderately feasible.



Performance anxiety from constant faculty observation was common among PG residents: 1 (11.1%) always felt anxious, 3 (33.3%) often felt anxious, 4 (44.5%) sometimes felt anxious, and 1 (11.1%) rarely felt anxious. Their challenges included limited assessment time, difficulty counselling patients about their prognosis, and managing clinical examinations and communication during the mini-CEX due to anxiety.

Most faculty members found time availability to be a major challenge when using the mini-CEX tool, mentioning phrases like "Time constraint," "Providing time in OPD is difficult," and "Busy schedule." They also noted a lack of enthusiasm from both residents and faculty, along with concerns about assessment bias. However, one faculty member felt it was manageable for PG residents due to the small intake each year.

All residents supported the inclusion of mini-CEX in the paediatric PG curriculum, with 2 (22.2%) preferring assessments at least twice a year or more frequently, while 3 (33.3%) preferred assessments once per clinical rotation. All faculty members were also open to continuing the use of mini-CEX for WPBA: 1 (11.1%) was extremely likely, 4 (44.5%) were very likely, and 4 (44.4%) were moderately likely. They also agreed to include mini-CEX in the PG curriculum and resident logbooks, with 1 (11.1%) strongly agreeing, 6 (66.7%) agreeing, and 2 (22.2%) agreeing to some extent. Most recommended conducting assessments once or twice per clinical rotation, totalling about 4-5 assessments per year.

## DISCUSSION

Present study included nine residents and 10 faculty members and conducted 46 mini-CEX assessments in both OPD and IPD settings. This approach aligns with recommendations for multiple assessments over time to capture performance in various clinical contexts [11,12]. Structured feedback after WBPA is essential for guiding PG residents toward improvement, as described in various studies [3,13,14]. However, consistent implementation by medical faculties remains a challenge, as seen in present study. Traditional assessment methods often fail to identify specific knowledge and practice gaps in PG residents, leading to inaccurate performance assessments. Present study showed that all faculty acknowledged the mini-CEX tool's effectiveness in identifying knowledge gaps and enhancing teaching methods.

Present study observed significant improvements in mini-CEX scores across all domains for most residents in both settings. A statistically significant increase in satisfaction with the mini-CEX tool was also noted. Both residents and faculty reported that the mini-CEX improved clinical and communication skills, aligning with the goals of WBPA to promote learning and development. The high level of agreement on improving overall clinical competence supports the mini-CEX as both a formative assessment tool and an educational resource. Additionally, it motivates learning, benefiting both residents and faculty and potentially enhancing faculty engagement in education. These findings are consistent with similar studies [15-18].

Most participants felt comfortable during assessments in both OPD and IPD settings. All faculty members agreed that the regular implementation of the mini-CEX within the department is feasible. These findings align with similar studies in India, highlighting the widespread acceptance and practicality of the mini-CEX as an assessment tool [6-9,16-18]. However, individualised change management plans are necessary to sustain WBPA over the long term. Methods initially accepted by faculty and students often deteriorate due to repetitive tasks, insufficient student commitment, lack of faculty motivation and time availability.

Residents commonly experienced performance anxiety due to continuous faculty observation, as reported in other studies [18].

This discomfort stems from the awareness that their actions are closely monitored. To address this, a resident suggested implementing blinded assessments, where residents are unaware of faculty evaluations during the mini-CEX. This could enhance the tool's validity by minimising bias and providing a more accurate representation of residents' actual practice, as they would not feel compelled to perform solely for scoring purposes. This adjustment aligns with the goal of achieving ideal WBPA.

The study included an adequate number of mini-CEX assessments per resident in both OPD and IPD settings. Feedback from residents and faculty provided valuable insights along with numerical data. The improvement in mini-CEX scores demonstrates the tool's reliability and effectiveness. These factors make present study results valid.

## Limitation(s)

The short study duration, being part of the Advanced Course in Medical Education (ACME) curriculum innovation project, posed a challenge. Many participants found time constraints to be a barrier to the regular use of the mini-CEX tool. Future research should investigate faculty commitments over a longer period. Additionally, multicentric trials are needed to identify further challenges and effective methods for integrating the mini-CEX into PG curricula across various medical and allied specialties.

## CONCLUSION(S)

The study demonstrated significant improvements in mini-CEX scores across all domains in both OPD and IPD settings, along with increased satisfaction among residents and faculty. It enhances faculty engagement in PG teaching and improves students' learning attitudes. The mini-CEX was deemed feasible and acceptable; however, challenges like time constraints and the need for greater commitment were noted. Faculty development and effective change management strategies are necessary to address these challenges.

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PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Paediatrics, Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Hemal Dave,  
Parul University Campus, At and PO. Limda, Ta. Waghodia,  
Vadodara-391760, Gujarat, India.  
E-mail: [dr.hemal.dave@gmail.com](mailto:dr.hemal.dave@gmail.com)

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