Assessment of Pediatric Residents' and Undergraduate Students' Knowledge about Infants', and Toddlers' Neurodevelopment: an Intervention Study

Original Article

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ABSTRACT

Background: pediatricians are acting as a first contact for children and their families in the event of illness. These physicians also provide follow-up care, regular physical exams, and ill child evaluations. The pediatrician has the satisfaction of following a child from birth through late adolescence and is often the first adult outside of family members with whom the child establishes a social relationship.

Objectives: To assess the knowledge of first year Pediatric residents and undergraduate students, who are joining pediatric round, regarding infant and toddler neurodevelopment.

Methods: This interventional study involved 90 undergraduate students and 20 pediatric residents. Data were collected using pre and post-test to assess four domains of development (Gross and Fine Motor, Language and social interaction and cognitive development).

Results: 110 participants completed pre and post-test. Pretest results showed that 20 residents and 90 students got a mean total pretest score [13.6 ± 2.21] and [11.61 ± 2.72] respectively. Also, post-test results showed considerable improvement for both residents and students with mean total post-test results [22.55 ± 6.99] and [16.64 ± 5.17] respectively.

Conclusion: Our results demonstrated that educating pediatric residents and undergraduate students on developmental milestones showed significant, quantifiable gains in knowledge following a fertile lecture.

Key Words: Developmental milestones, infants and toddlers, pretest.

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INTRODUCTION

Development is the process by which each child evolves from helpless infancy to independent adulthood. Growth and development of the brain and central nervous system is often termed psychomotor development and is usually divided into four main domains: Gross and fine motor skills, Speech, and language, Social and personal and activities of daily living Performance and cognition[1].

Global developmental delay (GDD) is defined as the failure to achieve developmental milestones within the expected age range. Objectively, this refers to significant delay in two or more developmental domains in children aged 5 years or younger[2].

An estimated 150 million children suffer from some kind of disability, and over 200 million are not fulfilling their developmental potential. Prevalence data are scarce on children below 3 years due to the limited availability of tools to assess young children and the lack of simple yet reliable and valid instruments that can be used in large surveys. Most of these children live in the poorest parts of the world. These children often do poorly in school, are less likely to be productive adults, and are at increased risk of transferring poverty to the next generation[3].

The prevalence of disability among children in Egypt aged 1 < 6 years was found to be 8.1% (at least one type of disability). The detected prevalence is higher than those reported in other countries. The international prevalence of child disability was found to be 5% worldwide[4].

Pediatricians are acting as a first contact for children and their families in the event of illness. These physicians also provide follow-up care, regular physical exams, and ill child evaluations. The pediatrician has the satisfaction of

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following a child from birth through late adolescence and is often the first adult outside of family members with whom the child establishes a social relationship. Participating in the physical and social development of the child is a very satisfying part of providing pediatric care[5].

Pediatric residents need to have a systematic approach when evaluating a child for development, including taking a developmental history, conducting a developmental assessment and being aware of the red flags that would warrant further specialist referrals when necessary. Knowledge of developmental milestones is essential for the pediatric residents to be able to provide anticipatory guidance and suggest appropriate activities to the parents or caregivers so that they can facilitate the next stage of development. It is essential that pediatric residents conduct developmental surveillance, which is an informal yet structured monitoring of developmental status over time[6].

The objective of the study was to assess the knowledge of first year Pediatric residents and undergraduate students, who are joining pediatric round, regarding infant and toddler neurodevelopment.

METHODS

This interventional study involved 90 undergraduate students and 20 pediatric residents. Data were collected using pre and post-test to assess four domains of development (Gross and Fine Motor, Language and social interaction and cognitive development).

Quantitative measures were done for baseline (pre-test) data to assess the participants' knowledge about infants and toddlers' neurodevelopment.

A set of questions prepared and revised by a committee of experts in the neurodevelopment field was used as the pre- and post-test[7]. They include 40 multiple-choice questions in English language about the milestones of an infant and toddler's development in four different categories including motor, speech, social interaction, and cognitive development. There were 10 questions for each of the 4 knowledge fields. In assessing the test results, each correct answer was graded for 1 mark and no mark is given for the incorrect answer, the total number of correct answers was categorized under four labels including, A (40-31), B (30-21), C (20-11), D (10-0).

Intervention involved a power point 1 hour lecture which was given to the undergraduate students and the pediatric residents.

Immediately after the lecture, the test was repeated (post-test) to assess the improvement of the knowledge of the 2 participating groups. A comparison was done between residents (group 1) and undergraduate students' (group 2) pretest and posttest results in each domain and in total score.

Sample size calculation:

Using the PASS 15 program for sample size calculation, setting power at 80%, alpha error at 5% after reviewing results from the previous study, showed that 66.2% of residents have knowledge level less than accepted regarding the child development stages[7], assuming an effect size difference =0.3 between the level of knowledge before and after the education sessions, based on this assumption and after 20% adjustment for dropout rate, sample size of 110 participants were included.

Statistical analysis:

Data were collected, revised, coded, and entered to the Statistical Package for Social Science (IBM SPSS) version 27. The quantitative data were presented as mean, standard deviations and ranges when parametric. Also, qualitative variables were presented as number and percentages.

ETHICAL CONSIDERATION

This study was conducted after approval of "Research Ethical Committee" of Ain-Shams University Faculty of Medicine on 19/9/2023 (Ethical Committee Approval Number: FMASU MS 543/2023).

An informed consent was obtained from participants, after explaining the purpose of the study, before enrollment.

RESULTS

110 participants completed pre and post-test. Pretest results showed that 20 residents and 90 students got a mean total pretest score [13.6 ± 2.21] and [11.61 ± 2.72] respectively. Also, post-test results showed considerable improvement for both residents and students with mean total post-test results [22.55 ± 6.99] and [16.64 ± 5.17] respectively.

Table 1: Showed Comparison between group pediatric resident (group 1) and undergraduate students (group 2) regarding participants' knowledge about infants and toddlers' neurodevelopment pretest.

Pretest scores		Group 1	Group 2	Test value	*P-value*	Sig.
		No.= 20	No.= 90			
Gross and fine Motor domain scores	Mean ± SD	4.2 ± 0.89	2.96 ± 1.41	3.766•	0.000	HS
	Range	3 – 6	1 – 5			
Cognitive scores	Mean ± SD	2.8 ± 1.01	3.04 ± 1.41	-0.732•	0.466	NS
	Range	1 – 5	1 – 5			
Social scores	Mean ± SD	2.7 ± 1.3	2.87 ± 1.33	-0.508•	0.613	NS
	Range	1 – 6	1 – 5			
Speech scores	Mean ± SD	3.9 ± 1.17	2.74 ± 1.3	3.652•	0.000	HS
	Range	1 – 7	1 – 5			
Total score	Mean ± SD	13.6 ± 2.21	11.61 ± 2.72	3.053•	0.003	HS
	Range	10 – 19	5 – 19			
Classification	D (10-0)	18 (90.0%)	85 (94.4%)	0.542*	0.461	NS
	C (20-11)	2 (10.0%)	5 (5.6%)			
	B (30-21)	0 (0%)	0 (0%)			
	A (40-31)	0 (0%)	0 (0%)			

P-value > 0.05: Non-significant; *P-value* < 0.05: Significant; *P-value* < 0.01: Highly significant *: Chi-square test; •: Independent t-test

The previous table showed that there was no statistically significant difference between the two studied groups regarding cognitive and social scores pretest with *p-value* = 0.466 and 0.613. Also, the table showed that there was statistically significant increase in motor and speech scores pretest in group 1 than group 2 with *p-value* <0.001 and <0.001; respectively. The table also showed that there was statistically significant increase in the total score of group 1 [13.6 ± 2.21] pretest than group 2 [11.61 ± 2.72] with *p-value* = 0.003 while no statistically significant difference between both groups regarding classification of total score pretest with *p-value* = 0.461 (Table 1).

Table 2: Showed comparison between group pediatric resident (group 1) and undergraduate students (group 2) regarding participants' knowledge about infants and toddlers' neurodevelopment posttest scores.

Posttest scores		Group 1	Group 2	Test value	*P-value*	Sig.
		No.= 20	No.= 90			
Gross and fine Motor domain scores	Mean ± SD	5.1 ± 1.77	3.94 ± 2.51	1.947•	0.054	NS
	Range	2 – 9	0 – 8			
Cognitive scores	Mean ± SD	6.3 ± 1.69	4.62 ± 2.61	2.747•	0.007	HS
	Range	3 – 9	0 – 8			
Social scores	Mean ± SD	5.65 ± 2.3	3.92 ± 2.45	2.887•	0.005	HS
	Range	2 – 10	0 – 8			
Speech scores	Mean ± SD	6.1 ± 1.86	4.16 ± 2.52	3.253•	0.002	HS
	Range	1 – 9	0 – 8			
Total score	Mean ± SD	22.55 ± 6.99	16.64 ± 5.17	4.315•	0.000	HS
	Range	10 – 37	4 – 30			
Classification	D (10-0)	3 (15%)	40 (44.4%)	16.262*	0.001	HS
	C (20-11)	10 (50%)	42 (46.7%)			
	B (30-21)	5 (25%)	8 (8.9%)			
	A (40-31)	2 (10%)	0 (0%)			

P-value > 0.05: Non-significant; *P-value* < 0.05: Significant; *P-value* < 0.01: Highly significant *: Chi-square test; •: Independent t-test

The previous table showed that there was no statistically significant difference between the two studied groups regarding motor scores post-test with *p-value* = 0.054. Also, the table showed that there was statistically highly significant increase in cognitive, social and speech scores post-test in group 1 than group 2 with *p-value* <0.001, <0.001 and <0.001; respectively. The table also showed that there was statistically highly significant increase in the total score of group 1 [22.55 ± 6.99] post-test than group 2 [16.64 ± 5.17] with *p-value* = 0.000 moreover, there was statistically highly significant difference between both groups regarding classification of total score post-test with *p-value* = 0.001 (Table 2).

Table 3: Showed comparison between pre and posttest scores in residents (group 1).

Group 1 scores		Pre	Post	Test value	*P-value*	Sig.
		No.= 20	No.= 20			
Gross and fine Motor domain scores	Mean ± SD	2.8 ± 1.01	5.1 ± 1.77	-5.779	0.000	HS
	Range	1 – 5	2 – 9			
Cognitive scores	Mean ± SD	4.2 ± 0.89	6.3 ± 1.69	-5.921	0.000	HS
	Range	3 – 6	3 – 9			
Social scores	Mean ± SD	2.7 ± 1.3	5.65 ± 2.3	-6.314	0.000	HS
	Range	1 – 6	2 – 10			
Speech scores	Mean ± SD	3.9 ± 1.17	6.1 ± 1.86	-5.482	0.000	HS
	Range	1 – 7	1 – 9			
Total score	Mean ± SD	13.6 ± 2.21	22.55 ± 6.99	-6.023	0.000	HS
	Range	10 – 19	10 – 37			
Classification	D (10-0)	18 (90.0%)	3 (15%)	23.048	0.000	HS
	C (20-11)	2 (10.0%)	10 (50%)			
	B (30-21)	0 (0%)	5 (25%)			
	A (40-31)	0 (0%)	2 (10%)			

P-value > 0.05: Non-significant; *P-value* < 0.05: Significant; *P-value* < 0.01: Highly significant *: Chi-square test; •: Paired t-test

The previous table showed that there was statistically highly significant increase in motor, cognitive, social, speech and total scores post-test in group 1 than pretest scores with *p-value* <0.001 for all. The table also showed there was statistically highly significant difference between pre and post-test in group 1 regarding classification of total score pre and post-test with *p-value* < 0.001 (Table 3).

Table 4: Showed comparison between pre and posttest scores in students (group 2).

Group 2 scores		Pre	Post	Test value	*P-value*	Sig.
		No.= 90	No.= 90			
Gross and fine Motor domain scores	Mean ± SD	3.04 ± 1.41	3.94 ± 2.51	-3.062•	0.003	HS
	Range	1 – 5	0 – 8			
Cognitive scores	Mean ± SD	2.96 ± 1.41	4.62 ± 2.61	-5.614•	0.000	HS
	Range	1 – 5	0 – 8			
Social scores	Mean ± SD	2.87 ± 1.33	3.92 ± 2.45	-3.768•	0.000	HS
	Range	1 – 5	0 – 8			
Speech scores	Mean ± SD	2.74 ± 1.3	4.16 ± 2.52	-4.809•	0.000	HS
	Range	1 – 5	0 – 8			
Total score	Mean ± SD	11.61 ± 2.72	16.64 ± 5.17	-9.048•	0.000	HS
	Range	5 – 19	4 – 30			
Classification	D (10-0)	85 (94.4%)	40 (44.4%)	53.328•	0.000	HS
	C (20-11)	5 (5.6%)	42 (46.7%)			
	B (30-21)	0 (0%)	8 (8.9%)			
	A (40-31)	0 (0%)	0 (0%)			

P-value > 0.05: Non-significant; *P-value* < 0.05: Significant; *P-value* < 0.01: Highly significant *: Chi-square test; •: Paired t-test

The previous table showed that there was statistically highly significant increase in motor, cognitive, social, speech and total scores post-test in group 2 than pretest scores with *p-value* <0.001 for all. The table also showed there was statistically highly significant difference between pre and post-test in group 2 regarding classification of total score pre and post-test with *p-value* < 0.001 (Table 4).

DISCUSSION

Undergraduate students and Pediatric residents must be experienced in developmental milestones to effectively monitor children's growth, identify delays early, and implement timely interventions. Understanding these milestones makes better communication with parents and enhances collaboration with interdisciplinary teams. This knowledge also aids in building trust with families and promoting appropriate developmental activities.

The pretest analysis revealed notable differences and similarities between the groups. Cognitive and social scores were comparable, indicating similar baseline levels in these domains. However, Group 1 exhibited markedly higher motor and speech scores than Group 2, suggesting a significant initial advantage. The total pretest score was also superior for Group 1, indicating remarkable enhancement in their total scores on the pretest when compared to group 2.

The best score was observed in the motor domain, highlighting the superior baseline motor abilities in Group 1. In contrast, the worst score was in the social domain, suggesting that both groups had relatively lower baseline social abilities.

Moreover, the lack of statistical significance in the classification of total scores in the pretest (*p-value* = 0.461) suggests that any observed variations in individual scores were relatively equal across both groups, implying that participants had similar baseline characteristics and knowledge levels before the interventions were applied. This uniformity is crucial as it establishes a solid foundation for assessing the efficacy of the interventions post-implementation.

A study was done in Iran where Participants were 71 postgraduate year (PGY) 1-3 from 3 major pediatric hospitals of Tehran included 26 pediatric residents' postgraduate year (PGY) 1, 26 PGY2, and 23 PGY3. The mean number of correct answers was 15.83, and the mean score that the residents got in each category was 3.35 in cognitive development, 5.14 in motor development, 3.01 in social interactions and 4.32 in speech development[8].

As comparing post-test results between both groups, the cognitive, social, and speech scores exhibited statistically significant improvements in Group 1 compared to Group 2, with *p-values* all less than 0.001. Furthermore, the total score analysis revealed a highly significant increase in Group 1, with a mean score of 22.55 ± 6.99 compared to 16.64 ± 5.17 in Group 2, and a *p-value* of 0.000. Besides, The significant difference in the classification of total scores post-test, with a *p-value* of 0.001.

Regarding each group, our study Results Indicated that the interventions applied were effective in promoting improvements across all measured domains and overall scores from pretest to post-test. Furthermore, there was a significant difference in the total score classification between the pretest and post-test.

Implying that the interventions implemented in both groups led to meaningful progress in the participants' performance. This highlights the importance of targeted interventions in improving growth and development knowledge among undergraduate students and pediatric residents.

A study conducted at the Department of Child Development of the Lee Kong Chian (LKC) medical school, 36 fourth-year undergraduate medical Students reported a significant improvement in their self-assessment of knowledge and skills in relation to child development and This was found to be statistically significant[9].

Improving the developmental conditions of children with global developmental delay is of top importance, as it is the most prevalent issue they face. Early detection of developmental delays, followed by timely intervention, can significantly enhance the status of these patients. To enable early detection, greater focus is needed on monitoring children's developmental progress and milestones. Accordingly, we recommend placing greater emphasis on pediatric residents and undergraduate students' education about developmental milestones.

CONCLUSION

Our results demonstrated that educating pediatric residents and undergraduate students on developmental milestones showed significant, quantifiable gains in knowledge following a fertile lecture.

CONFLICT OF INTEREST

No conflict-of-interest to declare.

AUTHORS CONTRIBUTIONS

Asmaa Wafeeq Abdelaziz Supervised the research, provided scientific guidance, and edited the manuscript. Reham Mohamed Elhossiny participated in clinical part of the research by producing the lecture. Shymaa Deifalla designed the study. Islam Fayez Abdelaziz Elhadad collected and analysed the data, Edited the manuscript. Heba Moustafa Hamza Fahmy supervised the research

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تقييم دراية الأطباء المقيمين وطلبة البكالريوس بالتطور العصبي للرضع والأطفال الصغار: دراسة تداخلية

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المقدمة: يعمل أطباء الأطفال كجهة اتصال أولى للأطفال وأسرهم في حالة المرض. كما يقدم هؤلاء الأطباء رعاية متابعة، فحوصات بدنية دورية، وتقييمات للأطفال المرضى. يتمتع طبيب الأطفال بفرصة متابعة الطفل من الولادة حتى أواخر مرحلة المراهقة، وغالبًا ما يكون أول شخص بالغ خارج أفراد العائلة يكوّن الطفل معه علاقة اجتماعية.

الهدف من الدراسة: تقييم معرفة الاطباء المقيمين للسنة الاولي في طب الاطفال وطلاب المرحلة الجامعية فيما يتعلق بتطور الجهاز العصبي للرضع والأطفال الصغار.

طريقة البحث: شملت هذه الدراسة التداخلية ٩٠ طالبًا جامعيًا و٢٠ طبيبًا مقيمًا في طب الأطفال. تم جمع البيانات باستخدام اختبارات قبلية وبعدية لتقييم أربعة مجالات للتطور(التطور الحركي الكبير والدقيق، اللغة، التفاعل الاجتماعي، والتطور المعرفي)

نتائج البحث: أكمل ١١٠ مشاركًا الاختبارات القبلية والبعدية. أظهرت نتائج الاختبار القبلي أن ٩٠ طالبًا و٢٠ طبيبًا مقيمًا حصلوا على متوسط درجات إجمالية قدرها [١٣,٦ ± ٢,٢١] و[١١,٦١ ± ٢,٧٢] على التوالي. كما أظهرت نتائج الاختبار البعدي تحسنًا ملحوظًا لكل من الطلاب والأطباء المقيمين بمتوسط درجات إجمالية قدرها [٢٢,٥٥ ± ٦,٩٩] و[١٦,٦٤ ± ٥,١٧] على التوالي.

الاستنتاج: أظهرت نتائجنا أن تعليم الأطباء المقيمين في طب الأطفال وطلاب المرحلة الجامعية حول مراحل التطور الرئيسية أدى إلى تحسن كبير في المعرفة بعد محاضرة مثمرة.