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Guidelines for Authors



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Editorial

Reimagining primary health care: more of the same is not enough

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One of the major achievements in global development, especially in global health, is the incredible progress in child survival. Since the launch of the Millennium Development Goals in 2000, the number of young child deaths has dropped significantly to unprecedented levels.

According to the 2023 estimates from the United Nations Inter-Agency Group for Child Mortality Estimation (IGME), there was an accelerated decline in under-five deaths between 1990 and 2022. The global under-five mortality rate dropped from 12 million annually in 1990 to 5.5 million in 2022. This represents a significant milestone, as humanity has not seen such notable progress recently (1,2).

At this pivotal moment, it is essential to ask what factors contributed to these significant changes and how we can fully understand the elements that drove this remarkable achievement. While multiple factors have played critical roles in improving child survival and reducing young child mortality, the most significant contributors can be summarized as follows (3,4):

Improvements and increased investment in the health sector: The health sector has accounted for approximately 50% of the reduction in young child mortality. Within this sector, advances in strengthening primary health care by enhancing access to routine immunizations and community health programs have been instrumental in improving child survival outcomes.

Socio-economic development improvements: The other 50% of the reduction is attributed to enhancements in various socio-economic development sectors, including household food and nutrition security, access to safe and adequate water, and improvements in personal and environmental hygiene and sanitation. Furthermore, expanded access to quality education, particularly for girls and women, as well as early childhood development initiatives, has significantly contributed to better child survival outcomes.

In addition, the commitment from key global health and child survival actors has been vital for documenting this accelerated progress.

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These commitments are encapsulated in the “five Cs” of the global primary health care (PHC) optimization guideline, representing the chain of commitment among key PHC actors:

1. Commitment from the Community:

Community support for PHC programs, including advocacy for increased health budgets and both financial and non-financial contributions, is crucial. Community ownership and oversight of PHC program implementation have proven pivotal.

2. Commitment from Health Professionals:

Health workers must be dedicated to providing quality health care to all sectors of society with respect and compassion. Retaining and motivating the health workforce is essential to ensuring the PHC system functions effectively.

3. Commitment from Health Program Managers:

Health management teams at all levels must be committed to effective planning, implementation, and management of health programs to achieve better outcomes.

4. Commitment from Policymakers:

Members of parliament and officials from the Ministry of Health should engage in policy dialogue, remain open to policy changes, and commit to allocating the necessary human and financial resources to improve overall health and social well-being.

5. Commitment from Development Partners:

Development partners must remain committed to playing a catalytic role, align-

ing their priorities with national goals, and providing predictable and sustainable development assistance.

A systematic review conducted to identify successful factors in maternal and child survival in countries like Vietnam, Sri Lanka, and Kerala (India) has revealed several common elements that have significantly contributed to the reduction of maternal and child mortality (6):

- Relatively low-income inequality
- High levels of female education
- Improved access to healthcare
- Household food and nutrition security
- Political commitment and
- Enhanced communication and transport facilities

Despite notable progress in child survival during the Millennium Development Goals (MDG) era, stagnation has occurred since 2015. In some low- and middle-income countries, there has even been a regression in overall health and social well-being milestones. This decline is primarily attributed to the impacts of the COVID-19 pandemic and a global stagnation in household food and nutrition security observed since 2021.

While we continue to strengthen community health programs, it is crucial to reimagine the entire Primary Healthcare (PHC) system and develop innovative initiatives to boost PHC outcomes. To achieve this, reframing the PHC system is essential. The latest Global PHC Optimization Guideline introduces a

new approach aimed at improving the efficiency and effectiveness of the PHC system through vertical integration and program convergence.

Optimizing PHC through Vertical Integration and Program Convergence:

The new guideline presents two interconnected concepts. The first focuses on optimizing the PHC system by acknowledging the need to move away from the notion of an "ideal system," which is rarely achievable in real-world settings. Instead, it aims to establish an optimal PHC system where the three "Vital Organs"—Human Resources for Health, Health Commodities, and Health Financing—are developed and maintained to ensure the PHC system is functional and effective (12). It is important to note that while these foundational elements are prioritized, other health system pillars, such as governance and Health Management Information Systems (HMIS), will also be addressed once the foundational issues are resolved.

The second concept emphasized in the new PHC guideline is that optimization will occur solely through “Vertical Integration and Program Convergence.” This means that current vertical programs, which operate in silos, will begin to integrate their initiatives under one comprehensive plan, implementation strategy, and system of support. Specifically, all vertical Maternal, Neonatal, and Child Health (MNCH) programs will adopt an integrated planning and implementation approach. Furthermore, the

objective is to integrate various social sector programs at the district level through a multi-sectoral programming approach. This collaborative effort includes sectors such as Health, Nutrition, Water, Sanitation and Hygiene (WASH), Education, and social policy and child protection, which is known to reduce transaction costs, enhance efficiency, effectiveness, and ultimately improve overall health and social well-being outcomes.

Demystifying PHC Policy Translation

The new PHC guideline clarifies the misconception that translating PHC policy into practice is challenging and complex. The key takeaway from countries that have successfully reframed and redesigned their PHC systems is that optimizing PHC is achievable, provided the reframing process begins with robust diagnostics. Based on these diagnostics, the health system's maturity level can then be classified at both national and subnational levels. Here are simplified and practical steps to follow when reframing and redesigning the PHC system in low- and middle-income countries (12):

1. **Conduct Robust Diagnostics:** Generally, the health systems in most low- and middle-income countries are either weak or fragile and struggle to meet the growing health demands of their communities. Therefore, it is crucial to adopt a method similar to clinical assessment, where clinicians conduct thorough evaluations before

treating patients or prescribing medication. In the same vein, understanding that health systems in low-income countries grapple with various chronic health system issues is vital; these issues must be identified early and addressed promptly. Thus, a comprehensive investigation of the health system is essential to uncover major policy gaps and implementation challenges before attempting to reframe the PHC system.

2. Classify Health System Maturity Levels:

Based on diagnostic findings, it is crucial to classify the current level of health system maturity, as well as the Obstetric and Neonatal Transition Levels. This classification can effectively be done at both national and subnational levels. For practical purposes, health systems in low- and middle-income countries can be categorized into three maturity levels (8):

- **Health System Maturity Level One:** This classification refers to a country, province, or district where the Maternal Mortality Ratio (MMR) exceeds 400 per 100,000 live births, or the Neonatal Mortality Rate (NMR) is over 30 per 1,000 live births, along with a breakdown of one of the “Vital Organs” of the PHC system indicated by recurrent outbreaks of common communicable diseases (e.g., Malaria, Measles, Cholera). Such circumstances necessitate a radical overhaul of the PHC system, with a strong focus on repairing broken “Vital Organ components.

- **Health System Maturity Level Two:**

This level applies to a country, province, or district with an MMR between 140-400 per 100,000 live births or an NMR between 12-30 per 1,000 live births. In these cases, no recurrent disease outbreaks are documented, but serious quality challenges exist. The focus should be on quality planning and improvement, as well as strengthening quality assurance and quality control mechanisms to deliver quality, respectful, and compassionate healthcare.

- **Health System Maturity Level Three:**

This category pertains to a country, province, or district where the MMR is less than 140 per 100,000 live births, and the NMR is below 12 per 1,000 live births, where quality healthcare is provided with respect and compassion. These countries should aim to advance their tertiary and quaternary health systems to achieve health outcomes comparable to those of high-income countries.

3. Narrowing Disparities in Healthcare

After assessing the maturity level of the health system, the next step is to create a strategic and operational plan with clear overarching goals and milestones to address healthcare disparities. It is essential to identify and engage the most vulnerable segments of society, as a significant number of maternal and child deaths occur within these communities. Vulnerability can arise from biological factors (e.g.,

pregnant women), socioeconomic issues (e.g., individuals living in poverty), or geographic challenges (e.g., rural and remote areas or urban slums).

4. **Increase Total Health Expenditure: Target the Nadir Point for Health Financing**

The Nadir Point for health financing is the minimum Total Health Expenditure (THE) per capita per year that is necessary to ensure that the primary healthcare (PHC) system is fully functional. The global PHC guidelines present the minimum calculated THE for low- and middle-income countries (LMICs) as USD 240 per capita per year. Most countries that have successfully reformed their PHC systems and documented better health outcomes have invested a minimum total health expenditure of over USD 400 per capita per year. In contrast, countries that have invested less than 100 USD per capita per year are struggling with dysfunctional health systems and fail to cope with recurrent communicable disease outbreaks (9,12).

The Nadir Point for health financing should not rely solely on national treasury funds. Communities must contribute through risk pooling (such as health insurance) and other innovative health financing mechanisms. Additionally, development partners should continue providing catalytic funding to initiate change. Importantly, they should align their support with national health priorities

and offer predictable and flexible financing.

Conclusion

In conclusion, we strongly suggest that low- and middle-income countries take the lead in reimagining and redesigning their own PHC systems. They should conduct a detailed situational analysis of the health sector to identify major policy gaps and implementation challenges, particularly focusing on fixing the broken "vital organs" of the PHC system. It is equally important to identify and address the demand-side difficulties that hinder the utilization of health services. Priority should be given to improving access and expanding services for the most vulnerable groups in society. Most maternal and child deaths are concentrated among socially disadvantaged and marginalized populations, especially those living in remote areas, rural communities, and urban slums.

It is imperative to acknowledge that the highest quality health services are not free. If LMICs are committed to optimizing their PHC systems and transforming their health sectors to be more efficient and effective, they must be prepared to cover incremental costs through improved health budgeting and innovative health financing mechanisms. This includes actively engaging communities to support the PHC system both financially and in-kind.

Reference

1. United Nations Inter-agency Group for Child Mortality Estimation (UN IGME), Levels & Trends in Child Mortality: Report 2023, Estimates developed by the United Nations Inter-agency Group for Child Mortality Estimation, United Nations Children's Fund, New York, 2024
2. David Sharrow, Lucia Hug, et al.; Global, regional, and national trends in under-5 mortality between 1990 and 2019 with scenario-based projections until 2030: a systematic analysis by the UN Inter-agency Group for Child Mortality Estimation, *Lancet Glob Health* 2022; 10: e195–206; www.thelancet.com/lancetgh Vol 10 February 2022
3. Shyama Kuruvilla,^a Julian Schweitzer,^b David Bishai, et al; Success factors for reducing maternal and child mortality; *Bull World Health Organ* policy and practice 2014;92:533–544 | doi: <http://dx.doi.org/10.2471/BLT.14.138131>
4. Yibeltal Assefa, et al : Community health extension program of Ethiopia, 2003-2018: Successes and challenges toward universal coverage for primary healthcare services, March 2019, *Globalization and Health* 15 (1), DOI:10.1186/s12992-019-0470 <https://doi.org/10.1186/s12992-019-0470-1>
5. Addisalem Tebeje Zewudie, et al: Determinants of Under-Five Child Mortality in Ethiopia: Analysis Using Ethiopian Demographic Health Survey, 2016; Volume 2020, Article ID 7471545, 9 pages <https://doi.org/10.1155/2020/747154>
6. Madore, Amy, et al., 'Positive Outlier: Health outcomes in Kerala, India over time', *Global Health Delivery Case GHD-042*, Harvard Medical School and Brigham and Women's Hospital, Boston, April 2018.
7. GBD 2019 Healthcare Access and Quality Collaborators; Assessing performance of the Healthcare Access and Quality Index, overall and by select age groups, for 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019; *Lancet Glob Health* 2022; 10: e1715–43 published Online October 6, 2022 [https://doi.org/10.1016/S2214-09X\(22\)00429-6](https://doi.org/10.1016/S2214-09X(22)00429-6)
8. Souza, JP, et al., 'Obstetric Transition: The pathway towards ending preventable maternal deaths', *BJOG: An international journal of obstetrics & gynaecology*, vol. 121, suppl. 1, March 2014, pp. 1-4.
9. Karin Stenberg, Odd Hanssen et al: Guide posts for investment in primary health care and projected resource needs in 67 low-income and middle-income countries: a modelling study; *The Lancet Global Health*, Volume 7, Issue 11, e1500 - e1510

10. WHO/ World Bank Group , OECD: Delivering quality health services: A global imperative for universal health coverage; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/>
11. WHO/ UNICEF; Primary health care: transforming vision into action; www.who.int/news-room/events/detail/2020/12/14/default-calendar/primary-health
12. UNICEF: Optimizing primary health care from policy to practice, Practical Guide, United Nations Children's Fund (UNICEF), New York, December 2022
13. D'Aquino L, Pyone T, Nigussie A, et al. Introducing a sector-wide pooled fund in a fragile context: mixed methods evaluation of the health transition fund in Zimbabwe. *BMJ Open* 2019;9:e024516. doi:10.1136/bmjopen-2018-024516

Original article

Impact of a locally tailored educational intervention on pediatric residents' knowledge, attitudes, and skills in assessing primary headaches in children in Ethiopia

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Abstract

Background: Despite being a common neurological complaint, headaches, particularly migraines among children and adolescents, are often overlooked by parents, teachers, and primary care providers. Clinicians play a key role in evaluating and managing care. This is vital for better outcomes and quality of life for affected children. This study aimed to evaluate the effectiveness of an educational intervention on residents' clinical skills in identifying and managing primary headache among children .

Methods: The before-and-after intervention was conducted from October 1, 2021, to November 30, 2021, involving 122 pediatric residents from Tikur Anbesa Specialized Hospital, St. Paul Millennium Medical College, Arsi University College of Health Sciences, and Yekatit 12 Hospital Medical College. Participants completed a self-administered questionnaire assessing their sociodemographic characteristics, attitudes, knowledge, and practices related to diagnosis and management of primary headache among children. The intervention involves a 1-hour and 10-minute facilitator guided instructional video on primary headache among children, which included discussions, questions and answers sessions, and clinical vignettes. The educational intervention was conducted both in person and via Google Meet. After the sessions, participants retook the same assessment questionnaire. Data were analyzed using SPSS version 26, employing paired t-tests, ANOVA, and other statistical measures to evaluate the results.

Results: The educational intervention significantly improved residents' knowledge, as evidenced by an increase in the mean test scores from 5 ± 1.6 (pre-test) to 6.9 ± 1.7 (post-test) ($p < 0.001$). Residents with prior case discussions had a pre-test score of $5.3 (\pm 2.0)$ and a post-test score of $6.2 (\pm 2.0)$, which showed significantly better post-intervention scores ($p < 0.05$).

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Conclusion: *The study highlights the poor knowledge among paediatric residents regarding primary headaches before educational intervention. Demonstrates the efficacy of educational interventions in enhancing their understanding and management skills. This suggests a need for regular, targeted educational programs to improve paediatric headache care.*

Keywords: *Paediatrics Headache, Knowledge, Attitude, Practice, Pre- and Post-Educational Intervention*

Introduction:

Headaches, defined as pain above the orbitomeatal line, are among the most prevalent disorders of the nervous system, categorized into primary headache disorders, secondary headache disorders, painful cranial neuropathies, and other facial pains(1). A nationwide school-based study conducted in Ethiopia in 2021 revealed a gender- and age-adjusted 1-year prevalence of headaches of 72.3%.

Migraines accounted for 38.6%, tension-type headaches for 19.9%, undifferentiated headaches (UdH) for 12.3%, headaches occurring on ≥ 15 days/month for 1.2%, and probable medication-overuse headaches for 0.2%.(2).

Evaluating a child with a headache requires a comprehensive health and neurological assessment, including a detailed headache history. Accurate diagnosis is based on criteria established by the International Classification of Headache Disorders, 3rd edition beta (ICHD-3b), which guides appropriate treatment decisions (3). Treatment strategies vary, influenced by factors such as the patient's age, family structure, culture, beliefs, headache diagnosis, and the impact on daily life. Multidisciplinary treatment approaches have proven effective for children and adolescents, improving headache frequency and severity and reducing school

absenteeism(3).

Many migraine sufferers consult primary care providers, including general practitioners and pediatricians. Despite the availability of effective treatments, migraine management remains inadequate. Pediatric residents in referral centers often have limited exposure to children with primary headaches, constraining their ability to provide optimal management due to time constraints and competing medical conditions. Additionally, they may not be fully updated on the latest research-based diagnostic criteria and treatments(4).

Hence, this multicenter study was conducted to assess the effect of educational intervention on pediatric residents' knowledge, attitudes, and practices in the evaluation and management of primary headache among children.

Materials and Methods:

Study area and period

The study was conducted in four major university hospitals. These four hospitals were selected with convenience sampling. Three of them are in Addis Ababa; one of them is from Arsi, Oromia: Tikur Anbesa Specialized Hospital (TASH), St. Paul Millennium Medical College (SPMMC), Yekatit 12 Hospital Medical College (Y12HMC), and Arsi University Hospital (AUCHS). TASH is the largest

tertiary hospital in Addis Ababa, Ethiopia. Established in 1974, it is administered by AAU and is the largest teaching hospital in Ethiopia. St. Paul Millennium Medical College (SPMMC), established in 1969, formed the medical college in 2007. Yekatit 12 Hospital Medical College (Y12HMC), originally established in 1923 E.C., was designated a medical college in 2011 G.C. Arsi University Hospital (AUCHS); the hospital was renovated and re-structured as a new hospital in 1992. These institutions are part of the twelve university hospitals in the country; there were 209 pediatric residents in the Departments of Pediatrics and Child Health at TASH, SPMMC, AUCH, and Y12HMC during the study period. The study was conducted over a two-month period, from September 1, 2021, to October 31, 2021, in Ethiopia.

Study design

Institution-based pre- and post-educational in-

tervention; a cross-sectional study design with prospective data collection was employed.

Sample size and sampling technique

To calculate the sample size, we used a single population proportion formula with the assumption of a 95% level of confidence, a 5% marginal error, and a 5% non-response rate. Since the total population (N) of paediatric residents in TASH, SPMMC, Y12HMC, and AUCHS was 209, a correction formula was applied because the population is less than 10,000. Thus, the sample size became 135. We used stratified sampling; the sample size for each year of residency was calculated based on the proportion of residents in each year. Paediatric residents were randomly selected using a lottery method from the students' name list.

Table 1: Sample size stratification based on year of residency and school stratification

	AUCHS		SPMMC		TASH		Y12MMC		All	
	Total	Sample	Total	Sample	Total	Sample	Total	Sample	Total	Sample
R1	6	4	34	22	49	32	9	5	98	64
R2	5	3	23	15	34	22	5	3	67	43
R3	4	3	19	12	21	13	0	0	44	28

Data collection method and procedures

After obtaining informed consent, participants were provided with a link to a Google Form (an online survey administration software) developed in the English language. The survey was designed following a thorough literature review and consultation with pediatric and adult neu-

rologists. The objective was to assess socio-demographic characteristics, knowledge, attitudes, and practices regarding primary headaches among pediatric residents. A pilot study was conducted with 10 participants (approximately 5% of the sample size) to validate the questionnaire. Based on the pilot

study results, questions that were frequently unanswered were revised, and redundant questions were eliminated. Participants in the pilot study were excluded from the main study.

Questionnaire structure

The final questionnaire comprised 24 multiple-choice questions: 5 questions assessing socio-demographic background; 4 questions evaluating attitudes towards headache management; 5 questions examining clinical practices; and 10 questions measuring knowledge on the clinical evaluation and management of primary headache among children. Each question offered 2 to 5 possible answers, requiring participants to select the correct one. The same questionnaire was administered both before and after the educational intervention. The pre-intervention survey was completed within 20 minutes before viewing an educational video, which covered primary headache among children prevalence, pathophysiology, clinical evaluation, and management. The video included discussions, Q&A sessions, and clinical vignettes. After the video, participants completed the post-intervention survey within 15 minutes. The primary investigator monitored the completeness of the responses via the online survey software, ensuring that all data were accurately recorded and submitted.

Description of educational intervention program

After completing the initial questionnaire, participants were shown a comprehensive educational video lasting 1 hour and 10 minutes. This

video, prepared by the primary investigator in collaboration with a medical educationalist from Addis Ababa University Department of Paediatric and Child Health, covered various aspects of primary headache among children, including prevalence, pathophysiology, clinical evaluation, and management. During the video presentation, participants engaged in interactive elements such as discussions, questions, answers, and clinical vignettes, facilitated by the primary investigator, who is a paediatric neurology fellow. These interactions were conducted both in person and via Google Meet, an online video interactive platform, to accommodate all participants. To reinforce the material covered in the video, a summary of the presentation was provided to participants in a PDF document. Participants were given approximately 15 minutes to review this document. <https://youtu.be/KCuZh53b3sY>. The overall duration of the educational intervention program was 2 hours. Throughout the session, a training physician, the primary investigator – paediatric neurology fellow – acted as a facilitator to ensure that the information was consistently and accurately conveyed.

To ensure the anonymity of respondents, pre- and post-test results were not paired for individual physicians. Instead, the data were analyzed by comparing the aggregate pre-educational intervention scores with the aggregate post-educational intervention scores for all attendees based on year of residency

stratification. The key outcomes were measured based on scores from 10 key questions designed to assess knowledge of primary headache among children. The scoring system will classify scores as follows: Scores below 60% on these 10 key questions are defined as indicative of poor baseline knowledge. Scores of 60% or above are considered indicative of good knowledge. This classification was based on criteria taken from a previous study (Bennett et al., 2000; Patwardhan et al., 2006) (Minen et al., 2016) (Davis et al., 1999)

Data Processing and analysis: The collected data were first checked for completeness and consistency, then cleaned, coded, and entered into EpiData version 6.0. Following this, the data were exported, cleaned, and analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics were used to summarize the basic characteristics of the study participants. The association between variables was tested using binary logistic regression. To identify the factors independently associated with pediatric residents' knowledge

and practices regarding primary headache among children, multivariate linear regression analysis was performed. A p-value of less than or equal to 0.05 was considered statistically significant. The degree of association between dependent and independent variables was reported using the adjusted odds ratio (AOR) and 95% confidence interval (CI).

Result

Participants' sociodemographic background of the participants

Of the 135 pediatric residents selected to participate in the study, 122 completed the surveys, resulting in an 85% response rate. Performance data were not stratified by study site (TASH, SPMMC, Y12HMC, AUCHS) due to differences in sample sizes and the absence of third-year residency at Y12HMC. The highest non-response rate was among participants in the online study, who were unable to follow the educational intervention and complete the post-education assessment.

Table 2: Baseline characteristics of participating pediatric residents' education levels at four select teaching university hospitals, Ethiopia, October 15 - November 15, 2021

Variables	Category	N (%)
Year of residency	R1	65 (53.3)
	R2	35 (28.7)
	R3	22 (18.0)
Number of attachments in neurology clinic in months	0	35 (28.7)
	1-2	82 (67.2)
	3-4	5 (4.1)
Number of lecture hours on primary headache	0	98 (80.3)
	1-2	16 (13.1)
	≥3	8 (6.6)
Number of case discussion hours on primary headache	0	93 (76.2)
	1-3	27 (22.1)
	≥4	2 (1.6)

Impact of educational intervention on knowledge of participants

An assessment of the short-term impact of the educational intervention indicated that the percentage of correct answers increased for 9 out of the 10 key questions from the pretest to the post-test. One question showed a decrease in correct answers. A score of <60% (based on three previous similar studies) on 10 key questions marked as indicative of inadequate knowledge. Three of these questions related to prevalence, impact, and pathophysiology; three pertaining to clinical evaluation; and four questions were on the management of primary headache among children. Post-test results on the questions related to prevalence and pathophysiology showed improvement over pretest; 3 of the pre-EI questions were <60% and in the post-test all the results were improved but only 2 of the results scored >60%. Pretest scores that were <60% on clinical

evaluation questions related to primary headache among children improved to >60% in the post-test. But one question dropped in the post-test (42.6%) from the pre-test (49%). Three of the management questions that scored <60% pre-EI improved post-EI and 3 of the results scored >60%; but one of the management results was <60% in the post-test.

Statistical Analysis

The mean pre-test score was 5 ± 1.6 (poor baseline knowledge); the mean post-educational intervention score was 6.9 ± 1.7 (good knowledge); the difference between pre-test and post-test scores was statistically significant, with a p-value of 0.00, as determined by a paired t-test.

Comparison by year of residency

Pre-educational intervention results showed a statistically significant difference ($P < 0.05$) between year 1 and year 3 residents, with year

1 residents scoring lower. Post-educational intervention results did not show a statistically significant difference between year groups, indicating that the educational intervention effectively bridged the knowledge gap. Variables such as lecture hours, the number of months in the neurology clinic, and the number of patients seen per week did not have a statistically significant impact ($P > 0.05$) on the total pre- or post-educational intervention scores, as determined by ANOVA and t-test.

Practice

Among the participants, 48 (39%) reported examining at least one headache patient per week and 20 (16%) reported examining a headache patient every day. Regarding patients referral practices, 68 (55.7%) of residents refer the patients to a specialist when they do not respond to treatment. Conversely, 46 (37.7%) of pediatric residents rarely refer headache patients to a specialist.

On the other hand, only 8 (6.6%) pediatric residents reported ordering MRI scans for their headache patients themselves. Conversely, 111 (91%) stated they do not directly refer patients for MRI scans.

Attitude of the respondents

A total of 96 (78%) of pediatric residents believed that their exposure to headache patients before entering residency was inadequate. Similarly, a majority of participants (99, or 81%) felt that their exposure to headache patients during residency was also inadequate.

A total of 90 (76%) of participants reported

feeling moderately comfortable diagnosing migraine headaches. However, a notable proportion (25, or 20%) expressed discomfort in diagnosing migraine headaches. A significant majority (97, or 79.5%) of participants believe that lecture hours should be increased.

Discussion

Knowledge regarding the management of primary headache among children significantly improved post-intervention, and the mean percentage score improved from 61.5 percent to 74.5 percent following the educational intervention. In a study done by AHA by patwardhan M (5). on primary physicians, the results were comparable with our participants in the mean percentage score of the management part. Their study was done on 254 consenting primary care clinicians and found that pre-presentation scores of attendees and non-attendees were found to be similar. No significant difference in performance was noted across sites. A chi-square analysis revealed a statistically significant difference between pre- and post-presentation scores for 16 of the test's 20 questions. In the pre-test, all participants scored <66% on 2 questions related to prevalence, impact, and pathophysiology of migraine, 2 questions pertaining to history taking/physical examination, and 3 migraine management questions. Attendee scores improved to >66% post-test on all except 2 questions related to prevalence, impact, and pathophysiology of migraine (5). Emphasizing the importance of educational

intervention on improving knowledge of residents on understanding abortive, preventive treatments, and lifestyle modifications in alleviating patient suffering.

In another study done on primary care physician about 70 physicians chosen spontaneously, 52 PCPs returned completed questionnaires (74% response rate). In this study they compared pre-CME and post-CME results of a group of 52 physicians who attended the headache training program. The pretest scores gave a clear sign about the participant baseline knowledge of headache, indicating a poor awareness about the epidemiology and pathophysiology of the commonest headaches. In their conclusion they stated that Improvement in post-CME scores confirms that the program has a significant immediate impact on the PCPs knowledge, what probably affected positively the quality of patient care(7). Similarly our study showed post educational intervention improvement of the score of pediatric residents.

In our study, a significant portion of paediatric residents (37.7%) rarely referred headache patients to specialists, indicating a potential gap in appropriate referral practices. Like a study done among the 350 physicians in the UK and Switzerland where 31% of them said they would rarely or never refer a headache patient to a specialist, even in case of treatment failure (the corresponding figure for all practices surveyed was 26%)(5). Of course, most patients with primary headaches can receive adequate treatment in primary care if they are not too severely affected and if good clinical guide-

lines are available; also, very experienced primary care physicians may need to call on their specialist colleagues less often than others. Nonetheless, in a study conducted in the United Kingdom,(8) reported that 70% of patients presenting to GPs with new-onset primary headaches did not receive a diagnosis (8,9). The low referral rate in our setting according to the residents' report is because of inadequate medical education on primary headache.

Another similar study on Migraine Management Training Program for Primary Care Providers done in New York University Langone Medical Center. patients frequently first present with migraine symptoms to a primary care physician (PCP) and most remain in primary care – only a minority of migraine sufferers are treated at headache centres (Lipton et al., 1998). However, the care the patients receive in the primary care setting is often suboptimal, with studies showing inaccurate diagnoses, inadequate acute treatment, for example, NSAIDs for severe attacks, and an average of four years between migraine diagnosis and initiation of preventive medications. The American Migraine Prevalence and Prevention (AMPP) study showed that 38% of migraine sufferers meet criteria for preventive treatment but only 11% get it. PCPs hesitate to prescribe migraine preventive medications because of a lack of understanding about efficacy and side effects (10)

Regarding referring patient for MRI, only 6.6% of residents reported ordering MRI

scans in our study, contrasting with higher rates of MRI requests in other regions (over 80%), which may positively impact healthcare costs by promoting appropriate imaging utilization (5). For patients with primary headache, the primary modality of diagnosis is clinical evaluation with history and physical examination (11). With proper evaluation, unnecessary investigations can be avoided. But in our setting, the residents' low rate of MRI requests might not be explained by their clinical evaluation skills; it could be due to the non-availability of MRI services in larger parts of the country and relatively high costs in a healthcare system where patients are paying out of their pocket.

Most residents (78%) expressed dissatisfaction with their exposure to headache patients, highlighting a perceived inadequacy in clinical, lecture, and patient experiences. This aligns with findings from previous studies. In their study undergraduate medical education in headache is limited. Despite medical schools perceiving their training as adequate, both neurology and family practice residency program directors believe entering residents are inadequately prepared in headache upon entering the program (8) This emphasizes the importance of prioritizing headache education in medical training.

Conclusion

Primary headache among children represent a significant neurological disorder among pediatric patients in our country, necessitating attention from primary care providers, particularly pediatricians. This study has highlighted the inadequacies in knowledge regarding the prev-

alence, pathophysiology, clinical evaluation, and management of migraine patients among pediatric residents. However, the implementation of an educational intervention has demonstrated significant improvements in these areas. The findings underscore the importance of ongoing education and training initiatives to enhance the capabilities of healthcare providers in diagnosing and managing primary headache among children effectively. By addressing knowledge gaps and providing targeted interventions, healthcare professionals can contribute to improved patient outcomes and quality of life for children and adolescents affected by primary headaches. Moving forward, it is imperative to prioritize headache education in medical training programs and clinical practice settings. By ensuring that healthcare providers are equipped with the necessary knowledge and skills, we can better meet the needs of pediatric patients with primary headaches and optimize their care.

Limitations

This study encountered several limitations that may have impacted its outcomes and generalizability: Due to the constraints imposed by the COVID-19 pandemic, the educational session was delivered in a video format. This may have reduced the interactivity and engagement compared to in-person sessions. Limited Teaching Methods: The study did not incorporate other effective teaching methods such as patient models

and live demonstrations. **Time Constraints:** The short duration allocated to cover the comprehensive topic of primary headache among children was a limitation. **Potential Bias:** The discussion was conducted solely by the primary investigator, which might have introduced bias in the presentation and interpretation of the content. **Lack of Long-Term Follow-Up:** The study did not include follow-up assessments at 3- and 6-months post-intervention. The initial sample size calculation assumed a 5% non-response rate, but the actual non-response rate in this study was 15%, which was higher than anticipated due to factors such as time constraints and competing priorities among participants.

Declaration

Ethical Considerations

Proposal approval was obtained from the Department of Research and Ethics Committee (REC) before the commencement of data collection. To ensure participant privacy and confidentiality, personal identifier information (PII) was not included in the questionnaire. Informed consent was obtained. The information collected through the questionnaire was used exclusively for the purposes of this study.

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Authors' Contribution

BY led the study design, data collection, data

analysis, and interpretation of results, as well as manuscript writing. AM, MA, YD, and AA assisted with reviewing the proposal, developing the research questionnaire, educational intervention material development, and manuscript review. All authors reviewed and approved the final manuscript.

Conflict of Interest: The authors declare no conflicts of interest in relation to this study.

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Reference:

1. Mengistu G, Alemayehu S. Prevalence and burden of primary headache disorders among a local community in Addis Ababa, Ethiopia. *J Headache Pain*. 2013;14(1).
2. Zewde YZ, Zebenigus M, Demissie H, Tekle-Haimanot R, Uluduz D, Şaşmaz T, et al. The prevalence of headache disorders in children and adolescents in Ethiopia: A schools-based study. *Journal of Headache and Pain*. 2020 Sep 1;21(1).
3. Olesen J. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. Vol. 38, Cephalalgia. SAGE Publications Ltd; 2018. p. 1–211.

4. Genizi J, Srugo I, Assaf N, kerem nc. Paediatric primary headache: pharmacological and non-pharmacological treatments. Vol. 5, emj european medical journal citation: emj neurol. 2017.
5. Patwardhan MB, Samsa GP, Lipton RB, Matchar DB. Changing physician knowledge, attitudes, and beliefs about migraine: Evaluation of a new educational intervention. *Headache*. 2006 May;46(5):732–41.
6. Bennett NL, Davis DA, Easterling J, Friedmann P, Green JS, Koeppen BM, et al. Continuing medical education: A new vision of the professional development of physicians. *Academic Medicine*. 2000;75(12).
7. André Kowacs P, Alexandre Twardowschy C, Juliato Piovesan É, Dal-Prá Ducci R, Henrique Déa Cirino R, Hamdar F, et al. General practice physician knowledge about headache Evaluation of the municipal continual medical education program. Vol. 67, *Arq Neuropsiquiatr*. 2009.
8. Kernick D, Stapley S, Hamilton W. GP's classification of headache: Is primary headache underdiagnosed? *British Journal of General Practice*. 2008 Feb;58(547):102–4.
9. Gantenbein AR, Jäggi C, Sturzenegger M, Gobbi C, Merki-Feld GS, Emmenegger MJ, et al. Awareness of headache and of national headache society activities among primary care physicians-a qualitative study [Internet]. 2013. Available from: <http://www.biomedcentral.com/1756-0500/6/118>
10. Lipton RB, Stewart WF, Simon D. Medical consultation for migraine: Results from the American Migraine Study. *Headache*. 1998;38(2).
11. Perreault F, Christie S, Lelli D, Humphrey-Murto S. Current state of headache training within Canadian Neurology Residency program: a national survey. *BMC Med Educ*. 2023 Dec 1;23(1)

Original article**Family function and its association with stunting: A-cross sectional study among under-five children in rural areas of Indonesia**Sulton Wariin¹, Tantut Susanto^{2*}, Iis Rahmawati³, Dhimas Rizky Handoko⁴¹ Post graduate Nursing Program, Faculty of Nursing, Universitas Jember, Jember, Indonesia² Department of Community, Family & Geriatric Nursing, Faculty of Nursing, Universitas Jember, Jember, Indonesia³ Department of Maternity and Pediatric Nursing, Faculty of Nursing, Universitas Jember, Jember, Indonesia⁴ Faculty of Nursing, Universitas Jember, Jember, Indonesia

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Abstract

Background: Family function is the role or task carried out by the family to fulfill the physical, psychological, social and spiritual needs of its members, as well as to maintain the continuity and health of the family. Health problems including stunting in children in the family indicate that there are components of family function that are not optimal. Family function is crucial because toddlers are highly dependent on how the family provides care, nutrition, and parenting, all of which are integrated into family function. The purpose of this study was to analyze the factors that related of family function and stunting among under-five children in rural areas of Indonesia.

Methods: A cross-sectional study was conducted among 236 of rural families with stunted children using stratified random sampling in Jember, East Java of Indonesia. Measurement of family function using the Family Assessment Device (FAD) Questionnaire and stunting was measured using WHO Anthroplus. Data were analyzed using descriptive, comparative and logistic regression statistics knowing how big the risk influence is on the incidence of stunting.

Results: The prevalence of dysfunctional family function of rural families were 55.5% and stunted children for very short category were 64%. Logistic regression test shows family functions that influence the risk of stunting in rural families are problem solving (AOR 2.45; 95% CI= 1.36-4.41), communication (AOR 2.07; 95% CI= 1.15-3.71), role (AOR 2.70; 95% CI=1.55-4.70), affective response (AOR 2.08; 95% CI= 1.26 -3.43), and affective involvement (AOR 2.11; 95% CI=1.16-3.82).. The dimensions of family function were found to collectively predict 63% of the risk of stunting among under-five children

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Conclusion: *Family function influences the risk of stunting among under-five children in rural areas. Therefore, families will be able to improve family function for the welfare of all family members.*

Keywords: *Family function, Rural health; Stunting; Under-five children*

Introduction

Malnutrition is a global problem that also occurs in Indonesia and causes various health problems. One of the problems is stunting. Stunting can be prevented with special attention to the First 1000 Days of Life (1,2). The prevalence of stunting in the world is relatively high, including in Indonesia, with a target of reducing it to 14% by 2024 (3). The stunting rate in Jember (34.9%) which is the agricultural sector should be able to meet nutritional needs, because the results from agriculture and plantations are quite abundant. (4) to meet the nutritional needs of the surrounding area. Previous study stated that local food-based supplementary feeding interventions can improve the nutritional status of children in rural areas (5).

Poor nutritional status can lead to stunting as a result of inadequate food intake and declining health due to poverty (6). Poverty is also related to family function. Friedman (2003) states that one of the functions of the family is the economic function, where the continuity of the function will be affected by poverty (7) reference?. WHO (2018) stated that one of the factors causing stunting is conditions within the family that can affect cognitive development and function, thereby reducing productivity and economic growth (1,8) and will have an impact

on family life, including suboptimal family function when individuals later have families.

Family dysfunction can be seen in the relationships between family members, particularly in how they handle stress and express emotions. Tense, stressful family relationships and emotional dysregulation are among the main things related to family dysfunction, which is a factor that has a negative impact on health and well-being (9), including how there is a risk of suboptimal family functioning in families with low incomes. Families in Indonesia with the lowest level of welfare come from agrarian families with the highest percentage of poor people, including in Jember Regency (9,39%), whereas poverty is one of the indicators of a family's functioning which will later influence the suboptimal fulfillment of family functions (10–12), so that there is a vulnerability to family dysfunction in agrarian families. Families are expected to provide adequate parenting patterns for toddlers so that they influence optimal provision of exclusive breastfeeding, nutrition and child development in rural areas (13), including how the role of agrarian families in caring for children in it reflects the functioning of the care function. This is very important to note because the risk of agrarian families that are

closely related to poverty will have an impact on the suboptimal handling of stunting.

The government has made efforts to reduce stunting rates through Presidential Regulation Number 72 of 2021 concerning the acceleration of stunting reduction which involves all elements of regional leadership in reducing the prevalence of stunting with a target of 14% in 2024. Several strategies to achieve this goal include increasing leadership vision in all regions including down to the village government level, community empowerment, increasing specific and sensitive interventions, strengthening data information systems, research and innovation and the last is increasing food security, individuals and families (14). The family approach is most important to optimize because family function in caring for stunted children is a benchmark for success in overcoming stunting considering the government's target in 2024 stunting will decrease to 14%. Optimal family function will instill proper feeding and nutrition practices so that children's nutritional status problems can be overcome. Several previous studies have explained the relationship between general family function and children's nutritional status, but only bivariate analyses were performed. In this study, indicator variables for family function were analyzed in detail and their relationship to stunting in children. This is crucial and needs to be mapped to determine the risk of stunting, especially in agrarian families. Therefore, the purpose of this study is to analyze family function factors that influence the risk of stunting in

toddlers in rural Indonesia. The results of this study can be used as one of the options for family-based nursing interventions by paying attention to aspects of family function that can be optimized to address stunting problems.

Materials and methods

Study design and setting

The design of this study is a descriptive analytical study with a quantitative approach. The design used is analytical observational with a Cross-sectional approach conducted at three health center areas in Jember Regency and conducted in May-June 2024.

Population, sample size, and sampling technique

The population in this study was 784 stunted children with a sample calculation of 258 children with stratified random sampling and sample calculations based on the proportion of stunted toddlers in each integrated health post area in 3 community health center areas so that the number of samples in each area is proportional. In its implementation, the number of respondents collected was 236 agrarian families with stunted children, so the response rate in this study was 91%. The sample size was estimated using 95% confidence intervals.

Inclusion and exclusion criteria

The inclusion criteria in this study are families with stunted children, biological parents with stunted children, children under 5 years old, willing to be respondents, families with

primary income in the agricultural sector, while the exclusion criteria for this study are families with multiple sources of income (non-agrarian), children with congenital defects, children with special needs, children who are sick.

Data collection methods and instruments

Data were collected using the Family Assessment Device questionnaire adapted from (15). The questionnaire has 47 questions that have been tested for validity and reliability. The answer choices for this questionnaire include 1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree. This questionnaire consists of 7 dimensions of family function, namely problem solving, communication process, the role of each family member, affective responsiveness, affective involvement, behavioral control, and general family function. This method of measuring family function uses a cut-off point from the mean value obtained and is categorized into functioning and not functioning.

Stunting measurement using measuring instruments used are digital scales and calibrated height meters. The measurement results are entered into the WHO AntroPlus application. The data entered are the date of visit, the child's date of birth, weight and height, whether or not there is edema and the data obtained is in the form of a child's Z-score which is then categorized into short = very short and short = 2.

Respondents who participated in this study were agrarian families in agricultural areas who had stunted children, then given informed consent and explained the purpose of the study and

how to fill out the questionnaire via google form. Respondents who do not have a cell-phone will be facilitated by the researcher and assisted in filling out when the respondent does not understand it.

Data analysis

The data analysis used the IBM SPSS application version 26. In this study is using descriptive analysis to see how the frequency distribution of family characteristics including how the distribution of family function functions. Then a comparative test is carried out to see if there are differences in family functioning in agrarian families and the last is a logistic regression test. Before conducting the test, there are steps that must be taken as follows:

1. Descriptive analysis of family function includes the average, standard deviation, Z-score and significance value based on the Kolmogorov Smirnov data normality test and sees whether there is a significant difference between family function and stunting with the Mann Whitney test
2. Selection of characteristic variables that meet the requirements to enter the logistic regression test ($P < 0.25$). All family function variables are included in the multivariate analysis, namely logistic regression because the family function element is the main variable in the study
3. Conducting a logistic regression test on the characteristic variables that pass the selection and all family function

variables with the enter method by removing 1 variable with the highest significance value and seeing the change in OR value

4. If there is a change in OR > 10% when removing the variable. Then the removed variable is re-entered into the model.
5. The final model was found and the OR value is seen as an indicator of how much influence the independent variable has on the dependent variable. Ethical Considerations

This research has obtained ethical approval from the health research ethics commission of dr. Soebandi University number 332/KEPK/UDS /VI/2023.

Results

Respondents in this study were 236 agrarian families who had stunted children. The results of this study show the characteristics of agrarian families, the distribution of family function and the distribution of stunting. Bivariate analysis, namely the characteristics of agrarian families, family functions and the incidence of stunting for selection to the multivariate stage. The characteristics of agrarian families can be seen in Table 1 as follows:

Table 1. Characteristics of Rural Families in Jember, Indonesia (f=236)

Variables	Category	Frequency	Percentage
Ethnic	Java	145	61.4
	Madurese	90	38.1
	Osing	1	0.4
Parental Education Level	Not attending school	10	4.2
	Basic education	172	72.9
	Secondary education	42	17.8
	Higher education	12	5.1
Income	Less than regional income	232	98.3
	More than regional income	4	1.7
Marital Status	Married	231	97.9
	Widow	5	2.1
Mother's age when pregnant	17-25 years old	118	50.1
	26-35 years old	95	40.2
	36-45 years old	23	9.7
Number of children	≤2	168	71
	>2	68	29

Based on Table 1, agrarian families with stunted children are mostly Javanese (61.4%) with the educational background of parents being elementary education (72.9%) and most families are married (97.7%). The average income of parents of most families is below the regional minimum wage of Jember Regency (98.3%) with the number of children owned by the family mostly being less than or equal to

two (71%) and the majority of childbirth history is normal delivery (86.9%). Mothers in this family, when pregnant, were mostly 17-25 years old (50.1%). This study also looked at the distribution of the functioning of agrarian families. The functioning of the functions of agrarian families can be seen in Table 2 below:

Table 2 Distribution of Family Functions with Stunted Children in Jember, Indonesia (f=236)

Indicator	Mean ± SD	Z	P- value
Problem-solving	9,89±2,059	0,203	<0,001
Communication	12,17±2,554	0,166	<0,001
Role	16,43±3,102	0,204	<0,001
Affective response	6,38±1,629	0,254	<0,001
Affective engagement	12,45±2,821	0,245	<0,001
Behavior control	12,95±2,064	0,135	<0,001
General function	31,93±2,790	0,126	<0,001
Total family functioning score	102,28±10,39	0,160	<0,001

Note: P-value based on the *Kolmogorof smirnov*

Based on Table 2, the results show a significant difference in the total score of agrarian family functions with stunted children ($Z = -9.369$, $P\text{-value} = <0.001$). Furthermore, when viewed from the indicators of family function,

the results show a significant difference in problem solving, Communication, Role, Affective Response, Affective Involvement ($P < 0.001$).

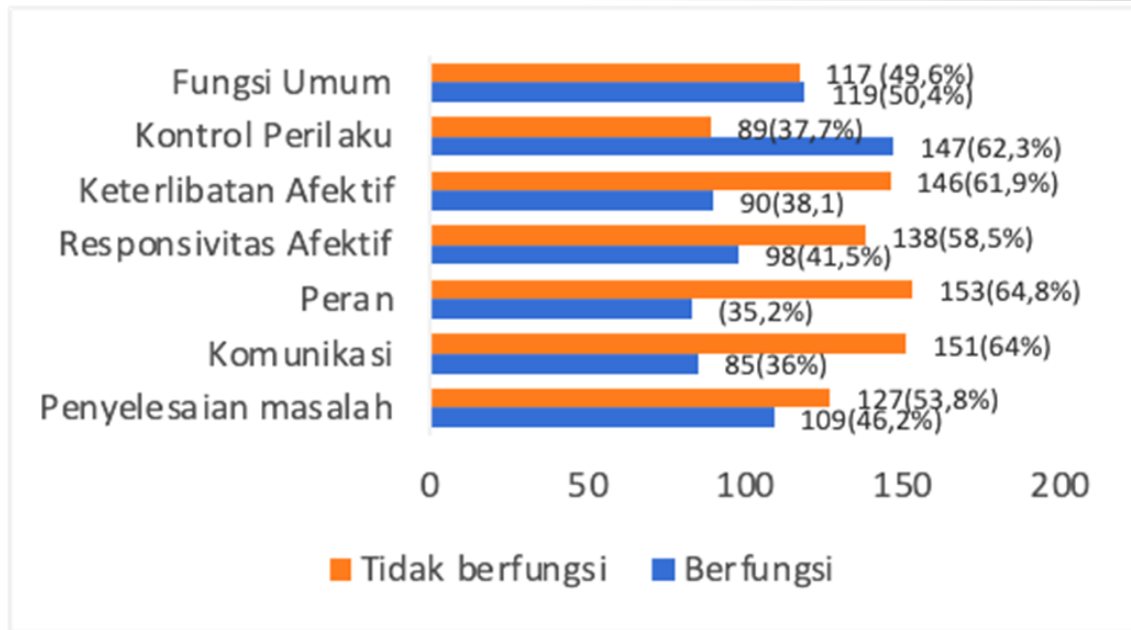


Figure 1. Proportion of distribution of rural family functions (f=236)

Based on Figure 1, it shows that most of the functions of agrarian families do not function in the elements of family function of problem solving, communication, roles, affective responsiveness and affective involvement. The family functions that function are behavioral

control (62.3%) and general functions (50.4%). This study also looked at how stunting is distributed in agrarian families. The distribution of stunted children in agrarian families can be seen in Figure 2 as follows.

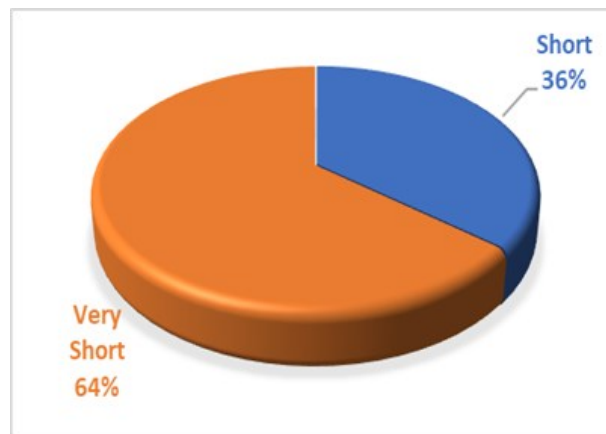


Figure 2. Distribution of stunting frequency

Based on Figure 2, the distribution of stunting in agrarian families is mostly in the very short category (64%). This study also looks at the

relationship between the characteristics of agrarian families and the incidence of stunting and can be seen in Table 3 below.

Table 3 Correlation analysis of respondent characteristics with stunting in Jember, Indonesia (f=236)

Variables	Category	Stunting				X^2	P-value
		Very Short		Short			
		f	%	f	%		
Ethnicity	Java	93	39.4	52	22.0	1.76	0.360 ^c
	Madurese	57	24.2	33	14.0		
	Osing	0	0.0	1	0.4		
Parental Education Level	Not attending school	7	3	3	1	25.80	0.000 ^b
	Basic education	124	53	48	20		
	Secondary education	13	5	29	12		
	Higher education	6	3	6	3		
Income	Less than regional income	148	62.7	84	36	0.323	0.624 ^b
	More than regional income	2	0.85	2	0.85		
Marital status	Married	147	62.3	84	35.6	0.02	1.000 ^b
	Widow	3	1.3	2	0.8		
Mother's Age When Pregnant	17-25 years old	76	32.2	42	17.8	26.77	0.816 ^a
	26-35 years old	65	27.5	37	15.7		
	36-45 years old	9	3.8	7	3.0		
Number of children	≤2	109	46	59	25	0.440	0.507 ^a
	>2	41	17.4	27	11.6		

note: *a* = Pearson Chi-square, *b* = Fisher's Exact Test, *c* = Likelihood Ratio

Based on Table 3, the results of the analysis show that there is no relationship between the characteristics of agrarian families and stunting as shown in the variables of ethnicity, income, marital status, maternal age during pregnancy, number of children, and history of childbirth ($P > 0.05$), but there is a relationship

between the level of parental education and stunting with a significance value of < 0.001 . This study also looks at the differences in the function of agrarian families towards stunting with short and very short categories and can be seen in Table 4 as follows:

Table 4 Correlation of family function with stunting in Jember, Indonesia (f=236)

Variables	Category	Stunting				X ²	P-value
		Very short		Short			
		f	%	f	%		
Problem-solving	Functioning	94	40	33	14	23,4	<0,001
	Non-Functioning	56	24	53	22		
Communication	Functioning	100	42	51	22	11,3	<0,001
	Non-Functioning	50	21	35	15		
Role	Functioning	101	43	52	22	20,4	<0,001
	Non-Functioning	49	21	34	14		
Affective responsiveness	Functioning	88	37	50	21	26,3	<0,001
	Non-Functioning	62	26	36	15		
Affective engagement	Functioning	88	37	58	25	24,5	<0,001
	Non-Functioning	62	26	28	12		
Behavior control	Functioning	58	25	31	13	0,55	0,582
	Non-Functioning	92	39	55	23		
General Function	Functioning	79	33	38	16	0,17	0,862
	Non-Functioning	71	30	48	21		
Total Score	Functioning	89	38	45	19	31,6	<0,001
	Non-Functioning	61	26	41	17		

note: P-value based on Mann Whitney

Based on Table 4, it was found that most of the differences in family functions in the short and very short categories with a significance value of <0.05, in problem solving, communication, roles, affective responsiveness and affective involvement, but there was no significant difference in behavioral control variables and general functions. The final research result is regression analysis. The variables included in

the logistic regression are 8 variables. X1-X8 are elements of family function and X8 is the education level variable that passed the bivariate test stage because the Chi Square test significance value was <0.25. The regression test was carried out in stages using the enter method by removing the largest significance value, namely variable X7 (P = 0.801) General function and showed no change in OR before and

after the expenditure was made. Furthermore, the variable with the highest significance value was removed, namely X8 ($P = 0.346$) and there was still no change in $OR > 10\%$ so that the parent's education level variable was worthy of being removed, but when viewed from the model fit value, it was fit to meet the significance value of 0.268 (> 0.05). The next largest significant variable expenditure is variable X6

($P=0.124$), there is still no change in $OR > 10\%$, but when looking at the Hosmer and Lemeshow value, the significance value is $0.006 < 0.05$ so that the model is not fit. So the final model X6 is returned and the appropriate ones are X1, X2, X3, X4, X5, X6 with a Hosmer and Lemeshow value of 0.268 and the final model is obtained as in Table 5 below.

Table 5 Final results of the logistic regression test

Variable	B	Exp(B) AOR	P-value	95% CI (Min-Max)
Constan	0,18	-	-	-
Problem-solving (X_1)	0,89	2,45	0,003	1,36-4,41
Communication (X_2)	0,72	2,07	0,014	1,15-3,71
Role (X_3)	0,99	2,70	<0,001	1,55-4,70
Affective responsiveness (X_4)	0,73	2,08	0,004	1,26-3,43
Affective engagement (X_5)	0,74	2,11	0,013	1,16-3,82
General Function (X_6)	0,36	0,69	0,124	0,44-1,10

note: P-value based on logistic regression test Hosmer-Lemeshow Goodness-Of-Fit Test ($p=0,268$); Cox and Snell $R^2=0.46$; Nagelkerke $R^2=0.63$

Based on Table 5, it was found that family functions that influence the risk of stunting in agrarian families are problem solving has a risk of 2.45 times compared to other family functions (AOR 2.45; 95% CI 1.36 to 4.41), communication has a risk of 2.07 times compared to other family function variables (AOR 2.07; 95% CI 1.15 to 3.71), role has a risk of 2.7 times compared to other family function varia-

bles (AOR 2.70; 95% CI 1.55 to 4.70), affective response has a risk of 2.08 times compared to other family function variables (AOR 2.08; 95% CI 1.26 to 3.43), affective involvement has a risk of 2.11 times compared to other family function variables (AOR 2.11; 95% CI 1.16 to 3.82). This family functioning can predict the risk of stunting by 63%.

Discussion

The findings of this cross-sectional study confirm that family dysfunction is significantly associated with the risk of stunting among under-five children in the rural, agrarian context of Indonesia. Our multivariate analysis reveals that the functionality of a family unit (specifically its ability to solve problems, communicate effectively, define roles, and manage affective responses and involvement) is a crucial determinant of child nutritional status, collectively explaining up to 63% of the stunting risk. Notably, deficits in fulfilling family roles (AOR 2.70) and ineffective problem-solving (AOR 2.45) emerged as the strongest predictors. This study moves beyond a general assessment of family function, providing specific evidence that distinct dysfunctional dimensions within the family environment create a tangible risk for poor child development outcomes.

Effective communication within the family is fundamental to health management, as it directly influences problem-solving effectiveness and the affective responses of family members (16,17). Our findings demonstrate that its dysfunction is a significant pathway to stunting (AOR 2.07). This is not merely about the absence of conversation, but a failure in the quality of dialogue needed to manage a child's health. This communication gap is contextualized by the low parental education levels observed (72.9% with basic education), a factor known to impact on knowledge and influence communication skills (18,19). Lado et al (2022)

suggest that higher education enables more appropriate and wise decision-making, including how to communicate to care for stunted children based on the knowledge the family has. When parents cannot effectively communicate, whether due to knowledge gaps regarding nutrition as highlighted by Putri & Nuzuliana (2020) or established family dynamics, they are less likely to recognize stunting as a problem and implement consistent health advice.

Following the breakdown in communication, dysfunctional problem-solving emerges as another powerful predictor of stunting (AOR 2.45). This shows a tangible reality where a majority of families, despite stable marital status, struggled to function optimally in their problem-solving processes. The impact of this is evident in the health outcomes of their children. The link between communication and problem-solving skills is well-established, as highlighted by Yunita et al (2020). Our findings suggest this dysfunction often begins with a failure in problem recognition, which is a key family responsibility in health management (23). Many families did not perceive their child's condition as a significant health problem, which was compounded by an absence of joint decision-making, especially when family support is low (24). This internal failure is exacerbated when families do not effectively utilize external support systems like local integrated health posts (Posyandu). Therefore, interventions must be

comprehensive, focusing not only on proactive family orientation towards health education and nutritional support (21), but also on strengthening the role of community nurses to guide families in these practical skills..

Dysfunction in family roles emerged as the most powerful predictor of stunting in this study, carrying a 2.70-fold increased risk (AOR 2.70). The findings is inseparable from the severe economic strain faced by the families, with 98.3% living below the regional minimum wage. Such economic hardship directly compromises the formal role of the father as a financial provider, a key component of family structure (25). This role is identified by Istiyati et al (2020) as crucial for parenting and decision-making. The resulting limitation in purchasing power for diverse, nutritious foods is a primary pathway to stunting, aligning with a recent review by Yani et al (2023) which linked household characteristics and low income to unfulfilled nutritional needs (18). Consequently, this places an immense burden on the mother, straining both her formal role as primary caregiver and her informal role in maintaining the family's emotional stability to protect the child from frequent illnesses, a known risk factor for stunting (10). Therefore, this role dysfunction is not an abstract concept but a direct consequence of economic vulnerability that impacts the family's ability to provide the environment necessary for healthy development (28).

Beyond structural aspects, the family's emotional climate, specifically affective responsiveness,

was a significant predictor of stunting (AOR 2.08). This dimension reflects the family's ability to respond to situations with appropriate emotion. Our findings, which indicated a lack of expressed affection, suggest a less nurturing home environment. Crucially, the ability to show appropriate affective responses is highly dependent on the level of affective involvement within the family (17). A home environment lacking this emotional warmth can directly impact child health, as positive affective attitudes are known to influence healthy behaviors (29,30). For a child, this means receiving consistent emotional attention, which is as vital for optimal growth as nutrients (31–33). A lack of this emotional connection can lead parents to be less attentive to feeding cues and parenting patterns (34), resulting in inappropriate provision of essential nutrients and thereby increasing stunting risk (35).

Finally, building on the previous points, affective involvement itself was a significant predictor of stunting (AOR 2.11). As theorized by Epstein et al. (1983) and Ryan et al. (2012), this dimension underpins affective responsiveness; while response is about expressing emotion, involvement is about demonstrating care through action and participation. Low involvement can manifest as parents being disengaged from daily caregiving. This lack of family teamwork, which Rahmadiyah et al (2024) identify as essential for meeting children's nutritional needs, means

opportunities for positive intervention are missed. Notably, a father's active involvement is particularly influential for child development (37), including providing appropriate, play-based stimulation to support physical growth (38). Therefore, a lack of active parental engagement creates a direct pathway to stunting by reducing the quantity and quality of care and stimulation the child receives.

This study has several limitations that should be acknowledged. First, its cross-sectional design does not allow for the establishment of causality between family function and stunting. Second, the data on family function were collected through self-reported questionnaires, which may be subject to social desirability bias. Future research using a longitudinal design and incorporating qualitative methods, as mentioned in our initial draft, would provide deeper insights into the dynamic interplay between family processes and child nutritional outcomes over time.

Conclusion

Based on the results of the study, it can be concluded that dysfunctional family functions have a risk of stunting. Family functions that influence the risk of stunting are problem solving, roles, communication, affective responsiveness, affective involvement and one variable characteristic of agrarian families as a control, namely the level of parental education. This underscores that stunting is not merely a nutritional issue but is deeply embedded within the family's functional and emotional dynamics, with

parental education also playing a significant role. Community nurses are expected to provide ongoing counseling services to families about the importance of family functioning, such as holding focus group discussion classes between agrarian families and families with optimal family functioning to foster an exchange of ideas. Nurses can also provide counseling on how to improve problem-solving, communication, roles, affective responses, and affective involvement to strengthen family functioning and ensure the well-being of all family members. Further qualitative and in-depth research is needed, especially on how value patterns in behavioral control are carried out because in this study it did not have an effect on stunting.

Ethical considerations

This research was approved Health Research Ethics Committee of Universitas dr. Soebandi with No. 332/KEPK/UDS/VI/2023.

Authors' contributions

SW drafted the proposal and TS, IR, and DRH re-viewed it. SW and TS collected the required data, SW and DRH analyzed it. All the authors participated in the write-up of the paper. All authors read and approved the final manuscript. All of authors also role for design of the study and data collection, analysis, and interpretation of data and in writing the manuscript and in deciding to publish.

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References

1. Kemenkes RI. Cegah Stunting, itu Penting. Pus Data dan Informasi, Menteri Kesehatan RI. 2018;1–27.
2. Kementerian Desa Pembangunan Daerah Tertinggal dan Transmigrasi. Buku saku desa dalam penanganan stunting. Sandjojo EP, editor. Buku Saku Desa Dalam Penanganan Stunting. Jakarta; 2017. 42 p.
3. Kemenkes RI. Hasil Survei Status Gizi Indonesia (SSGI) 2022. 2022;77–77.
4. BPS. Indeks Pembangunan Manusia Kabupaten Jember 2020. Badan Pusat Statistik Kabupaten Jember. 2020. 7 p.
5. Susanto T, Syahrul, Sulistyorini L, Rondhianto, Yudisianto A. Local-food-based complementary feeding for the nutritional status of children ages 6–36 months in rural areas of Indonesia. *Korean J Pediatr.* 2017;60(10):320–6.
6. Johri M, Saubramanian S V., Koné GK, Dudeja S, Chandra D, Minoyan N, et al. Maternal health literacy is associated with early childhood nutritional status in India. *J Nutr.* 2016;146(7):1402–10.
7. Friedman MM, Bowden VR, Jones EG. Family nursing: Research, theory, & practice. 5th ed. Upper Saddle River, NJ: Prentice Hall; 2003.
8. UNICEF. Nutrition, for every child UNICEF nutrition strategy 2020–2030. UNICEF Publ. 2020;1–98.
9. Silva DF, Souza-Talarico JN, Santos JLF, Duarte YAO. Family dysfunction and cognitive decline in aging: the “Health, Well-being, and Aging” (SABE) longitudinal population-based study. *Dement Neuropsychol.* 2023;17:e20220109.
10. Wahyudi F, Nugraheni A, Margawati A, Suharto, Hariyana B, Adespin DA. Analysis of the Influence of Family Functions on Reducing of Stunting Incidence. *Unnes J Public Heal.* 2023;12(2):26–35.
11. Isnaini F Al, Susanto T, Susumaningrum LA, Rasnil H, Siswayo S. Hubungan fungsi keluarga dengan status gizi balita pada keluarga tiri di kecamatan panti kabupaten jember. *J ppni.* 2020;1–10.
12. Statistiek BP. Kabupaten Jember Dalam Angka 2024. Jember: BPS Kabupaten Jember; 2024. 32 p.
13. Susanto T, Yunanto RA, Susumaningrum LA, Rasni H. Determination Of Maternal And Child Health Status In Relation To Nutritional Status And Development Of Children During Lactation: A Cross-Sectional Study Between Mothers With 0 – 6 Months Children In Rural Agricultural Areas Of Indonesia. *Malaysian J Public Heal Med.* 2021;21(2):61–74.

14. Presiden Republik Indonesia. Peraturan Presiden Nomor 72 Tahun 2021 tentang Percepatan Penurunan Stunting. 72 Jakarta, Indonesia: Sekretariat Negara; 2021.
15. Melfira EJ, Susanti SS. Fungsi Keluarga dalam Pencegahan Kehamilan Remaja Family Function in Adolescent Pregnancy Prevention Menurut World Health Organization (Who), Hasil Survei Dinas Kesehatan Provinsi Aceh. *JIM FKep.* 2018;III(3):67–73.
16. Ryan C, Epstein NB, Keitner GI, Miller IW, Bishop DS. Evaluating and Treating Families. *Evaluating and Treating Families.* 2012.
17. Epstein NB, Baldwin LM, Bishop DS. The Mc Master Family Assesment Device. *J Marital Fam Ther.* 1983;9(2):171–80.
18. Utaminingsih NLA, Suwendra W. Pengaruh Pendapatan dan Jumlah Anggota Keluarga Terhadap Kesejahteraan Keluarga di Kelurahan Karangasem. *Ekuitas J Pendidik Ekon.* 2022;10(2):256–63.
19. Nasriyah N, Ediyono S. Dampak Kurangnya Nutrisi Pada Ibu Hamil Terhadap Risiko Stunting Pada Bayi Yang Dilahirkan. *J Ilmu Keperawatan dan Kebidanan.* 2023;14(1):161–70.
20. Lado B, Warami H, Tjolli I. Penerapan Delapan Fungsi Keluarga dan Dampak Terhadap Kesejahteraan Keluarga Di Kabupaten Sorong. *Cassowary.* 2022;5(1):58–68.
21. Putri R, Nuzuliana R. Penatalaksanaan Efektif dalam Rangka Peningkatan Pertumbuhan Anak pada Kasus Stunting. *J Kesehat Vokasional.* 2020;5(2):110.
22. Yunita FC, Yusuf A, Nihayati HE, Hilfida NH. Coping strategies used by families in Indonesia when caring for patients with mental disorders post-pasung, based on a case study approach. *Gen psychiatry.* 2020;33(1):e100035.
23. Bailon SG, Maglaya AS. *Family health Nursing: The Process.* Philipines: UP College on Nursing Diliman; 1997.
24. Mariyani M, Azriful A, Bujawati E. Family Support Through Self Care Behavior for Hypertension Patients. *Divers Dis Prev Res Integr.* 2021;2(1):1–8.
25. Alligood M. *Nursing Theorists and Their Work (6th edn).* Vol. 24, Contemporary Nurse. 2007. 106–106 p.
26. Istiyati S, Nuzuliana R, Shalihah M. Gambaran Peran Ayah dalam Pengasuhan. *Profesi (Profesional Islam Media Publ Penelit.* 2020;17(2):12–9.
27. Yani DI, Rahayuwati L, Sari CWM, Komariah M, Fauziah SR. Family Household Characteristics and Stunting: An Update Scoping Review. *Nutrients.* 2023 Jan;15(1).
28. Ashidiqie MLII. Peran Keluarga Dalam Mencegah Coronavirus Disease 2019. *SALAM J Sos dan Budaya Syar-i [Internet].* 2020 May 25;7(8). Available from: <http://journal.uinjkt.ac.id/index.php/salam/article/view/15411>

29. Lawton R, Conner M, McEachan R. Desire or reason: predicting health behaviors from affective and cognitive attitudes. *Heal Psychol Off J Div Heal Psychol Am Psychol Assoc.* 2009 Jan;28(1):56–65.
30. Van Cappellen P, Rice EL, Catalino LI, Fredrickson BL. Positive affective processes underlie positive health behaviour change. *Psychol Health.* 2018 Jan;33(1):77–97.
31. Putri A, Widyani KN, Mazida Z, Husna AB, Sari YP, Putri MY, et al. Analisis Pemahaman Pemenuhan Kebutuhan Dasar Anak Usia Dini selama Masa Pandemi COVID-19 berdasarkan Karakteristik Ibu. *Biogr J Biostat Demogr Dyn.* 2021;1(2):72.
32. Fitriyah F, Formen A, Suminar T. Implementasi PAUD Holistik Integratif dalam Upaya Penguatan Sumber Daya Manusia Unggul. *Pros Semin Nas Pascasarj.* 2022; (60):418–22.
33. Den Ayu Ligina B, Suarta IN, Nurhasanah N. Implementasi PAUD HI (Holistik Integratif) Pada TK di Kabupaten Lombok Barat Tahun 2022. *J Ilm Profesi Pendidik.* 2022;7(3):1197–207.
34. Ningsih R, Priana AW, Tambunan ES, Supartini Y, Sulastri T. Perilaku Ibu dan Pemenuhan Gizi Pada Balita Usia 3-5 Tahun. *Jkep.* 2023;8(1):67–83.
35. Ningtias LO, Solikhah U. Perbedaan Pola Pemberian Nutrisi pada Balita dengan Stunting dan Non-Stunting di Desa. *J Ilmu Keperawatan Anak.* 2020;3(1):2–8.
36. Rahmadiyah DC, Sahar J, Widyatuti, Sartika RAD, Hassan H. Family Resilience With Stunted Children Aged Below 5 Years: A Qualitative Study in Depok City, Indonesia. *Glob Qual Nurs Res.* 2024;11:23333936231221750.
37. Aritonang SD, Hastuti D, Puspitawati H. Mothering, Father Involvement in Parenting, and Cognitive Development of Children Aged 2-3 Years in the Stunting Prevalence Area. *J Ilmu Kel dan Konsum.* 2020;13(1):38–48.
38. Ramadhani AS, Azizah W, Selpiyani Y, Khadijah. Bentuk-bentuk Stimulasi Pada Anak Dalam Perkembangan Motorik Anak Usia Dini di RA. *J Pendidik dan Konseling.* 2022;4(3):2360–70.

Original article

Art and music therapy as a support post-chemotherapy pain management in children: a quasi-experimental study in Indonesia

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Abstract

Background: Children with cancer undergoing chemotherapy often experience significant post-treatment pain, leading to both physical discomfort and psychological distress. Pharmacological treatment alone is often insufficient to manage this pain effectively. Non-pharmacological approaches such as art therapy and music therapy are increasingly considered as complementary strategies to enhance pain management and improve emotional well-being. However, studies directly comparing the effectiveness of these two methods remain limited.

Methods: This quantitative, quasi-experimental study used a two-group pretest-posttest design at Dr. Moewardi General Hospital in Surakarta, Indonesia. A total of 44 children aged 6 to 12 years undergoing chemotherapy participated. Participants were recruited using convenience sampling and chose one of two interventions: the art therapy group engaged in 30 minutes of coloring, while the music therapy group listened to instrumental music for 10 minutes. Pain intensity was measured daily for seven consecutive days before and after the interventions using the Wong-Baker Faces Pain Scale-Revised. Data were analyzed using the Wilcoxon and Mann-Whitney tests.

Results: Both therapies significantly reduced pain levels ($p < 0.001$; 95% CI: Art Therapy = 3.45–4.55; Music Therapy = 2.67–3.41) from baseline to the final assessment on Day 7. The art therapy group showed an average decrease of 4.00 points, while the music therapy group had a decrease of 3.04 points. Although there was a numerical difference, statistical analysis showed no significant difference between the two groups ($p = 0.342$).

Conclusion: Both art therapy and music therapy are effective in reducing post-chemotherapy pain in pediatric patients. These therapies provide safe, simple, and useful non-pharmacological options to support pain relief and enhance the emotional comfort of children undergoing cancer treatment.

Keywords: Art Therapy; Music Therapy; Pain; Child Cancer; Chemotherapy

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Introduction

Childhood cancer is a significant global health problem, with an increasing incidence and remaining a leading cause of disease-related death in children (1,2). An estimated 397,800 new cases occurred worldwide in 2015, with the majority (54%) found in Asia. In Indonesia, data show an alarming rise in cases, including a 63.6% increase in Yogyakarta over the last decade (3). Beyond the threat to life, cancer and its aggressive treatments, such as chemotherapy, also have serious impacts on children's emotional and social development due to prolonged hospitalizations and changes in routine (4,5).

Post-chemotherapy pain in children with cancer is a serious issue that not only has a physical impact but also causes significant psychological distress. Children undergoing chemotherapy often experience nausea, vomiting, fatigue, sleep disturbances, alopecia, and peripheral neuropathy (6,7). Psychological impacts such as anxiety, stress, and mood swings are also common (7-10). The severity of these side effects can interfere with the healing process and decrease a child's quality of life during cancer treatment.

To address these challenges, non-pharmacological therapies have been widely used as an effective companion approach. Interventions such as relaxation techniques, aromatherapy, massage, acupuncture, music therapy, and art therapy have been shown to help reduce pain intensity, anxiety, and improve children's well-being during treatment (11-13). Art thera-

py allows children to express emotions visually, helping them manage stress, fears, and traumatic experiences that are difficult to express verbally (14). Meanwhile, music therapy works through auditory stimulation that calms the nervous system, improves mood, and enhances coping mechanisms against pain and stress (15). Play therapy, more broadly, has also long been recognized for its role in helping children cope with the psychological impact of cancer through various activities such as role-playing, drawing, storytelling, or virtual reality, which can reduce anxiety, fear, and depression, as well as improve children's independence and quality of life (5,16-19).

Despite the promising potential of both art and music therapies, there are very few studies to date that directly compare the effectiveness of these two interventions in children with cancer. Most studies have evaluated only one of the two interventions separately, with music therapy being more predominantly studied. Research discussing art therapy is also limited, and no studies have explicitly compared these two interventions in the same patient group (20-22). These limitations leave a significant knowledge gap regarding the relative advantages, specific working mechanisms, and potential synergies between the two therapies (20,22,23). Based on this identified gap, this study aims to determine the difference in effectiveness between art therapy and music therapy on the level of post-chemotherapy pain in children with cancer.

Methods

Study Design

This study employed a quantitative quasi-experimental design with a two-group pretest–post-test approach. The aim was to compare the effectiveness of art therapy and music therapy in reducing post-chemotherapy pain among pediatric cancer patients.

Setting

The study was conducted from April 15 to May 25, 2025, in Room Tulip 6 at Dr. Moewardi General Hospital, Surakarta, Indonesia. The hospital is a tertiary referral center with a specialized pediatric oncology unit.

Population

The target population consisted of pediatric cancer patients undergoing chemotherapy. Inclusion criteria were: (1) diagnosed with cancer, (2) aged 6–12 years, (3) experiencing pain post-chemotherapy, and (4) having compos mentis awareness. The exclusion criterion was being in a coma or unconscious state.

Sampling

Convenience sampling was applied, a non-probability technique in which eligible participants were selected based on their availability and suitability at the time of data collection. The head nurse assisted in identifying suitable patients according to their condition and chemotherapy schedules.

The final sample size was determined by the number of eligible participants during the study period. A total of 44 participants were recruit-

ed. They were divided into two groups of 22 based on personal preference for intervention: art therapy or music therapy. Group allocation was not randomized, as allowing children to choose was considered more ethical and supportive of comfort, autonomy, and engagement in this vulnerable population.

Data Collection

Interventions were administered once daily for seven consecutive days.

- **Art therapy group:** participated in a 30-minute guided coloring activity using age-appropriate images and colored pencils.
- **Music therapy group:** listened to calming instrumental music through headphones for 10 minutes.

The differing intervention durations were based on the nature of the therapies (active vs. passive participation) and previous literature supporting their effectiveness.

Pain intensity was assessed using the Wong–Baker FACES Pain Scale–Revised (0–10), which includes facial illustrations to facilitate comprehension in children. Assessments were conducted by a trained research assistant at baseline (pre-intervention) and after each session (post-intervention) across seven days. For analysis, the post-intervention score on day seven was used.

A standardized monitoring sheet was employed during therapy sessions to record session duration, emotional responses, and level of child engagement.

Analysis

Data were analyzed using SPSS. Normality was tested with the Shapiro–Wilk test. Within-group differences between pre- and post-intervention scores were analyzed using the Wilcoxon signed-rank test, while between-group comparisons were conducted with the Mann–Whitney U test. Statistical significance was set at $p < 0.05$.

Ethical Considerations

The study received ethical approval from the

Ethics Committee of Dr. Moewardi General Hospital, Surakarta (No. 606/III/HREC/2025). Written informed consent was obtained from all participants' legal guardians, and confidentiality was strictly maintained.

Results

A total of 44 children with cancer undergoing chemotherapy participated in this study, divided equally into two intervention groups: art therapy and music therapy.

Table 1. Frequency distribution of characteristics of children with cancer (n=44)

Variable	Group	Art therapy, f (%)	Music therapy, f (%)
Gender	Male	8 (38.1)	13 (61.9)
	Female	14 (60.9)	9 (39.1)
Age	6-9 years	14 (56.0)	11 (44.0)
	10-12 years	8 (42.1)	11 (57.9)
Education	Kindergarten	1 (33.3)	2 (66.7)
	Primary School	21 (51.2)	20 (48.8)
Types of cancer	Acute Lymphoblastic Leukemia	20 (58.8)	14 (41.2)
	Retinoblastoma	0 (0.0)	3 (100.0)
	Osteosarcoma	1 (20.0)	4 (40.0)
	Other Cancers	1 (50.0)	1 (50.0)
Chemotherapy frequency	4-24 times	10 (43.5)	13 (56.5)
	24-48 times	3 (33.3)	6 (66.7)
	48-96 times	6 (66.7)	3 (33.3)
	>96 times	3 (100)	0 (0.0)
Total		22 (100)	22 (100)

Based on Table 1, the demographic data showed a relatively balanced distribution of male and female participants (21 and (23), respectively). The majority of participants were

aged 6–9 years (n=25) and were attending primary school (n=41). Acute Lymphoblastic Leukemia was the most common cancer type (n=34).

Table 2. Average decrease in pain score, 95% CI, and Mann-Whitney Test

Intervention	Pre-test	Post-test	Difference	Mean Rank	P value
Art Therapy	7.23	3.23	4.00	20.73	0.342
Music Therapy	6.77	3.73	3.04	24.27	

Pain intensity scores before and after the interventions are shown in Table 2. Both groups demonstrated a reduction in mean pain scores after the intervention. The art therapy group showed a numerically greater reduction than

the music therapy group, but the Mann-Whitney test indicated no statistically significant difference between the groups ($p = 0.342$).

Table 3. Data normality test results

Variable	Shapiro-Wilk P value	Interpretation
Art Therapy Pretest	0.001	Abnormal
Art Therapy Posttest	0.001	Abnormal
Music Therapy Pretest	0.001	Abnormal
Music Therapy Posttest	0.001	Abnormal

Table 3 shows the normality testing using the Shapiro-Wilk test. The p-values in both groups were less than 0.05, indicating that the data

were abnormally distributed. Thus, the non-parametric Wilcoxon test was used for within-group analysis.

Table 4. Wilcoxon test results before and after intervention

Group	Negative Ranks	Positive Ranks	Ties	P value
Art Therapy	22	0	0	0.000
Music Therapy	22	0	0	0.000

Table 4 shows the results of the Wilcoxon test, indicating that all participants in both the art therapy and music therapy groups experienced a significant reduction in pain scores post-intervention ($p = 0.000$). None of the participants showed an increase or an unchanged pain score.

Discussion

The primary finding of this study is that both art therapy and music therapy were effective in significantly reducing post-chemotherapy pain in children with cancer. The Wilcoxon test results demonstrated a p-value of 0.000

for both intervention groups, confirming the individual efficacy of both therapies in managing pain. Descriptively, the art therapy group showed a numerically larger average decrease in pain score, but the Mann-Whitney test yielded a p-value of 0.342, indicating that there was no statistically significant difference in effectiveness between the two interventions.

These findings are generally supported by existing literature. Both art and music therapies have been highlighted in systematic reviews and meta-analyses as beneficial in pediatric oncology settings. Art therapy facilitates the channelling of difficult emotions and experiences through visual expression, which can influence pain perception and provide a sense of control (14). While some studies suggest art therapy's primary benefit is emotional, this emotional regulation can indirectly contribute to pain reduction. Similarly, music therapy has been consistently demonstrated as effective in lowering pain and improving quality of life through auditory stimulation that induces relaxation and distraction (15,24).

The absence of a statistically significant difference between the two therapies suggests that both can be considered equally viable non-pharmacological options. This implies that healthcare providers have flexibility in offering either therapy based on patient preference, resource availability, or specific needs. Both therapies are complementary to conventional medical treatment and contribute to a more positive hospital experience.

Limitations

This study has several limitations that should be considered. First, the quasi-experimental design and the use of convenience sampling may limit the generalizability of our findings. Second, the sample size was relatively small, which may have limited the power to detect a significant difference between the groups if one existed. Third, the intervention duration was short (7 days), and longer-term effects were not measured. Future research should consider randomized controlled trials with larger samples and longer follow-up periods.

Conclusions

This study shows that both art therapy and music therapy are effective in lowering post-chemotherapy pain levels in children with cancer. Although art therapy showed a greater descriptive trend of decreasing pain, there was no statistically significant difference between the two types of therapy. Both interventions have relatively equivalent effectiveness and can be considered as adjuvant non-pharmacological options in post-chemotherapy pediatric pain management.

Declaration

Ethical consideration: This research was conducted in accordance with ethical principles. Informed consent was obtained from the parents/guardians of all child participants prior to their involvement in the study. The study was approved by the Health Research Ethics Committee of Dr. Moewardi General Hospital Surakarta with reference number

606/III/HREC/2025. All participant data were kept confidential and used solely for research purposes.

Conflict of interest: The authors declare that they have no competing interests.

Author's contributions SHMA: Study conception and design, data collection, data analysis and interpretation, drafting of the article, and critical revision of the article. **KDN:** Data analysis and interpretation. **I:** Drafting of the article. **SP:** Critical revision of the article.

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References

1. Johnston W, Erdmann F, Newton R, Steliarova-Foucher E, Schüz J, Roman E. Childhood Cancer: Estimating Regional and Global Incidence. *Cancer Epidemiol.* 2021;71.
2. Ward E, Sherman R, Henley S. Childhood Cancer Statistics. *Cancer J Clin.* 2019;69(5):384–401.
3. Sandi S, Supriyadi E, Purwanto I, Widjajanto P, Armytasari I, Ritter J. A province-wide childhood malignancy profiles in Indonesia (2010-2019). *Yogyakarta Pediatr Cancer Regist Paediatr Indones.* 2023;63(4).
4. Perasso G, Romeo M, Coccia P, Palego G, Mendiola PD. Fostering the Psychological Wellbeing of Children Diagnosed With Cancer: Multidisciplinary Insights in Pediatric Oncology. *Front Psychol.* 2025;16.
5. Nazari A, Sarmadi S, Ghazanfari M, Gholami M, Emami, Zeydi A, et al. The Effectiveness of Play Therapy on Depression and Anxiety In Hospitalized Children with Cancer: a Systematic Review. *Support Care Cancer.* 2025;33(2):88.
6. Bansal N, Amdani S, Lipshultz E, Lipshultz S. Chemotherapy-induced Cardiotoxicity in Children. *Expert Opin Drug Metab Toxicol.* 2017;13(8):817–32.
7. Hooke M, Linder L. Symptoms in Children Receiving Treatment for Cancer—Part I: Fatigue, Sleep Disturbance, and Nausea/Vomiting. *J Pediatr Oncol Nurs.* 2019;36(4):244–261.
8. Ruan H, Sun J, Zhao K, He M, Yuan C, Fu L. Subjective Toxicity Profiles of Children With Cancer During Treatment. *Cancer Nurs.* 2024;47(1):1–9.
9. Nugroho K, Auliya N. Relationship between Nurses' Therapeutic Communication and Family Anxiety Level of Patients Experiencing Emergency Conditions. *Babali Nurs Res.* 2024;5(2):423–432.
10. Nugroho D, Asih H, Lestari S. Responses and Expectations of Parents with Children Experiencing Emergencies due to Terminal Illnesses. A Phenomenol Study *J Nur Today.* 2025;17.
11. Santa da S, Schweitzer M, dos Santos M, Ghelman R, Filho V. Music Interventions in Pediatric Oncology: Systematic Review and Meta-Analysis. *Complement Ther Med.* 2021;59.

12. Nugroho K, Sucipto U. Maintaining Self-Stress During the Pandemic (Community Service Stikes Panti Waluya During The Covid-19 Pandemic). *J Community Serv Kasih STIKES Dirgahayu Samarinda*. 2020;2(1):11–5.
13. Astuti Y, Sukini T, Purwanto A. The Effect of Music Therapy on Pain in Children Post-chemotherapy. *J Ilmu Keperawatan Jiwa*. 2024;11(3):859–868.
14. Martínez-Vérez V, Gil-Ruíz P, Domínguez-Lloria S. Interventions through Art Therapy and Music Therapy in Autism Spectrum Disorder, ADHD, Language Disorders, and Learning Disabilities in Pediatric-Aged Children: A Systematic Review. *Children*. 2024;11(6):706.
15. Luzzatto P, Magill L. Art and Music Therapy. In: *Psycho-Oncology*. Oxford University Press. 2015. 497–502 p.
16. Ibrahim H, Arbianingsih, Amal A, Huriati. The Effectiveness of Play Therapy in Hospitalized Children with Cancer: Systematic Review. *J Nurs Pract*. 2020;3(2):233–43.
17. Hüzmeleli H, Semerci R, Kebudi R. The Effect of Therapeutic Play on Fear, Anxiety, and Satisfaction Levels of Pediatric Oncology Patients Receiving Chemotherapy. *J Pediatr Nurs*. 2024;7:195–201.
18. Frygner-Holm S, Russ S, Quitmann J, Ring L, Zyga O, Hansson M. Pretend Play as an Intervention for Children With Cancer: A Feasibility Study. *J Pediatr Oncol Nurs*. 2020;37(1):65–75.
19. Li W, Chung J, Ho E. The Effectiveness of Therapeutic Play, Using Virtual Reality Computer Games, in Promoting the Psychological well-being of Children Hospitalised with Cancer. *J Clin Nurs*. 2011;20(15):2135–2143.
20. Facchini M, Ruini C. The Role of Music Therapy in the Treatment of Children With Cancer: A Systematic Review of Literature. *Complement Ther Clin Pract*. 2021;42.
21. Zanchi R, Scarpellini C, Lazzarin L, Bonini P. Creative Arts Therapies in Pediatric Oncology: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Complement Ther Clin Pr*. 2024;56.
22. R-C RR, Noreña-Peña A, Chafer-Bixquert T, Lorenzo Vásquez A, González de Dios, J, Solano Ruiz C. The Relevance of Music Therapy in Paediatric and Adolescent Cancer Patients: a Scoping Review. *Glob Heal Action*. 2022;15(1).
23. Olaizola S, Lalloo C, Vickers V, Kelenc L, Tariq S, Brown S, et al. Art Therapy for Paediatric Pain: A Scoping Review. *Children*. 2024;11(6):619.
24. Miller M, Rath C, Moeschle S, Hargrove T, Cho A, Chen P, Six-Means A. Music Therapy for Pain and Anxiety Reduction in Pediatric Patients Undergoing Procedures: A Systematic Review and Meta-Analysis Protocol. *J Pediatr Surg Nurs*. 2025;14(1):15–24.

Original article

Determinants of infant formula feeding among mothers in Sorong City, Southwest Papua, Indonesia: A cross-sectional analytical study

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Abstract

Background: Infant formula use is increasing in Indonesia despite ongoing breastfeeding promotion campaigns. Understanding the socio-economic, cultural, and informational factors influencing this decision is essential for designing effective interventions, particularly in rapidly urbanizing regions such as Sorong City, Southwest Papua.

Methods: We conducted a community-based cross-sectional analytical study between March and June 2024 among 180 mothers of infants aged 0–12 months in Sorong City, selected through stratified random sampling. Data were collected using a pre-tested, structured questionnaire covering socio-demographic, cultural, economic, and information-seeking variables. Descriptive statistics summarized participant characteristics, while multivariable logistic regression identified predictors of formula use. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were reported. Ethical approval was obtained from the relevant institutional review board, and informed consent was secured from all participants.

Results: Of the 180 mothers surveyed, 46.7% reported current use of infant formula. In multivariable analysis, two factors emerged as significant predictors: use of digital media for nutrition information (AOR = 2.30; 95% CI: 1.13–4.68; $p = 0.022$) and greater household microeconomic capacity (AOR = 2.05; 95% CI: 1.05–4.02; $p = 0.035$). Most socio-demographic, cultural, health, and product-related factors were not statistically significant, though nutrition-related cultural beliefs approached significance ($p = 0.054$).

Conclusion: In Sorong City, economic capacity and access to digital health information appear to exert greater influence on formula feeding decisions than traditional socio-cultural factors. Public health strategies should integrate digital engagement, combine economic empowerment with breastfeeding support, and strengthen the regulation of online marketing for breast-milk substitutes.

Keywords: Infant formula feeding; breastfeeding promotion; Indonesia

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Introduction:

Optimal infant nutrition remains a public health priority, particularly in rapidly developing urban settings where socio-cultural, economic, and environmental factors intersect. Sorong City, located in Southwest Papua, Indonesia, exemplifies this complexity. Despite national and local campaigns promoting exclusive breastfeeding, the use of commercial infant formula persists among mothers of children under two years of age, raising concerns about potential health consequences (1–3).

Exclusive breastfeeding during the first six months of life is well established as providing substantial benefits for child growth, immune function, and cognitive development (4–6). However, surveys in several Indonesian provinces, including Southwest Papua, indicate that many mothers either supplement or replace breast milk with infant formula before the recommended period (7,8). The drivers of such practices are multifaceted, including maternal knowledge, economic circumstances, access to healthcare, and perceptions shaped by digital media and product marketing (9–12).

While extensive literature has examined determinants of breastfeeding and formula use in Indonesia and globally (13–18), most studies have focused on isolated factors. Few have explored the combined effects of socio-demographic, informational, cultural, economic, and policy-related influences in a single analytical framework, particularly in under-researched urban contexts such as Sorong City. Understanding these complex interactions is

essential to inform targeted interventions and policy adjustments aimed at improving early childhood nutrition.

This study aimed to address the influence of socio-demographic, knowledge-related, cultural, health, product, experiential, environmental, and economic-policy on mothers' decisions to provide infant formula in Sorong City. The study tried to identify factors having statistically significant association with formula feeding and discuss their implications for local health promotion programmes, community interventions, and policy development.

Methods

Study design and duration

This study employed a cross-sectional analytical design, enabling the identification of associations between multiple predictor variables and the decision to use infant formula. Data collection was conducted between March and May 2024, a period chosen to minimise seasonal variations in infant feeding practices.

Study location and population

The research was carried out in Sorong City, Southwest Papua, Indonesia—a coastal urban hub with diverse ethnic composition, marked socio-economic disparities, and variable access to healthcare facilities. The study population comprised mothers residing in Sorong City with children aged 0–24 months at the time of data collection. Mothers who were unable to provide informed consent or who had children with severe congenital anomalies affecting feeding were excluded.

Sample size and sampling strategy

A total sample of 180 mothers was determined to provide adequate statistical power for logistic regression analysis. The minimum sample size was calculated using the formula for proportions in analytical cross-sectional studies, assuming a 95% confidence level, an anticipated prevalence of formula feeding of 50% (to maximise sample size), and a 5% margin of error. A stratified random sampling approach was used, with districts (kecamatan) serving as strata to ensure representation across different socio-economic and cultural backgrounds within Sorong City.

Data collection instrument

Data were collected using a structured, interviewer-administered questionnaire developed in Indonesian. The instrument covered socio-demographic characteristics, maternal knowledge, socio-cultural and environmental influences, health and medical factors, product attributes, personal experiences, and economic-policy contexts. The questionnaire underwent content validation by three public health and paediatric nutrition experts, achieving a Content Validity Index (CVI) of 0.88. A pilot test involving 20 mothers in a neighbouring district ensured clarity and reliability, yielding a Cronbach's alpha of 0.82.

Variables and operational definitions

The dependent variable was the maternal decision to provide infant formula (exclusive formula feeding or mixed feeding versus exclusive breastfeeding). Independent variables were

categorised as follows:

1. Socio-demographic: maternal age, education, occupation, household income, marital status, parity, ethnicity.
2. Knowledge-related: maternal awareness of breastfeeding benefits, access to information, and use of digital media for nutrition information.
3. Socio-cultural: family support, community feeding norms, cultural beliefs, religious influences.
4. Health and medical: maternal/child health status, delivery location, perceived breast milk adequacy.
5. Product-related: price, perceived quality, nutritional composition, safety, accessibility.
6. Experiential: prior breastfeeding/formula feeding experience.
7. Environmental: geographic accessibility, availability of breastfeeding facilities.
8. Economic policy: microeconomic capacity (savings, financial support), household socio-economic status, perceived influence of public policy.

Data analysis

Descriptive statistics were used to summarise respondents' characteristics and variable distributions. Bivariate associations were assessed using chi-square tests and independent t-tests as appropriate. Multiple logistic regression was then performed to identify independent predictors of formula use, with results

expressed as adjusted odds ratios (AORs) and 95% confidence intervals (CIs). Multicollinearity was assessed using variance inflation factors (VIF < 10 considered acceptable), and model fit was evaluated with the Hosmer–Lemeshow test. Analyses were conducted using Jamovi software (version 2.4).

Results

Characteristics of the study population

A total of 180 mothers participated, of whom 88 (48.9%) practised exclusive formula feeding and 92 (51.1%) engaged in mixed feeding (breast milk and formula). The mean maternal age was 25.9 years (SD 4.2), ranging from 19

to 33 years. Most respondents had completed at least junior high school (72.2%), and 53.3% were unemployed. Household income was evenly distributed, with 52.8% earning below the provincial minimum wage. Nearly two-thirds (64.4%) were delivered in a healthcare facility, and 50% reported perceived limitations in breast milk supply. Ethnic distribution indicated that 55% were of Papuan background, while 45% were non-Papuan. Social media use for accessing information was reported by 47.8% of respondents. Table 1 summarises the socio-demographic and selected characteristics of respondents.

Table 1. Socio-demographic and selected characteristics of respondents (N = 180)

Characteristic	Category	Exclusive formula n (%)	Mixed feeding n (%)	Total n (%)
Maternal age (years)	Mean age	25.5 ± 4.35	26.4 ± 4.08	—
Education	No schooling	17 (9.4)	14 (7.8)	31 (8.6)
	Elementary	21 (11.7)	24 (13.3)	45 (12.5)
	Junior high	15 (8.3)	20 (11.1)	35 (9.7)
	Senior high	16 (8.9)	15 (8.3)	31 (8.6)
	Higher education	19 (10.6)	19 (10.6)	38 (10.6)
Employment status	Employed	44 (24.4)	52 (28.9)	96 (26.7)
	Unemployed	44 (24.4)	40 (22.2)	84 (23.3)
Income	Less than minimum wage	45 (25.0)	50 (27.8)	95 (26.4)
	Greater than or equal to Minimum wage	43 (23.9)	42 (23.3)	85 (23.6)
Ethnicity	Papuan	52 (28.9)	47 (26.1)	99 (27.5)
	Non-Papuan	36 (20.0)	45 (25.0)	81 (22.5)

Note: Values for age are mean ± SD; all other values are frequencies (percentages).

Factors associated with formula milk use

In the multivariable logistic regression model, two factors emerged as statistically significant predictors of formula milk use. First, mothers who utilised technology and digital media to access nutritional information had more than twice the odds of choosing formula milk compared with those who did not (AOR = 2.30; 95% CI: 1.13–4.68; $p = 0.022$). Second, greater household microeconomic capacity—reflected in savings or access to external financial sup-

port—was associated with a twofold increase in the likelihood of formula milk provision (AOR = 2.05; 95% CI: 1.05–4.02; $p = 0.035$).

Socio-demographic characteristics (maternal age, education, occupation, income), cultural variables, health and medical factors, and product attributes were not statistically significant predictors after adjustment. Cultural beliefs related to nutrition approached significance ($p = 0.054$).

Table 1. Socio-demographic and selected characteristics of respondents (N = 180)

Predictor	AOR	95% CI	p-value
Use of digital media for nutrition info	2.30	1.13–4.68	0.022
Microeconomic capacity (savings/financial support)	2.05	1.05–4.02	0.035
Cultural beliefs related to nutrition	0.85	0.72–1.00	0.054
Education (\geq senior high vs $<$ senior high)	1.20	0.68–2.10	0.455
Employment status (employed vs unemployed)	1.35	0.88–2.08	0.170
Household income (\geq minimum wage vs $<$)	1.15	0.79–1.68	0.411

The analysis identified two significant predictors of formula milk use: digital information-seeking behaviour and household microeconomic resources. In contrast, most socio-demographic, cultural, health, and product-related variables were not significantly associated with the outcome. Cultural beliefs related to nutrition approached statistical significance, suggesting a potential, albeit limited, influence. Taken together, these findings indicate that in Sorong City, economic capacity and access to digital health information may exert a stronger influence on formula feeding decisions than traditional socio-cultural factors.

Discussion

This study identified two independent predictors of maternal decision-making in providing infant formula in Sorong City: use of digital media for nutritional information and household microeconomic capacity. Contrary to much of the existing literature, socio-demographic factors, cultural influences, and most health or product-related attributes were not statistically significant after adjustment.

Mothers who accessed nutritional information through digital platforms were over twice as likely to choose formula milk. This aligns with evidence from urban contexts in other

low- and middle-income countries, where internet-based marketing and peer discussions can influence infant feeding practices (19-21). Digital engagement provides mothers with exposure to product advertisements, peer narratives, and medical or pseudo-medical advice, which can shape perceptions of formula's convenience and adequacy. However, this may also bypass conventional health promotion channels that prioritise exclusive breastfeeding.

Households with higher microeconomic capacity—reflected in savings or external financial support—were more likely to purchase formula milk. This is consistent with studies from Ethiopia and Peru, which found that formula use increases with household financial stability due to the higher recurrent cost of formula relative to breastfeeding (22-23). In the Sorong context, the ability to afford premium formula brands may be interpreted by families as a symbol of improved childcare quality.

Previous Indonesian studies have frequently cited maternal education, occupation, and cultural norms as major determinants of infant feeding decisions (24-26). However, our findings suggest that in Sorong City these factors may be attenuated by the influence of modern information channels and economic capacity. This echoes findings from Singapore and urban China, where cultural influences weakened as digital marketing and globalised consumer norms expanded (27-28).

Interestingly, our analysis revealed no significant effect of family support or traditional cultural practices, contrasting with findings from

Rwanda and South Africa, where such factors remained prominent determinants of infant feeding behaviour (29-30). One plausible explanation is the rapid urbanisation and increasing digital penetration in Sorong, which may be shifting maternal guidance from local kinship networks toward online communities and health-related social media. The lack of associations for socio-demographic variables may reflect the relatively homogeneous age and educational profiles within our sample, limiting the variability needed to detect such effects. The near-significance of nutrition-related beliefs ($p = 0.054$) suggests that cultural influences may persist to some extent, although their impact appears to be overshadowed by the immediacy and accessibility of digital information. Similarly, the absence of significant associations for perceived product quality or breast milk limitations implies that these factors may not serve as primary decision drivers when families possess sufficient economic resources and engage extensively with digital platforms.

The findings of this study carry important implications for both practice and policy in urbanising contexts similar to Sorong City. First, breastfeeding promotion strategies should harness the same digital platforms that mothers commonly use, ensuring that accurate, evidence-based information is visible, engaging, and capable of countering the persuasive tactics of commercial marketing. Second, while improved household economic capacity may increase the ability to purchase

infant formula, it also presents an opportunity to strengthen breastfeeding practices if coupled with targeted nutrition education, accessible lactation support services, workplace accommodations, and adequate maternity leave provisions. Finally, stronger regulation and enforcement of the International Code of Marketing of Breast-milk Substitutes is urgently required within digital environments, particularly in closed online community groups where unverified or misleading claims about infant feeding are frequently circulated. Together, these measures could help align maternal decision-making with optimal infant nutrition practices, even amidst rapid socio-economic and technological change.

Limitations

Several limitations should be acknowledged. First, the cross-sectional design precludes any inference of causality between the identified predictors and formula feeding practices. Second, data on feeding behaviours and influencing factors were self-reported by mothers, introducing the potential for recall error and social desirability bias. Third, as the study was conducted exclusively in Sorong City, the findings may not be generalisable to rural areas of Papua or other provinces with differing socio-cultural and economic contexts. Finally, the analysis did not capture certain potentially relevant variables, such as maternal mental health, paternal involvement, or workplace policies, which could also play an important role in shaping infant feeding decisions.

Conclusion

This study demonstrates that in Sorong City, the decision to provide infant formula to children under two years of age is primarily influenced by digital information-seeking behaviour and household microeconomic capacity, rather than by socio-demographic or traditional cultural factors. These findings suggest that in rapidly urbanising, digitally connected communities, economic resources and online information flows may override conventional influences on infant feeding practices. Practical implications include the need for targeted breastfeeding promotion through the same digital channels frequented by mothers, regulation of online marketing of formula products, and integration of economic empowerment initiatives with evidence-based maternal nutrition education. Future research should adopt longitudinal or mixed methods designs to explore causal pathways and to examine how digital media consumption interacts with cultural norms, healthcare engagement, and policy interventions in shaping infant feeding decisions.

Declaration

Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of Health Polytechnic, Ministry of Health, Sorong (Reference No: DM.03.01/4.1/1987/2024). Written informed consent was obtained from all participants after they were provided with verbal and written explanations of the study

objectives, procedures, risks, and benefits. Confidentiality and anonymity were maintained throughout the research process.

Conflict of Interest

The authors declare no conflict of interest related to this study.

Authors' Contribution

A.C.M. conceived and designed the study, supervised data collection, and drafted the manuscript. E.S. contributed to data analysis, interpretation of findings, and manuscript revisions. Both authors read and approved the final manuscript.

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References

1. Wells JCK, Marphatia AA, Amable G, et al. The future of human malnutrition: rebalancing agency for better nutritional health. *Glob Health*. 2021;17:119.
2. Islam MR, Trenholm J, Rahman A, Pervin J, Ekström EC, Rahman SM. Sociocultural influences on dietary practices and physical activity behaviors of rural adolescents—a qualitative exploration. *Nutrients*. 2019;11:2916.
3. Leach M, Nisbett N, Cabral L, Harris J, Hossain N, Thompson J. Food politics and development. *World Dev*. 2020;134:105024.
4. Duncan E, Ashton L, Abdulai AR, et al. Connecting the food and agriculture sector to nutrition interventions for improved health outcomes. *Food Secur*. 2022;14:657-675.
5. El Bilali H, Strassner C, Ben Hassen T. Sustainable agri-food systems: environment, economy, society, and policy. *Sustainability*. 2021;13:6260.
6. Grote U, Fasse A, Nguyen TT, Erenstein O. Food security and the dynamics of wheat and maize value chains in Africa and Asia. *Front Sustain Food Syst*. 2021;4:617009.
7. Cuevas García-Dorado S, Cornselsen L, Smith R, Walls H. Economic globalization, nutrition and health: a review of quantitative evidence. *Glob Health*. 2019;15:15.
8. UNICEF. The state of children in Indonesia. UNICEF Indonesia. 2020 May 30 [cited 2024 Jun 29]. Available from: <https://www.unicef.org/indonesia/reports/state-of-children-in-indonesia-2020>
9. Nurhasan M, Samsudin YB, McCarthy JF, et al. Linking food, nutrition and the environment in Indonesia: a perspective on sustainable food systems. Bogor: CIFOR-ICRAF; 2021. doi:10.17528/cifor/008070.

10. Wijaya S. Indonesian food culture mapping: a starter contribution to promote Indonesian culinary tourism. *J Ethn Foods*. 2019;6:9.
11. West Papua Provincial Statistics Agency. West Papua Province in figures 2023. Manokwari: West Papua BPS; 28 February 2023 [cited 29 June 2024]. Available from: <https://papuabarat.bps.go.id/publication/2023/02/28/1675aaebd5ba59b4d6e1cd3/provinsi-papua-barat-dalam-angka-2023.html>
12. Health Development Policy Agency. Survey report. Jakarta: Ministry of Health of the Republic of Indonesia; 2023 [cited 29 June 2024]. Available from: <https://www.badankebijakan.kemkes.go.id/laporan-hasil-survei/>
13. Health Development Policy Agency. SKI 2023 as a benchmark for national health achievements. Jakarta: Ministry of Health of the Republic of Indonesia; 15 July 2023 [cited 29 June 2024]. Available from: <https://www.badankebijakan.kemkes.go.id/ski-2023-sebagai-tolok-ukur-capaian-kesehatan-nasional/>
14. Health Development Policy Agency. Main findings of SKI 2023. Jakarta: Ministry of Health of the Republic of Indonesia; 2023 [cited 29 June 2024]. Available from: <https://www.badankebijakan.kemkes.go.id/daftar-frequently-asked-question-seputar-hasil-utama-ski-2023/hasil-utama-ski-2023/>
15. Pugu MR. Stunting-free status as an indicator of human security for communities in Southwest Papua Province from the perspective of international relations. *Syntax Literate*. 2023;8:6236-51.
16. Muro-Valdez JC, Meza-Rios A, Aguilar-Uscanga BR, et al. Breastfeeding-related health benefits in children and mothers: vital organs perspective. *Medicina (Kaunas)*. 2023;59:1535.
17. Carretero-Krug A, Montero-Bravo A, Morais-Moreno C, et al. Nutritional status of breastfeeding mothers and impact of diet and dietary supplementation: a narrative review. *Nutrients*. 2024;16:301.
18. Tran LM, Nguyen PH, Young MF, Martorell R, Ramakrishnan U. The relationships between optimal infant feeding practices and child development and attained height at age 2 years and 6–7 years. *Matern Child Nutr*. 2024;20:e13631.
19. Pérez-Escamilla R, Tomori C, Hernández-Cordero S, et al. Breastfeeding: crucially important, but increasingly challenged in a market-driven world. *Lancet*. 2023;401:472-485.
20. Topothai C, Tan GPP, van der Eijk Y. Commercial milk formula marketing following increased restrictions in Singapore: a qualitative study. *Matern Child Nutr*. 2024;20:e13562.
21. Morse H, Brown A. Accessing local support online: mothers' experiences of local breastfeeding support Facebook groups. *Matern Child Nutr*. 2021;17:e13227.

22. Kera AM, Zewdie A, Akafu W, Kidane R, Tamirat M. Formula feeding and associated factors among mothers with infants 0–6 months old in Mettu Town, Southwest Ethiopia. *Food Sci Nutr*. 2023;11:4136-4145.
23. Rothstein JD, Winch PJ, Pachas J, et al. Vulnerable families and costly formula: a qualitative exploration of infant formula purchasing among peri-urban Peruvian households. *Int Breastfeed J*. 2021;16:11.
24. Paramashanti BA, Dibley MJ, Huda TM, Prabandari YS, Alam NA. Factors influencing breastfeeding continuation and formula feeding beyond six months in rural and urban households in Indonesia: a qualitative investigation. *Int Breastfeed J*. 2023;18:48.
25. Laksono AD, Wulandari RD, Ibad M, Kusriani I. The effects of mother's education on achieving exclusive breastfeeding in Indonesia. *BMC Public Health*. 2021;21:14.
26. Permatasari TAE, Rizqiya F, Kusumaningati W, Suryaalamshah II, Hermiwahyoeni Z. The effect of nutrition and reproductive health education of pregnant women in Indonesia using quasi-experimental study. *BMC Pregnancy Childbirth*. 2021;21:180.
27. Topothai C, Tan GPP, van der Eijk Y. Commercial milk formula marketing following increased restrictions in Singapore: a qualitative study. *Matern Child Nutr*. 2024;20:e13562.
28. Guo S, Wang Y, Fries LR, et al. Infant and preschooler feeding behaviors in Chinese families: a systematic review. *Appetite*. 2022;168:105768.
29. Birungi A, Koita Y, Roopnaraine T, Matsiko E, Umugwaneza M. Behavioural drivers of suboptimal maternal and child feeding practices in Rwanda: an anthropological study. *Matern Child Nutr*. 2023;19:e13420.
30. Chakona G. Social circumstances and cultural beliefs influence maternal nutrition, breastfeeding and child feeding practices in South Africa. *Nutr J*. 2020;19:47.

Original Article

Time to achieve full enteral feeding and its predictors among neonates weighing less than 2500g admitted to public hospitals in Hawassa municipal administration, Sidama region, Ethiopia: A follow up study.

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Abstract

Background: Low birth weight neonates are at high risk for complications, including feeding intolerance and protracted hospital stays. Understanding and identifying predictive factors for time to achieve full enteral feeding can help optimize nutritional regimens and improve outcomes for LBW neonates admitted to Hawassa city Hospitals.

Methodology: An institution-based longitudinal study design was used from September 2022 to December 2024. A total of 209 research participants were recruited using basic random sampling techniques. Trained data collectors used a structured questionnaire to gather data, and SPSS version 25 was used for data input, cleaning, and analysis. The study employed a Cox proportional hazards regression model to determine significant factors affecting the time required to attain full enteral feeding. To take confounding effects into account, independent variables identified by bivariate analysis with p-values less than 0.25 were included in the multivariate model.

Result: Among of the 209 newborns admitted to the NICU at the hospitals, 174 [83.2% (95% CI = 78.1%-88.3%)] were able to attain full enteral feeding. Overall, five days was the median time to complete enteral feeding. Birth weight (AOR: 0.55, CI (0.32,0.93)), respiratory distress syndrome (AOR: 0.61, CI (0.39,0.94)), and breast feeding over formula milk (AOR: 2.2, CI (1.45,3.47)) were all predictors that were substantially correlated with the time to full enteral feeding.

Conclusion: According to this study, the neonate achieved full enteral feeding rapidly. The findings also show that birth weight, respiratory distress syndrome, and feeding method are key predictor of achieving full enteral feeding, with breastfeeding accelerating the process.

Keywords: Low birth weight, full enteral feeding, preterm, NICU

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Background

Around 60% of neonatal deaths happen because of being LBW and VLBW (1, 2). Full enteral feeding (FEF) means the infant gets all their feeding—about 120 to 150 ml/kg/day—only through intestine, which could be mother's milk or formula, without additional parenteral nutrition (3). Studies show that babies who weigh between 1000 g and 1500 g usually reach FEF in about a week. But those under 1000 g might take up to two weeks to do so (4). The postnatal growth rate is recommended to be equivalent to intact fetuses at the same gestational age (5). The standard protocol for administering nutrition to VLBW neonates typically involves initiating enteral milk feeds at low volumes, with a gradual increase over a period of 1 to 2 weeks. However, conservative enteral feeding strategies can impede the secretion of gastrointestinal hormones and the motility of the digestive system, thereby hindering the functional adaptation of the gastrointestinal tract and disrupting microbial colonization patterns. (6, 7) Early initiation of enteral feeding & getting to full feeding fast are crucial for taking care of infants. These steps help lower the chances of infections & liver problems, and encourage gut growth, leading to shorter hospital stay. Furthermore, starting feedings early can have long-term advantages like better brain development and healthier hearts & kidneys functions (8, 9).

In places like Ethiopia, there are many challenges that can slow down enteral feeding for

such infants. If feeding is delayed, it can make it tough for their digestive systems to adapt. This delay may mess with normal flora the baby needs, leading to longer hospital stays and higher costs in healthcare along with more hospital acquired infections.(10) In developed countries, survival rates and health outcomes for VLBW infants have been favorable due to improved early feeding practice (11). While some progress has been made in Ethiopia regarding early feeding habits, many VLBW infants still stay NPO (nothing by mouth) during those first days after being born (12). Reaching full enteral feeding (FEF) quickly in VLBW and LBW neonates is a key marker of good care. Finding out what affects how fast they reach FEF is vital for using evidence-based methods to improve neonates' health outcomes, especially where resources are limited. Unfortunately, there isn't much research done in Ethiopia about how long it takes to reach FEF and what factors influence this among LBW infants in NICUs. This study plans to fill that gap at Hawassa City administrative hospitals.

Neonates, those weighing less than 2500 grams at birth, especially those less than 1500 grams, often have a tough time getting enough nutrition due to their immature gastrointestinal systems. As a result, they are at high risks for problems like NEC & sepsis. (13, 14) Getting to full enteral feeding is essential for their growth and health. But in this vulnerable group, it's often delayed. Research

shows that starting feeding early, using human milk, and actively handling feeding intolerance can help shorten the time it takes to reach full enteral feeding (9). Finding local factors is paramount for creating specialized interventions. At this study area, the challenges of a constrained NICU along with different neonatal care practices complicate this issue. This study aims to find out what influences the time it takes for infants less than 2500 g to achieve full enteral feeding at public hospitals in the Hawassa city administration. This study is also crucial for identifying predictors of successful full enteral feeding, shedding light on the unique challenges and barriers encountered by these newborns (15) and contributing to global knowledge.

Method and materials

Study area, period and design

The public hospitals in Hawassa city, Sidama region, Southern Ethiopia, served as the study's sites. The study period covered admissions of VLBW infants from September 2022 to December 2024. An institution-based longitudinal study design was entertained to figure out the time to attain full enteral feeding and its predictors in low birth weight neonates hospitalized in the neonatal intensive care unit (NICU) at public hospitals (HUCSH, Adare General and Tulla Primary Hospital) in the Hawassa municipality, Sidama, Ethiopia. When we reviewed the chart, there were only 173 cases that fulfilled the inclusion criteria. To overcome this, we included new cases from each hospital pro-

portionally after the study has commenced and followed for the outcome.

Population

During the designated study period, all newborns admitted to NICUs at public hospitals served as the source population, while neonates with birth weights under 2500 g who were admitted to the NICU in the Hawassa public hospitals were included in the study population.

Inclusion and exclusion criteria

Neonates with a birth weight of less than 2500 g who were admitted to the NICU during the study period and had complete medical and feeding records were included. Newborns admitted after 24 hours of life, those who died or were transferred to another facility within 24 hours of admission, and neonates with incomplete medical records or missing feeding data were excluded.

Sample size determination:

The sample size was calculated using a single population proportion formula. Using a proportion (P) of 63.4% from a previous study in Hawassa on time to achieve full enteral feeding in preterm infants (17), and with a 95% confidence interval, the initial sample size was determined to be 357. To account for a finite population, the final sample size was adjusted using a finite population correction (FPC) formula, with an expected total population of 500 infants during the study period, yielding an adjusted sample size of 209.

Sampling technique

The sample size was proportionally allocated for the three hospitals depending on the case-load assessed from the registration book for the year before this study. A simple random sampling technique method was used to select charts of the study participants. SPSS version 25 was used to generate a random sample of 209 neonatal charts. In order to maintain the integrity and validity of the research findings, missing data are managed via using well-defined procedures and pilot testing before full-scale implementation.

Data collection methods

The data was collected using a checklist that was developed in English. Participants were screened from the registration book by using a medical record number. Two NICU nurses who had a BSc degree in nursing and trained in NICU nurses' training have extracted the data using the checklist; one medical doctor who has been working in NICU supervised the data collection. The neonates followed until they reached full feeding. This time is considered the average time when LBW infants started to regain their birth weight, and it is also considered the time when early full enteral feeding should be achieved. A pre-test was done on 10% of the study sample size. The pre-test was used to test the clarity and understandability of the checklist. The completeness and consistency of the collected data were checked daily. Data collection was carried out by trained personnel with experience

in neonatal data abstraction to ensure accuracy and consistency.

Variables

The dependent variables were time to achieve full enteral feeding (measured in days), and the independent variables included neonatal factors (gestational age, birth weight, APGAR score, initial feeding method, and complications like NEC or sepsis), maternal factors (age, antenatal care, mode of delivery, and presence of pregnancy complications), and clinical factors (time of initiation of enteral feeding, initial type of feed, and the presence of co-morbidities).

Data quality assurance

The tool was pretested in another institution prior to the actual data collection period, and the pretest findings were not used in the actual data for the study. Based on the results of the pretest it was modified to improve clarity, understandability, and simplicity of the data collection tool by the principal investigator. Data was checked for completeness, accuracy and consistency by principal investigator on daily base.

Data process and analysis

Data were entered into EpiData version 3.1 and analyzed using SPSS version 25. Descriptive statistics was used to summarize the demographic and clinical characteristics of the neonates. Kaplan-Meier survival analysis was performed to estimate the time to achieve full enteral feeding, and the log-rank test was used to compare time to full enteral feeding

across different groups (e.g., birth weight categories, gestational ages). To identify significant predictors of time to achieve full enteral feeding, a Cox proportional hazards regression model was used, with following assumptions: Proportional Hazards Assumption (hazard ratio (HR) between any two individuals, defined by their predictor variables, remains constant over time), Linearity Assumption (the effect of each predictor variable on the hazard rate should be additive and constant), Non-informative Censoring, and Independence of Survival Times. Independent variables with p-values <0.25 in bivariate analysis were included in the multivariate model to control for confounding effects. A p-value of <0.05 was considered statistically significant in the final model.

Operational definitions

Full enteral feeding (FEF): defined as the ability to tolerate 120-150 mL/kg/day of enteral feeds without signs of feeding intolerance (20).

Necrotizing enterocolitis (NEC): inflammation of the bowel wall characterized by temperature instability, lethargy, feeding intolerance, abdominal distension and tenderness, absent bowel sounds, bloody stools, vomiting, discolored abdominal walls, and intramural air

(pneumatosis intestinalis) or pneumoperitoneum on abdominal X-ray.

Survival time: it is the time from admission within 24 hours of birth to NICU up to the occurrence of an event/FEF.

Follow-up time: from the time of admission within 24 hours of birth until either an event or censorship occurs.

Censored: all VLBW neonates with predictors other than an event (lost to follow-up, died after 24 hours of birth, not FEF over the follow-up period, referred to another health facility before FEF, and against medical treatment before FEF)

Results

Neonatal sociodemographic characteristics

In all, 209 neonates were incorporated in the study. Of the newborns, 56.9% were male, and 38 (18.2%) had very low birth weights. The average birth weight (BW) was 1852.4 (± 390) grams, and the average gestational age (GA) was 34.3 (± 2.5) weeks. Of the infants, 28 (13.4%) were extremely preterm, and 32 (15.3%) were small for gestational age. Calculated in the first and fifth minutes, infants' APGAR scores were low, at 44.0% and 7.7%, respectively. (Table 1)

Table 1: Neonatal characteristics of neonates admitted to the NICU of HUCSH, Adare General and Tulla Primary Hospital 2024

Variables	Categories	Frequency	Percentage
Sex	Male	119	56.9
	Female	90	43.1
Age	<7 day	204	97.6
	>7 day	5	2.4
Gestational age	28-32weeks	28	13.4
	32-34weeks	46	22.0
	34-37weeks	82	39.2
	Term (37- 42 weeks)	53	25.4
Weight	LBW	169	80.9
	ELBW	2	1.0
	VLBW	38	18.2
Weight for age	SGA	32	15.3
	AGA	176	84.2
	LGA	1	.5
1 st min APGAR score	< 7	92	44.0
	>7-10	117	56.0
5 th min APGAR score	< 7	16	7.7
	>7-10	193	92.3
Hospital	HUCSH	148	70.8
	Adare	33	15.8
	Tula	28	13.4
Neonatal complication	Yes	191	91.4
	no	18	8.6

The majority of neonates (91.4%) had neonatal complications; neonatal sepsis and respiratory distress syndrome were the prevalent

complications among neonates, 63.5% and 52.6%, respectively (Figure 1).

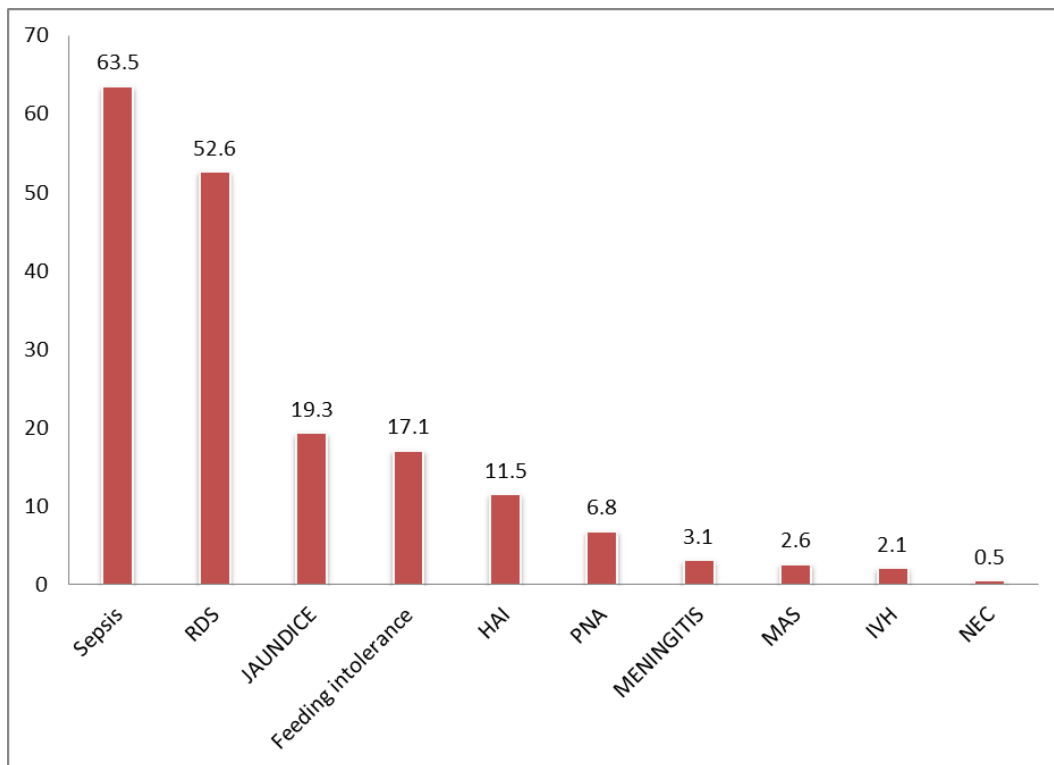


Figure 1: Neonatal complications (%) among neonates admitted to the NICU of HUCSH, Adare General and Tulla Primary Hospital 2024

Maternal socio-demographic characteristics

Thirty-one (14.8%) of the women were younger than twenty, and 111 (53.6%) were nulliparous. 203 mothers (97.1%) gave birth in medical facilities, while 16 mothers (7.7%) did not have any ANC follow-up during the current pregnancy. Twenty-eight (13.4%) of the pregnancies resulted in multiple pregnancy outcomes, and more than two-thirds (65.6%)

of the neonates were delivered vaginally spontaneously. Of the women, 101 (48.3%) experienced pregnancy-related problems, and nearly three-fourths (71.8%) had received prenatal steroids. Pregnancy-induced hypertension affected 47 (46.5%) of the mothers of newborns, followed by PROM in 23 (22.8%), antepartum hemorrhage in 10 (9.9%), and severe pre-eclampsia in 7 (6.9%). (Table 2)

Table 2: Maternal characteristics of neonates admitted to the NICU of HUCSH, Adare General and Tula Primary Hospital 2024

Variables	Categories	Frequency	Percentage
Age	<20	31	14.8
	21 -34	153	73.2
	>35	25	12.0
Parity	Primiparous	112	53.6
	Multiparous	97	46.4
Place of birth	Health facilities	203	97.1
	Home	6	2.9
ANC follow-up	Yes	193	92.3
	No	16	7.7
ANC steroidal use	yes	150	71.8
	no	59	28.2
Complications	yes	101	48.3
	no	108	51.7
Type of complications	Preeclampsia	47	46.5
	Eclampsia	7	6.9
	PROM	14	13.9
	APH	10	9.9
	Other	23	22.8
Birth outcome	singleton	178	85.2
	twin	28	13.4
	triplets	3	1.4
Mode of delivery	Vaginal delivery	137	65.6
	Cesarean	68	32.5
	Instrumental	4	1.9

Neonatal treatment related information

Five (2.4%) and thirty-four (16.3%) of the neonates were fed mixed and formula milk, respectively. 85 (75.2%) of the 113 (54.1%) individuals who had received oxygen support

were sustained by continuous positive airway pressure. Thirty-five (17.1%) had maintenance fluid, and nearly three-fourths (73.7%) had received antibiotics. (Table-3)

Table 3: The Management of neonates admitted to NICU at HUCSH, Adare General and Tulla Primary Hospital 2024

Variables	Categories	Frequency	Percentage
Oxygen support	Yes	113	54.1
	No	96	45.9
Device used for oxygen	INO2	28	24.8
	CPAP	85	75.2
Antibiotic use	Yes	154	73.7
	No	55	26.3
Starting time of feeding	within 24 hr	117	56.0
	1-3 days	83	39.7
	>3 days	9	4.3
Type of feeding	Breast milk	163	78.0
	Formula	34	16.3
	Mixed feeds	5	2.4
Feeding frequency per day	≥8	165	78.9
	<8	44	21.1
Duration of Antibiotic use (n=154)	≤7	108	70.1
	>7	46	29.9

Follow-up and full enteral feeding attainment of neonates

A total of 209 neonates were tracked for varying lengths of time, with a median follow-up period of 5 days and a minimum of 1 day to a high of 25 days. Of the neonates, 174 [83.2% (95% CI = 78.1%-88.3%)] were censored during the follow-up period, and 35 [16.7% (95% CI = 11.6%-21.8%)] were able to attain full enteral feeding. 93.1% of the neonates snagged full enteral feeding within 14 days, and the mean (SD) age at the onset of enteral feeding (trophic feeding) was 1.68 (1.1) days.

Five (4.4–5.5) days was the median (IQR) time it took to achieve full enteral feeding. A total of 1302 newborn days (3.56 infant years) of follow-up were at risk. Achieving complete enteral feeding had an incidence rate of 13.3 [95% CI: 11.5-15.5] per 100 neonatal days. The incidence rate of full enteral feeding achievement for neonates who received only breast milk was 14.9 [95% CI: 12.7-17.5] per 100 neonatal days; it was 8.3 [95% CI: 5.6, 12.2] per 100 neonatal days for neonates who received formula and mixed feeding. (Figure-2)

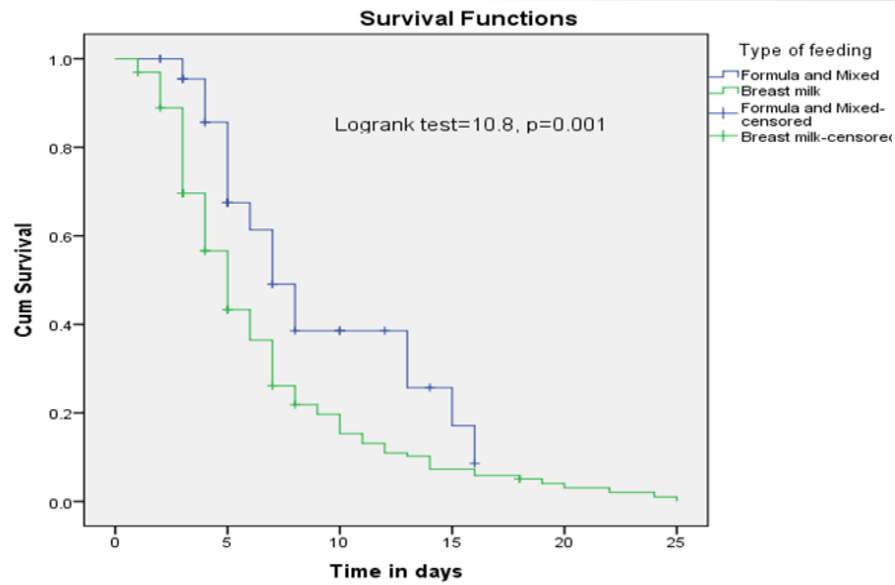


Figure 2: Kaplan-Meier survival estimate by type of feeding for the time to full enteral feeding among neonates admitted to the NICU at HUCSH, Adare General and Tulla Primary Hospital 2024

The median time to full enteral feeding achievement was 9 (95% CI: 5.73, 12.27) days for newborns under 1500 g and 5 (95% CI: 4.49, 5.50) days for neonates weighing 1500–2499 g. (Figure 3).

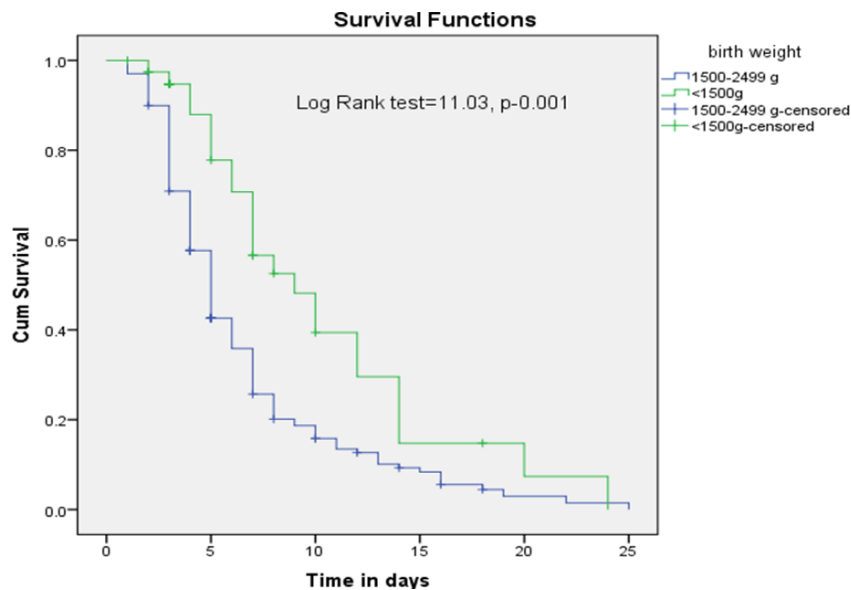


Figure 3: Kaplan-Meier survival estimate by birth weight for the time to full enteral feeding among neonates admitted to the NICU at HUCSH, Adare General and Tulla Primary Hospital 2024

Predictors of full enteral feeding achievement

The bivariable Cox regression analysis divulged that the following factors had p-values

less than 0.25: delivery weight, weight for gestational age, preterm delivery, feeding type, respiratory distress syndrome, birth outcome,

neonatal sepsis, and newborn jaundice. Nonetheless, full enteral feeding performance was predicted by infant weight, respiratory distress syndrome, and feeding method in the final multivariable Cox regression. Neonates with a birth weight less than 1500 g were 45% [AHR: 0.55; 95% CI: 0.32, 0.93] less likely to have full enteral feeding as compared with those with a birth weight age of 1500–2500 g.

Similarly, neonates admitted with RDS were 39% [AHR: 0.61; 95% CI: 0.39, 0.94] less likely to have full enteral feeding as compared to their counterparts. Moreover, the hazard ratio of full enteral feeding among neonates is 2.2 [AHR: 2.3; 95% CI: 1.45, 3.47] times higher as compared with those revived with formula and mixed feeding. (Table 4)

Table 4: Bivariate and multivariate Cox-regression analysis of predictors of full enteral feeding achievement of infants admitted to the NICU at HUCSH, Adare General and Tulla Primary Hospital 2024

Variables	Categories	Outcome		CHR (95% CI)	AHR (95%CI)
		Event (n, %)	Censored (n,%)		
GA	Very Preterm	20(71.4)	8(28.6)	0.41(0.24,0.70)	0.90(0.43,1.88)
	Moderate Preterm	38(82.6)	8(17.4)	0.52(0.33,0.80)	0.84(0.47,1.47)
	Late Preterm	68(82.9)	14(17.1)	0.83(0.57,1.22)	1.04(0.68,1.61)
	Term	48(90.6)	5(9.4)	1	1
Type of feeding	Breast milk	148(90.8)	15(9.2)	1.88(1.23,2.85)	2.2(1.45,3.47) **
	Formula & Mixed	26(56.5)	20(43.5)	1	1
Birth outcome	Single	152(85.4)	26(14.6)	1.31(0.83,2.05)	0.87(0.54,1.41)
	Multiple	22(71.0)	9(29.0)	1	1
Birth weight in g	<1500	24(60.0)	16(40.0)	0.51(0.33,0.79)	0.55(0.32,0.93)**
	1500-2500	150(88.8)	19(11.2)	1	1
Weight for age	SGA	28(87.5)	4(12.5)	1.43(0.95,2.15)	1.23(0.78,1.95)
	AGA	146(82.5)	31(17.5)	1	1
RDS	Yes	81(80.2)	20(19.8)	0.58(0.43,0.78)	0.61(0.39,0.94)**
	No	93(86.1)	15(13.9)	1	1
Neonatal sepsis	Yes	101(82.8)	21(17.2)	0.73(0.54,0.99)	0.88(0.62,1.24)
	No	73(83.9)	14(13.1)	1	1
Jaundice	Yes	28(75.7)	9(24.3)	0.73(0.49,1.11)	0.69(0.45,1.06)
	No	146(84.9)	26(15.1)	1	1

** Significant association. RDS Respiratory distress syndrome

Discussion

Of the neonates in this study, 174 (83%) were able to achieve full enteral feeding over the follow-up period. Ninety-three percent of the neonates achieved complete enteral feeding within 14 days. The median time to reach full enteral feeding was five days. The incidence rate to full enteral feeding achievement was 13.3 per 100 infant days. The achievement of full enteral feeding was predicted by the following variables: Breastfeeding over formula milk, respiratory distress syndrome, and birth weight.

In this study, the mean gestational age (GA) was 34.3 weeks, and the median time to achieve full enteral feeding was five days. With a GA between 32 and 37 weeks, the trial's median time to acquire full enteral feeding was 5 days, which was comparable to the findings seen in the study done in Addis Ababa (21). India had a 7-day IQR (7–9.5 days) with a mean GA of 30.8 weeks; Kenya and Nigeria demonstrated that the full enteral feeds were established by a median time of 8 (4.5, 12) days; Northwest Ethiopia had a median time of 10 days (3–18 days); and the UK had an 11-day IQR (8–13 days) with a median GA of 26. (12, 18, 22-24). Furthermore, it is much less than the median survival time of full enteral feeding in the Netherlands (20 days) and Italy (13 days, with a mean GA of 29 weeks) (22, 25). This could be due in part to the diversity of the research population. For example, compared to research done in Northwest Ethiopia, Kenya,

Nigeria, and Italy, the mean gestational age of the newborns in this study was 34.3 weeks. In contrast to this study, which included all LBW and VLBW newborns, the Netherlands study focused on preterm neonates with NEC, which may cause delays in obtaining complete enteral feeding due to its catastrophic effects on the gastrointestinal system.(26) There is proof that as gestational age increases, less time is needed to achieve full enteral feeding (27). Their well-developed and mature gastrointestinal systems may be the source of this. Additionally, a well-developed and matured gastrointestinal system may accept a tiny and rising amount of milk given as a treatment, which also determines the level of tolerance to the feeding. (22, 28)

The findings of this study are in contrast to the NICU criteria, which stipulate that enteral nutrition has to be advanced to a full enteral feeding in 7 days for neonates weighing 1 to 1.5 kg and 14 days for neonates weighing less than 1 kg (4). This could be the result of differences in test results, availability of skilled labor, and medical equipment, all of which are strongly related to the quality of care given in the NICU. Babies that postponed reaching FEF were more likely to suffer from poor brain development, extended hospital stays, and postnatal growth failure, according to studies. (29)

Compared to neonates receiving formula and mixed feeding, those exclusively breastfed

have a 2.2-fold earlier chance of getting full enteral feeding (26). A study carried out in Indonesia, Italy, and Northwest Ethiopia aligns with this conclusion. (17, 22, 28) This may be explained by the fact that human breast milk encourages the gut flora to mature, which in turn supports immunological regulation, digestion, and nutrition utilization. Because breast milk contains a variety of bioactive factors, such as growth factors, adipokines, cytokines, and antioxidants, as well as unique nutritional factors, such as fatty acids and fatty acid derivatives or mediators, which act as an energy source and as regulators of development, immune function, and metabolism, it is implied that exclusive breastfeeding for VLBW is necessary for the early establishment of full enteral feeding and to prevent complications. (30-32) The ideal first enteral feeding for newborns is colostrum or breast milk from the mother. In the event that this is unavailable, formula milk is the final choice, followed by donor human milk (33). In our research, formula milk was the primary source of nutrition for 16% of the newborns. Regretfully, our unit lacked a human milk donor system, which may be the area in need of system enhancement.

Birth weight of the neonates also significantly predicted how long it would take them to reach FEF. In line with researches conducted in Addis Ababa and India, newborns weighing less than 1500 g had a 45% lower chance of experiencing full enteral feeding than those weighing between 1500 and 2500 g. (34, 35)

Neonates admitted with RDS also predict time to reach FEF, with a 39% reduced chance of full enteral feeding. The time it takes to reach full feeding may be delayed since most patients with severe RDS have delayed stomach emptying. Research conducted in Kenya and Nigeria supports this conclusion (18). According to other research conducted in Indonesia, newborns with RDS who need mechanical ventilation may take longer to reach full feeding (19, 36). During the first 72 hours of life, premature infants experiencing acute respiratory distress have delayed gastric emptying, which might postpone the start of enteral feeding (37).

The fact that this is a multi-center longitudinal study improves its strength. However, this study does have several limitations, though. Due to inadequate or erroneously recorded information, the study design's reliance on medical records may create biases. Additionally, the small sample size could lead to biases. Thus a prospective study with larger study participants will invalidate this drawback. The study found that the overall incidence of reaching full feeding was 13.3 per 100 neonatal days, and the median time to acquire full enteral feeding was five days. The method of feeding (Breastfeeding Vs Mixed feeding), respiratory distress syndrome and birth weight all predicted the achievement of full enteral feeding. The newborn in this trial achieved full enteral feeding in a comparatively short amount of time. The creation of a

breast milk bank is one of the things we should concentrate on in order to significantly affect the FEF of this neonates. Since this study also demonstrated that human breast milk will boost the rate of attaining full enteral feeding, more studies may still be needed to determine how breast milk enhances early complete enteral feeding in comparison to formula or mixed feeding practices. Delays in achieving enteral feeding are also linked to RDS and low birth weight. We should work with the obstetrics department to lessen the impact of being LBW and RDS on FEF success. Further research on how lowering LBW and RDS improves FEF is paramount to filling this gap.

Declaration

Ethical consideration: The Institutional Review Board (IRB) of Hawassa University Health Sciences and Medical College granted ethical approval. In addition, the heads of each ward gave their agreement, and the willingness of study participants was inquired about. Names and other personally identifiable information were kept anonymous for the sake of the participants' privacy. Participants could withdraw from the study at any moment, and their membership was entirely up to them.

Authors' contributions

Each author significantly contributed to the ideation, design, data gathering, analysis, and interpretation of the article. Additionally, they consented to take full accountability for the work and participated in its creation or critical

revision of any substantial intellectual substance.

Competing interests: The objectivity of this manuscript has not been compromised by any financial holdings, memberships, or affiliations that the author is aware of.

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References

1. Cutland CL, Lackritz EM, Mallett-Moore T, Bardají A, Chandrasekaran R, Lahariya C, et al. Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. *Vaccine*. 2017;35(48 Pt A):6492-500.

2. Woelile TA, Kibret GT, Workie HM, Amare AT, Tigabu A, Aynalem YA, et al. Survival Status and Predictors of Mortality Among Low-Birth-Weight Neonates Admitted to the Neonatal Intensive Care Unit at Felege Hiwot Comprehensive Specialized Hospital, Bahir Dar, Ethiopia, 2020. *Pediatric Health Med Ther.* 2021;12:451-66.
3. Nangia S, Bishnoi A, Goel A, Mandal P, Tiwari S, Saili A. Early Total Enteral Feeding in Stable Very Low Birth Weight Infants: A Before and After Study. *J Trop Pediatr.* 2018;64(1):24-30.
4. Dutta S, Singh B, Chessell L, Wilson J, Janes M, McDonald K, et al. Guidelines for feeding very low birth weight infants. *Nutrients.* 2015;7(1):423-42.
5. Horbar JD, Ehrenkranz RA, Badger GJ, Edwards EM, Morrow KA, Soll RF, et al. Weight Growth Velocity and Postnatal Growth Failure in Infants 501 to 1500 Grams: 2000-2013. *Pediatrics.* 2015;136(1):e84-92.
6. Klingenberg C, Embleton ND, Jacobs SE, O'Connell LA, Kuschel CA. Enteral feeding practices in very preterm infants: an international survey. *Arch Dis Child Fetal Neonatal Ed.* 2012;97(1):F56-61.
7. Embleton ND, Berrington JE, Dorling J, Ewer AK, Juszczak E, Kirby JA, et al. Mechanisms Affecting the Gut of Preterm Infants in Enteral Feeding Trials. *Front Nutr.* 2017;4:14.
8. Tsang RC, Uauy R, Koletzko B, Zlotkin S. Nutrition of the preterm infant: scientific basis and practical guidelines: Digital Educational Publishing, Inc.; 2005.
9. Rennie JM. Rennie & Robertson's Textbook of Neonatology E-Book: Elsevier Health Sciences; 2012.
10. Bora R, Murthy NB. In resource limited areas complete enteral feed in stable very low birth weight infants (1000–1500 g) started within 24 h of life can improve nutritional outcome. *The Journal of Maternal-Fetal & Neonatal Medicine.* 2017;30(21):2572-7.
11. Oddie SJ, Young L, McGuire W. Slow advancement of enteral feed volumes to prevent necrotising enterocolitis in very low birth weight infants. *Cochrane database of systematic reviews.* 2021(8).
12. Tewoldie MT, Girma M, Seid H. Determinants of time to full enteral feeding achievement among infants with birth weight 1000-2000g admitted to the neonatal intensive care unit of public hospitals in Hawassa city, Sidama region Ethiopian, 2019: A retrospective cohort study. *PloS one.* 2022;17(7):e0271963.
13. Kandasamy Y. Infection control during administration of parenteral nutrition in preterm babies. *Arch Dis Child Fetal Neonatal Ed.* 2009;94(1):F78.

14. Perez K, Valentine GC, Nangia S, Burrin DG, Maheshwari A, Abayneh M, et al. Advancement of enteral feeding in very-low-birth-weight infants: Global issues and challenges. *newborn*. 2022;1(3):306-13.
15. Belay DM, Erku D, Bayih WA, Kassie YT, Minuye Birhane B, Assefa Y. Improving the quality of neonatal health care in Ethiopia: a systematic review. *Frontiers in Medicine*. 2024;11:1293473.
16. Berseth CL. Neonatal small intestinal motility: motor responses to feeding in term and preterm infants. *J Pediatr*. 1990;117(5):777-82.
17. Esubalew H, Messelu MA, Tarekegn BT, Admasu AT, Abrha NN, Terefe B. Time to full enteral feeding and its predictors among very low birth weight (VLBW) neonates admitted to the neonatal intensive care units (NICU) in comprehensive specialized hospitals in Northwest Ethiopia. *BMC pediatrics*. 2024;24(1):366.
18. Imam ZO, Nabwera HM, Tongo OO, Andang'o PE, Abdulkadir I, Ezeaka CV, et al. Time to full enteral feeds in hospitalised preterm and very low birth weight infants in Nigeria and Kenya. *Plos one*. 2024;19(3):e0277847.
19. Sukmawati M, Kardana IM, Artana IWD, Putra PJ, Cempaka PMVP, Clearesta KE. Time to Achieve Full Enteral Feeding in Very Low Birth Weight Infants and Associated Factors in Neonatology Unit. *Babali Nursing Research*. 2023;4(3):481-91.
20. Nangia S, Bishnoi A, Goel A, Mandal P, Tiwari S, Saili A. Early total enteral feeding in stable very low birth weight infants: a before and after study. *Journal of tropical pediatrics*. 2018;64(1):24-30.
21. Terefe A, Demtse A, Abebe F, Mislul E, Tachbele E. Predictors of Time to Full Enteral Feeding in Low Birth Weight Neonates Admitted to Neonatal Intensive Care Unit: a Multi Center Prospective Follow Up Study. 2023.
22. Corvaglia L, Fantini MP, Aceti A, Giber-toni D, Rucci P, Baronciani D, et al. Predictors of full enteral feeding achievement in very low birth weight infants. *Plos one*. 2014;9(3):e92235.
23. Krishnamurthy S, Gupta P, Debnath S, Gomber S. Slow versus rapid enteral feeding advancement in preterm newborn infants 1000–1499 g: a randomized controlled trial. *Acta paediatrica*. 2010;99(1):42-6.
24. Salas AA, Li P, Parks K, Lal CV, Martin CR, Carlo WA. Early progressive feeding in extremely preterm infants: a randomized trial. *The American journal of clinical nutrition*. 2018;107(3):365-70.
25. Kuik SJ, den Heijer AE, Mebius MJ, Hulscher JB, Bos AF, Kooi EM. Time to full enteral feeding after necrotizing enterocolitis in preterm-born children is related to neurodevelopment at 2–3 years of age. *Early Human Development*. 2020;147:105091.

26. Mihatsch WA, Pohlandt F, Franz AR, Flock F. Early feeding advancement in very low-birth-weight infants with intrauterine growth retardation and increased umbilical artery resistance. *Journal of pediatric gastroenterology and nutrition*. 2002;35(2):144-8.
27. Patwardhan G, Soni A, Rachwani N, Kadam S, Patole S, Pandit A. Factors associated with time to full feeds in preterm very low birth weight infants. *Journal of tropical pediatrics*. 2018;64(6):495-500.
28. Hendrayanti T, Ramadanti A, Indrayady I, Indra RM. Achievement of full enteral feeding using volume advancement in infants with birth weight 1,000 to < 2,000 grams. *Paediatrica Indonesiana*. 2020;60(4):173-7.
29. Yoon SA, Lee MH, Chang YS. Impact of time to full enteral feeding on long-term neurodevelopment without mediating by postnatal growth failure in very-low-birth-weight-infants. *Scientific Reports*. 2023;13(1):2990.
30. Tudehope DI. Human milk and the nutritional needs of preterm infants. *The Journal of pediatrics*. 2013;162(3):S17-S25.
31. Dutta S, Singh B, Chessell L, Wilson J, Janes M, McDonald K, et al. Guidelines for feeding very low birth weight infants. *Nutrients*. 2015;7(1):423-42.
32. Kumar RK, Singhal A, Vaidya U, Banerjee S, Anwar F, Rao S. Optimizing nutrition in preterm low birth weight infants—consensus summary. *Frontiers in nutrition*. 2017;4:20.
33. Hay WW. Nutritional support strategies for the preterm infant in the neonatal intensive care unit. *Pediatric gastroenterology, hepatology & nutrition*. 2018;21(4):234-47.
34. Getahun BA, Mulatu S, Workie HM. Time to Reach Full Enteral Feeding and Its Predictors among Very Low Birth Weight Neonates Admitted in the Neonatal Intensive Care Unit: A Follow-Up Cohort Study. *Journal of Nutrition and Metabolism*. 2024;2024(1):9384734.
35. Terefe A, Demtse A, Abebe F, Mislou E, Tachbele E. Predictors of time to full enteral feeding in low birth weight neonates admitted to neonatal intensive care unit: a prospective follow up study. *BMC pediatrics*. 2024;24(1):64.
36. Rohit V, Vivek S, Minakshi B, Divyank P. Respiratory and Gastrointestinal Involvement in Birth Asphyxia. *Acad J Ped Neonatol*, 6 (4). 2018.
37. dos Santos Mezzacappa MAM, Collares EF. Gastric emptying in premature newborns with acute respiratory distress. *Journal of pediatric gastroenterology and nutrition*. 2005;40(3):339-44

Case report

Harlequin Ichthyosis in a new born in Rwanda: A Case Report

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Abstract

Harlequin Ichthyosis is a rare and most severe congenital disorder of the skin caused by a loss-of-function mutation of ABCA12 gene. Here, we presented a male neonate with hyperkeratotic, tight, armor-like skin separated by a deep erythematous fissure whose diagnosis of Harlequin Ichthyosis was made based on the typical clinical features. Supportive management for prevention of infection, prevention of dehydration and electrolyte imbalance was started for him but has died after seven days of hospital stay from respiratory failure. Lack of advanced neonatal care, absence of diagnostic facilities and lack of treatment options like systemic retinoids can be contributing factors to the high mortality of affected neonates.

Keywords : harlequin ichthyosis, ABCA12 gene mutation, case report, outcome, Rwanda

Introduction

Harlequin Ichthyosis (HI) is a rare autosomal recessive congenital ichthyosis caused by a loss-of-function mutation of the gene coding for Adenosine Triphosphate Binding Cassette Subfamily A member 12 (ABCA12), a transmembrane lipid transporter protein, believed to play a vital role in normal differentiation of keratinocytes, normal desquamation and barrier function of the skin (1). While a higher incidence of this condition is seen in cultures where consanguineous marriage is common, no racial or sex predilection has been identified so

far (2). Newborns with HI are covered with thick armor-like hyperkeratotic skin with deep erythematous fissures. Ears are flat and hypoplastic. Eyelids and lips are everted outwards while nasal bridges are depressed. The skin is tight which restricts movement of the chest; digits are ischemic due to overlying thick constricting skin (3). Here, we presented a case of a term neonate born with typical clinical features of Harlequin Ichthyosis who presented at a level 2 teaching hospital in Rwanda. To our knowledge, this is the first case report on HI in Rwanda.

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Case presentation

A one-hour old male neonate was transferred to neonatal unit after he was born to a 35-year-old para 5 mother delivered by caesarian section at gestational age of 38 weeks. Mother had seven uneventful antenatal care visits at the nearby health center but ultrasound was not done during the follow-up. She had not taken any traditional medication and has no known chronic medical illness. All family members including children are healthy and parents have no consanguineous marriage. The baby had a birth weight of 2840gm and an APGAR score of 5, 7 and 8 in the first, fifth and tenth minutes respectively.

On initial examination, the baby had dysmorphic features and difficult breathing having flaring of ala nasi and grunting. Temperature was 35.8°C which improved to 36.8°C by active rewarming, respiratory rate was 62 breaths per minutes and pulse rate was 150 beats per minutes; head circumference, length and weight were 34cm, 47cm and 2840gm respectively: anthropometric measurements are appropriate for gestational age. The body is symmetrical.

The infant's head was covered with hyperkeratotic skin with areas of dark hair interspersed with deep fissures. His ears were flat and rudimentary and the normal morphology of the pinnae was absent and covered with a thick skin. The face had a symmetrical outline but eye-

brows and eyelashes were absent. Eyelids were retracted and everted (ectropion). Eye balls were normal without corneal opacity. His nose was hypoplastic and nasal alae were underdeveloped. His lips were everted (eclabium), his mouth was open resembling a "fish-mouth" and making mouth closure difficult. (Figure 1 and 2). Tongue and oral mucosa were normal and pink in color.

Movement of the infant's chest during respiration was restricted but otherwise the chest was clear to auscultation and air entry was sufficient bilaterally. The heart sounds were normal with no murmur or gallop appreciated. Abdomen also had restricted movement but no abdominal wall defect noted and anal opening was patent. Penis was rudimentary, urethral opening was at the tip of the glans penis. Testes were not descended bilaterally (figure 3).

Skin was erythematous, thickened and hyperkeratotic resembling an armor with a deep fissure. The fissure was more pronounced on the head, chest, abdomen, proximal thigh and buttocks.

Extremities were grossly symmetrical in size, covered with a thick, erythematous and hyperkeratotic skin and have limited mobility. Palms and soles were devoid of crease, digits were hypoplastic and ischemic due to constriction band.



Figure 1: Rudimentary Hypoplastic Ears, Thick Hyperkeratotic Skin with Erythematous Fissures



Figure 2: Eclabium, Ectropion, Underdeveloped Nasal Bridge, Thick Hyperkeratotic Skin Constricting The Hypoplastic Digits



Figure 3: Erythematous Skin with Deep Fissures, Undescended Testis

Laboratory investigations were sent on admission after inserting an umbilical vein catheter and results showed no abnormalities. Genetic testing was not done.

The diagnosis of Harlequin Ichthyosis was based on the typical clinical findings of erythematous, hyperkeratotic thickened skin with deep fissures, ectropion and eclabium. The absence of asymmetry of face and limbs size, absence of blisters and absence of hair abnormalities helped us exclude other possible differential diagnosis like Netherton syndrome, congenital erythroepidermolytic ichthyosis, CHILD syndrome and chondroplasia punctata.

The neonate was started on intravenous antibiotics and fluids. He was kept in an incubator with a higher humidity. Skin care and dressing with a Vaseline gauze was initially performed daily. Topical Tretinoin was applied once daily starting from the fourth day but oral retinoid was not available. Nasogastric tube feeding with expressed breast milk was started after 24 hours of admission and escalated slowly until he tolerated 180ml/kg/day on the sixth day of life.

He was passing urine and no change in the amount of urine was noted as wet diapers were being changed up to five times per day.

The respiratory distress has not changed significantly until the sixth day of life. On the sixth day, the respiratory rate started to increase and reached above 70 breaths per minute but pulse rate and temperature were in the normal range for his age; level of consciousness had not changed from the baseline. On the seventh day of life, the respiration becomes progressively fast and shallow, and finally became apneic for which resuscitation was done but was not successful. He died of respiratory failure after seven days of hospital stay.

Discussion

Harlequin Ichthyosis is rare and the most severe form of autosomal recessive congenital Ichthyoses (3,4). The gene mutation responsible for HI is a functional null mutation of ABCA12 gene on the long arm of chromosome 2 which encodes for a transmembrane lipid transporter protein (5).

Consanguineous marriage and a family history of Harlequin Ichthyosis increase the risk of having a baby with HI (3). In our case, there is no consanguineous marriage or family history of congenital skin disorder.

The diagnosis of HI can be made based on the clinical findings at birth. Newborns with HI have thick armor-like, tight skin covered with a yellowish material separated by deep, erythematous fissures. They have hypoplastic or flat ears, hypoplastic nose with depressed nasal bridge, everted eyelids (ectropion) and everted lips (eclabium) (6). Fingers may be hypoplastic and ischemic due to obstruction of blood supply by the tight hyperkeratotic skin (6). Genetic testing and pathologic examination of the skin can also establish the diagnosis of HI after birth (6). Second and third trimester ultrasonographic evaluation may also show evidence for ectropion and eclabium, dysplastic ears, joint contracture, and echogenic amniotic fluid so called snowflake signs can be seen (7). Prenatal diagnosis can also be established by genetic analysis using Next Generation Sequencing (NGS) that can detect ABCA12 gene mutation (8).

The management of HI is primarily supportive, focusing on prevention and treatment of fluid and electrolyte disturbance, as well as other related complications. This requires a multidisciplinary team comprising of neonatologists, ophthalmologists, orthopedic surgeons, respiratory therapists, nutritionists and dermatologists (9).

Prevention and treatment of infection is one of the primary determinants of long term survival

in affected neonates (2). Additionally, skin care with application of petroleum jelly, fasciotomy and release of constriction rings, and adequate management of pain are vital (2).

Retinoids are the mainstay of therapy in HI to facilitate the desquamation of hyperkeratotic skin and improve the normal barrier function of the skin. Although systemic retinoids are the drug of choice to treat HI, topical retinoids can also be used as they may improve ectropion and joint contracture (10).

The majority of affected infants die in the first few weeks of life from infection, dehydration, electrolyte disturbance and/or respiratory failure. The common cause of respiratory failure in children with HI includes lower respiratory tract infection, pulmonary interstitial fibrosis and restricted chest movement from the thickened skin (6). In our case, the exact cause of respiratory failure is not established but possibly related to restricted chest movement and infection. With improved neonatal intensive care service, affected individuals can survive even to adulthood (6).

In our case of HI, lack of a well-equipped neonatal intensive care unit, lack of systemic retinoid, lack of genetic and pathologic testing to confirm the diagnosis were the major challenges faced. Additionally, ultrasonographic evaluation was not performed during pregnancy, which limited early diagnosis and preparation for delivery in a hospital setting with a well-equipped neonatal intensive care service.

Conclusion

HI is a very rare and severe form of autosomal recessive congenital ichthyosis caused by mutation of ABCA12 gene. Early diagnosis and management with a multidisciplinary team approach is critically important to improve the survival of affected neonates.

Informed consent

Written informed consent was obtained from the parents of the neonate to publish the information and image of the patient.

Conflict of interest

All authors have declared that there is no conflict of interest.

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Authors' Contribution

Patient management: Getachew Yilma Adimaw and Nkurunziza Boniface

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Manuscript crafting: Getacehw Yilma Adimaw

Manuscript revision: Nitsuh Addis Tiru and Rebecca Catherine Gerrity

All Authors have approved the final version of the manuscript.

References

1. Enjalbert F, Dewan P, Caley MP, Jones EM, Morse MA, Kelsell DP, et al. 3D model of harlequin ichthyosis reveals inflammatory therapeutic targets. *J Clin Invest.* 2020;130(9):4798–810. <https://doi.org/10.1172/JCI132987>
2. Tsivilika M, Kavvadas D, Karachrysafi S, Sioga A, Papamitsou T. Management of Harlequin Ichthyosis: A Brief Review of the Recent Literature. *Children.* 2022;9(6). doi:10.3390/children9060893.
3. Harlequin Ichthyosis - Symptoms, Causes, Treatment | NORD [Internet]. Available from: <https://rarediseases.org/rare-diseases/ichthyosis-harlequin-type/>
4. Oji V, Tadini G, Akiyama M, Blanchet Bardon C, Bodemer C, Bourrat E, et al. Revised nomenclature and classification of inherited ichthyoses: Results of the First Ichthyosis Consensus Conference in Sorze 2009. *J Am Acad Dermatol.* 2010;63(4):607–41. doi:10.1016/j.jaad.2009.11.020.
5. Thomas AC, Cullup T, Norgett EE, Hill T, Barton S, Dale BA, et al. ABCA12 is the major harlequin ichthyosis gene. *J Invest Dermatol [Internet].* 2006;126(11):2408–13. doi:10.1038/sj.jid.5700455.
6. Rajpopat S, Moss C, Mellerio J, Vahlquist A, Gånemo A, Hellstrom-Pigg M, et al. Harlequin ichthyosis: A review of clinical and molecular findings in 45 cases. Vol. 147, *Archives of Dermatology.* 2011. p. 681–6. doi: 10.1001/archdermatol.2011.9.
7. Nikbina M, Sayahi M. Harlequin ichthyosis newborn: A case report. *SAGE Open Med Case Reports.* 2022 Jan 1;10. doi:10.1177/2050313X221139610.

8. Spingler T, Wiechers C, Hoopmann M, Kagan KO. Prenatal diagnosis of a fetal harlequin ichthyosis. Vol. 309, Archives of Gynecology and Obstetrics. Springer Science and Business Media Deutschland GmbH; 2024. p. 1651–3. doi:10.1007/s00404-023-07164-9.
9. Turyasiima M, Mohamed DM, Yusuf HM, Nakalema G, Akot BG, Kyoshabire J, et al. Clinical Diagnosis and Management Challenges of Harlequin Ichthyosis in a Preterm Neonate: A Case Report From Uganda. Cuevas Covarrubias SA, editor. Case Rep Dermatol Med [Internet]. 2025 Jan 21;2025 (1). doi: 10.1155/crdm/7982066.
10. Zaenglein AL, Levy ML, Stefanko NS, Benjamin LT, Bruckner AL, Choate K, et al. Consensus recommendations for the use of retinoids in ichthyosis and other disorders of cornification in children and adolescents. *Pediatr Dermatol*. 2021 Jan 1;38(1):164–80. doi:10.1111/pde.14408.

Case Report

A case of Kawasaki disease refractory to initial intravenous immunoglobulin therapy linked to febrile seizures at Japanese Red Cross Maebashi Hospital, Japan

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Abstract

Febrile seizures (FS) and Kawasaki disease (KD) are both common pediatric conditions among the Asian population. However, FS rarely occur during KD, and the relationship between the two is unclear. Herein, we report the case of a 17-month-old boy of KD with FS. Despite low predictive risk scores for initial intravenous immunoglobulin (IVIG) therapy failure, none of which include seizures as a risk factor, initial IVIG failed to provide symptom relief, necessitating a second IVIG and intravenous prednisolone. In KD, FS may themselves contribute to IVIG resistance.

Keywords: Kawasaki disease; febrile seizure; intravenous immunoglobulin; prednisolone; coronary artery lesions

Introduction

Febrile seizure (FS) are convulsive events in children aged 6 months to 5 years, affecting 2–5% in Western countries and with higher incidence in Indian (5–10%), Japanese (6–9%), and Guamanian (14%) populations (1). Although FS are associated with a favorable neurological prognosis, they may increase the risk of subsequent epilepsy and Tourette syndrome (1). However, their pathogenesis remains unclear.

Kawasaki disease (KD), a common disease in Japanese and Asian children, is a systemic vasculitis syndrome of unknown etiology.

Coronary artery lesions (CALs) are its most serious complications; patients unresponsive to initial intravenous immunoglobulin (IVIG)—the gold-standard treatment—are at high risk of CALs (2). Neurological symptoms are rare in KD (3), and the association between KD and FS remains unclear.

Herein, we report a patient with KD and FS who was hospitalized at Japanese Red Cross Maebashi Hospital, Japan. Despite low predictive risk scores for initial IVIG resistance, including the Egami, Formosa, Kobayashi, Sano, and Son scores (Table 1) (2,4-8), the patient required multiple IVIG treatments

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for symptom alleviation. Notably, seizures are not included as risk factors in any of these five scores.

Table 1. Overview of the four predictive risk scores for resistance to initial intravenous immunoglobulin (IVIG) in Kawasaki disease.

	Points	Cutoff points	Sensitivity	Specificity
Egami (4)	2; ALT \geq 80 IU/L 1; age \leq 6 months 1; days of illness at initial treatment \leq 4 1; platelet count of $\leq 30 \times 10^{10}/L$ 1; CRP \geq 8 mg/dL	≥ 3	78%	76%
Formosa (5)	2; neutrophil percentage \geq 60% 1; albumin $<$ 3.5 g/dL 1; positive lymphadenopathy	≥ 3	91%	81%
Kobayashi (6)	2; days of illness at initial treatment \leq 4 2; neutrophil percentage \geq 80% 2; AST \geq 100 IU/L 2; sodium \leq 133 mmol/L 1; platelet count $\leq 30 \times 10^4/mm^3$ 1; CRP \geq 10 mg/dL 1; age \leq 12 months	≥ 4	86%	68%
Sano (7)	1; CRP \geq 7 mg/dL 1; total bilirubin \geq 0.9 mg/dL 1; AST \geq 200 IU/L	≥ 2	77%	86%

ALT, alanine transaminase; AST, aspartate aminotransferase; CRP, C-reactive protein.

Case presentation

The patient was a 17-month-old Japanese boy with no relevant medical or family history who was initially diagnosed with complex FS after experiencing two generalized tonic-clonic seizures that stopped spontaneously within 5 min on the second day of fever (day 2), without the administration of anticonvulsant medications. He was not taking any antipyretics. Because of

a cluster of convulsions, he was admitted to the hospital for observation. On day 7, he was diagnosed with KD based on the presence of five of the six principal symptoms compatible with complete KD (2). Microbial antigen tests, including adenovirus and streptococci, were negative. His symptoms, laboratory findings, and predictive risk scores for initial IVIG resistance are summarized in Table 2.

Table 2. Patient characteristics

Seizure	Two GTCs on Day 2
Main symptoms of KD	
Fever	Yes (from Day 1)
Conjunctivitis	No
Oral mucous membrane changes	Yes
Peripheral extremity changes	Yes
Polymorphous rash	Yes
Cervical lymphadenopathy	Yes
Diagnosis of KD	
Day 7	
Blood test result on Day 7 (when the diagnosis of KD was made)	
White blood cell count ($\times 10^4/\text{mm}^3$)	5,400
% neutrophils	56.5%
Platelet count ($\times 10^4/\text{mm}^3$)	20.3
Albumin (g/dL)	3.6
AST (IU/L)	41
ALT (IU/L)	17
Total Bilirubin (mg/dL)	0.3
Sodium (mmol/L)	138
CRP (mg/dL)	1.32
Egami score	1
Formosa score	1
Kobayashi score	1
Sano score	0
Initial treatment	IVIg 2 g/kg + ASA 30 mg/kg/day (started on Day 7)
Second IVIg	Yes (2 g/kg on day 9)
Additional intravenous PSL	Yes (started at 2 mg/kg/day on Day 9 and tapered off by Day 17)
Coronary artery lesion	No
Neurological sequelae of KD	No
Any other adverse events due to KD treatment	No

KD, Kawasaki disease; AST, aspartate aminotransferase; ALT, alanine transaminase; CRP, C-reactive protein; IVIG, intravenous immunoglobulin; PSL, prednisolone; GTCS, general tonic-clonic seizure; ASA, acetylsalicylic acid.

He was treated with IVIG (2 g/kg) and oral acetylsalicylic acid (ASA) (30 mg/kg/day); however, fever and other symptoms persisted. A second IVIG dose and intravenous prednisolone (PSL) (2 mg/kg/day) were administered on day 9. Subsequently, fever resolved

by day 10, and all the other symptoms disappeared by day 12. He had no recurrent seizures

or CALs. Despite receiving PSL therapy until day 17, he experienced no steroid-related adverse effects, such as hypoadrenocorticism, hyperglycemia, or obesity. The patient did not receive any antibiotic therapy, nor did he undergo head computed tomography, magnetic resonance imaging, or cerebrospinal fluid testing during the clinical course. As part of long-term follow-up for KD, he underwent regular medical examinations, electrocardiography, and echocardiography. Neither CALs nor recurrence of KD was observed at 2 years after disease onset. The patient's clinical course is chronologically summarized in Table 3.

Table 3. Chronological clinical course of the patient.

Day	BT (°C)	Symptom	Therapy	CA Z-score
1	38.2			
2	38.0	Two GTCSs Peripheral extremity changes (until day 11)	Admission	
7	39.7	Oral mucous membrane changes (until day 9) Polymorphous rash (until day 10) Cervical lymphadenopathy (until day 11)	First IVIG 2 g/kg ASA 30 mg/kg/day (until day 11)	RCA -0.56 LAD 0.36
9	38.1		Second IVIG 2 g/kg PSL 2 mg/kg/day (until day 11)	RCA -0.18 LAD 0.37
10	36.6			
12	36.5		ASA 5 mg/kg/day (until day 50) PSL 1 mg/kg/day (until day 14)	RCA -0.18 LAD -0.69
15	36.2		PSL 0.5 mg/kg/day (until day 17)	
17	35.9		Discharge	RCA 0.17 LAD 0.04

BT, body temperature; GTCS, generalized tonic-clonic seizure; IVIG, intravenous immunoglobulin; ASA, acetylsalicylic acid; PSL, prednisolone; CA, coronary artery; RCA, right coronary artery; LAD, left anterior descending artery.

No symptoms were observed after day 11.

Discussion

Neurological symptoms are relatively rare manifestations of KD. Liu et al. reported complication rates of 5.1% for neurological symptoms and 0.9% for seizures, noting no association between neurological symptoms and IVIG resistance (3). However, the relation between seizures and IVIG resistance remains unclear. Elevated levels of inflammatory cytokines can enhance neuronal excitability and trigger FS (9). Therefore, the risk of FS may also increase in KD, which is characterized by elevated blood levels of inflammatory cytokines; however, this hypothesis has not yet been validated. Our patient was classified as low risk by all five IVIG resistance scores (Egami, Formosa, Kobayashi, Sano, and Son) (4-8) and had no CAL risk factors based on the American Heart Association statement (2). Nevertheless, the patient was IVIG-resistant, requiring re-administration of IVIG. The addition of PSL to IVIG resulted in a favorable treatment course. IVIG is extremely costly, with a growing shortage of globulin products worldwide (10). If seizures are an independent predictor of IVIG resistance, concomitant steroid therapy during initial therapy for patients

with KD and seizures may be considered to avoid the increased medical costs and resource pressures associated with repeated IVIG administration. Importantly, although seizures may be risk factors for IVIG resistance, based on this report, they do not appear to predict worse long-term prognosis, as this patient recovered without developing sequelae.

This case has one major limitation. We could not rule out the possibility that the seizures developed as a manifestation of mild meningitis or encephalitis/encephalopathy complicated KD, as central nervous system imaging and cerebrospinal fluid testing were not performed. However, the absence of recurrent or prolonged neurological symptoms supported this decision, which is consistent with guidance from a previous review on FS management (9). Further studies of patients with KD and seizures are needed to clarify the pathogenesis of KD with seizures.

Declarations

Ethical consideration: The patient's parents provided informed consent for the publication of this study and the accompanying data.

Author contributions: TI, RS, and MS designed the study and prepared the manuscript for publication. KT and AM revised the manuscript. All the authors have read and approved the final version of the manuscript.

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References

1. Leung AK, Hon KL, Leung TN. Febrile seizures: an overview. *Drugs Context* 2018; 7:212536.
2. Jone P-N, Tremoulet A, Choueiter N, et al. Update on diagnosis and management of Kawasaki disease: a scientific statement from the American Heart Association. *Circulation* 2024; 150:e481-500.
3. Liu X, Zhou K, Hua Y, et al. Neurological involvement in Kawasaki disease: a retrospective study. *Pediatr Rheumatol Online J* 2020; 18:61.
4. Egami K, Muta H, Ishii M, et al. Prediction of resistance to intravenous immunoglobulin treatment in patients with Kawasaki disease. *J Pediatr* 2006; 149:237-40.
5. Lin MT, Chang CH, Sun LC, et al. Risk factors and derived formosa score for intravenous immunoglobulin unresponsiveness in Taiwanese children with Kawasaki disease. *J Formos Med Assoc* 2016; 115:350-5.
6. Kobayashi T, Inoue Y, Takeuchi K, et al. Prediction of intravenous immunoglobulin unresponsiveness in patients with Kawasaki disease. *Circulation* 2006; 113:2606-12.
7. Sano T, Kurotobi S, Matsuzaki K, et al. Prediction of non-responsiveness to standard high-dose gamma-globulin therapy in patients with acute Kawasaki disease before starting initial treatment. *Eur J Pediatr* 2007; 166:131-7.
8. Son MBF, Gauvreau K, Tremoulet AH, et al. Risk model development and validation for prediction of coronary artery aneurysms in Kawasaki disease in a North American population. *J Am Heart Assoc* 2019; 8:e011319.
9. Corsello A, Marangoni MB, Macchi M, et al. Febrile seizures: a systematic review of different guidelines. *Pediatr Neurol* 2024; 155:141-8.
10. Migowa A, Njeru CM, Were E, et al. Kawasaki disease in Kenya and review of the African literature. *Pediatr Rheumatol Online J* 2024; 22:43.

Perspective

The evolution of modern child healthcare in Ethiopia: A brief treatise

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“There can be no keener revelation of a society’s soul than the way in which it treats its children.” Nelson Mandela

Summary

Pediatrics is a relatively new medical specialty, which was first institutionalized in Europe and North America in the mid-19th century. It was delivered as part of the general medical service until the Ethio-Swedish Pediatric Clinic (ESPC) was established in Addis Ababa in 1959. Before that, child healthcare services were provided in the country in various pioneer general hospitals and lower-level health facilities. This continued after 1959, along with child healthcare services provided at maternal and child health clinics, and later in a few children-only facilities. The Ethio-Swedish Pediatric Clinic played a pivotal role in introducing and laying the foundation for the state-of-the-art services, training, and research in pediatric and child healthcare in Ethiopia.

The ESPC, along with the Children Nutrition Unit (later renamed the Ethiopian Nutrition Institute), is considered a historical landmark in the mapping of health and nutrition profiles of children in the country, and the initiation and development of pediatrics, including care for sick and malnourished children. Child healthcare services, training, and research continued to expand with the influx of Ethiopian pediatricians and nurses trained abroad, and the establishment of the Department of Pediatrics at the School of Medicine of Addis Ababa University, supplanting the ESPC. The increase in the number of institutions of higher education and public and private health facilities greatly contributed to the expansion of services to children in the country.

The pattern of diseases in children has remained similar to the pattern documented earlier (1959-1975), when pediatric services were initiated, although HIV/AIDS and Coronavirus Disease-2019 (COVID-19), have been major new developments. Common childhood illnesses have primarily included acute respiratory infections/pneumonia, diarrhea, fever, malaria, and malnutrition, which have been major contributors to the high child mortality and morbidity. Current reports show that Ethiopia has made major strides in reducing infant and childhood mortality. Under-five mortality has dropped from 202 to 67, and infant mortality from 129 to 64 per 1,000 live births, from 1990 to 2016, respectively.

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With the expansion of public and private pediatric teaching institutions and services in Addis Ababa and other parts of the country, scientific publications on maternal, newborn, and child health in Ethiopia have increased significantly, with a substantial portion published during the last decades. Progress in pediatrics and child healthcare led to the formation of the Ethiopian Pediatric Society in 1995, and the establishment of its organ, the Ethiopian Journal of Pediatrics and Child Health, in 2005. Though the country has made major strides in reducing child mortality, challenges remain, particularly in neonatal mortality, child malnutrition, and development.

Keywords: *Pediatrics, Modern Child healthcare, History, Ethiopia.*

Background

Pediatrics and Child Health:

The word “pediatrics” means “healer of children,” derived from two Greek words: (pais = child) and (iatros = doctor or healer) (1). Nils Rosen von Rosenstein (1706-1773) has been called “The Father of Pediatrics”, and his book *Diseases of Children, and Their Remedies*, London, 1776, is generally regarded to be the first modern textbook on the subject (2). The field is a relatively new medical specialty, developing only in the mid-19th century, led by Abraham Jacobi (1830–1919), who is known as the father of American pediatrics (3). Considering the history of medicine, pediatrics is relatively a recent discipline, and so are the institutions devoted to it. It became a medical specialty in the mid-nineteenth century. Before that time, children were cared for in general hospitals within general medicine, obstetrics, and midwifery services. It was in the 19th century when the pediatric hospitals, as we know them today, appeared in Europe (L'Hôpital Des Enfants-Malades, Paris, 1802) (4) and North America (Children's Hospital of Philadelphia,

1855) (5). The first department of pediatrics was established at Harvard University in 1888 by Dr. Thomas Morgan Rotch (6)

The historical evolution of childcare reflects diverse cultural beliefs and practices, impacting everything from hygiene practices and food preferences to perceptions of illness and healing. In ancient times, child healthcare was often rooted in cultural beliefs and practices, with many societies attributing illness to supernatural causes and relying on rituals, herbal remedies, and the guidance of shamans or healers, rather than scientific understanding. As far back as 400 BC, Hippocrates addressed pediatric concerns, including conditions like asthma, clubfoot, and mumps (7). Among the ancient Jewish population, hygiene, proper nutrition, and parenthood were highly esteemed. A large family was often viewed as a divine blessing. Similarly, Christianity emphasized the protection of the vulnerable by the strong and the care of the ill by the well, underlining the intrinsic value of children (8). Muslims have adopted and improved many practices, such as home-made

herbal and medicinal tonics, dietary restrictions, and amulets to ward off bad spirits (9).

Science and innovation have profoundly impacted child healthcare and the quality of their lives, albeit a variation in pace across time and space. As emphasized by Verma. M, et al. (10), child healthcare has benefited from innovation and evidence-based approaches, enhancing children's attainment of the maximum functional potential in their growth and development. This makes children distinct from adults, signifying and necessitating pediatric nursing, a specialized nursing profession that focuses on the medical care of infants, children, and adolescents from birth up to the age of 18. Underscoring this, Florence Nightingale in her seminal book "Notes on Nursing," wrote: "It is the real test of a nurse whether she can nurse a sick infant" (11). Inaugural pediatric nurses, such as Anna Haswell (1908), also stressed the special nursing services required for child health (6).

Country Context:

Ethiopia, a country in the horn of Africa, attained its current size of about 1.1 million km² around 1900 and then had an estimated population of about 9.6 million (12). The population steadily grew and, currently, Ethiopia is the second most populous country in Africa, next to Nigeria (13). Based on the Ethiopian Central Statistical Agency (CSA) 2007 census, the country's population was estimated at 74 million, and was projected to increase to about 109 million by July 2024 (the estimate by other

sources, viz. international organizations, was much higher, ranging from 120 million to 135 million), of which some 23% lived in urban areas, and about 45% were under 19 years of age (14,15). The population is diverse in ethnic groups, languages, settlement patterns, and culture. Over a century now, the country has faced significant challenges, including recurrent periods of drought and famine, epidemics/pandemics, internal conflicts, occupation (2023-2041 by Italy), and political instability, as well as ongoing issues with poverty, inequality, and human rights abuses.

Historically rooted in agriculture and trade, Ethiopia's economy has transitioned from a traditional, largely agrarian model to a more diversified economy with significant growth in recent decades, although challenges remain. Modern health services, in general, have developed in the country over six periods from 1500 to present: Period of introduction (1500-1900), period of Ethiopianization (1900-35), Italian occupation (1935-41), period of restoration and basic health services (1941-74), the primary health care period (1974-91), the sector wide approach period (1991-onwards) (16). These fairly distinct categorization of the period during which modern health services helps to understand the historical perspectives, the role of each level, the events antedating the current health system organization, and the pattern of governance of the system, as well as the evolution of modern child healthcare in Ethiopia.

As described by Pankhurst R. (17), though Ethiopia long had its system of medical lore, and a remarkably extensive local traditional pharmacopoeia, the people of the country were for centuries deeply interested in foreign medical practices of all kinds. The quest for modern medicine started during Emperor Lebna Dengel's reign in the 15th century, when the emperor appealed to the Portuguese king for physicians and surgeons to cure illnesses. The quest was no less apparent in the eighteenth century, at the time several early nineteenth-century European foreign travelers also acquired considerable reputations for their medical skills, justified or unjustified. Of note, the care given by the Scottish James Bruce in 1769 to children who suffered from severe smallpox epidemic at the Massawa port, Tigray, and the royal court in Gondar constituted a landmark event.

By the middle of the nineteenth century, some modern medicines were relatively well known and relatively much used in the country's more important towns, particularly in governing and related circles in Shoa and Tigray. The coming of modern medicine to Ethiopia advanced significantly further during the reign of Menelik, when foreign contacts, particularly with his early ties with Italians, expanded. Before and after the battle of Adwa in 1996, the Russian Red Cross missions, which duly set up Ethiopia's first hospital in Addis Ababa. The Italians, French, and British legations all added medicine to their diplomatic activity, providing

fringe benefits to the population.

Foreign medicine also began in the provinces at about the same time. In Harar, Ras Makonnen Hospital (Ethiopia's second provincial hospital) was initiated in 1901 with the support of French missionaries, entirely run by them. The Russian Hospital was closed in 1906, a serious blow to medicine in the country. In 1910, the first government hospital in Ethiopia, Menelik II Hospital, was established and staffed by Russian health personnel, and served as a training facility for auxiliary health personnel until the Italian invasion in 1936 (17).

During World War II, Ethiopian nurses came from a variety of countries. In 1939, Princess Tsehai, Emperor Selassie's daughter, completed her training and became the first nurse in Ethiopia. In 1945, Swedish medical and nursing personnel were recruited to alleviate the healthcare workforce in Ethiopia. In addition, the World Health Organization (WHO) "Field Mission" sent a physician and nurse to help organize "dresser" courses, or courses in auxiliary nursing (18). The Russian Red Cross Hospital, named after Dejazmatch Balcha, was founded in 1947. It was the first Russian multidisciplinary medical institution in Africa, and provided medical care to Ethiopians for nearly 80 years.

There was no enunciated health policy in Ethiopia before the 1950s, since when the need for preventative and curative services through a network of hospitals, health centers,

and health stations was recognized (16). A comprehensive Health Services Policy was adopted at the end of the Imperial period, facilitated by the World Health Organization, but its implementation was thwarted by the regime change that took place in the early 1970s. In the mid-1970s, Ethiopia's health policy shifted towards disease prevention and control, rural health services, and community involvement, paving the way for the adoption of the Primary Health Care (PHC) strategy. The policy, which has remained in place since 1991, capitalizes on decentralization, regional empowerment, and the needs of less-privileged rural communities (19). The private and other non-governmental sectors, along with international collaboration, are encouraged, as are institutional capacity building and the promotion of self-reliance. Healthcare facilities (both public and private), human resources for health, and health research, including for children, expanded progressively over the last 75 years.

Aim of the Article

The history of modern institutionalized child healthcare and pediatric specialization in Ethiopia, in essence, begins with the opening of the first children's hospital (1959) and continues through the founding of the Ethiopian Pediatric Society (1995), the publication of the Ethiopian Journal of Pediatrics and Child Health by the Society (2005), and up to the present. Ethiopian traditional medicine is highly complex and diverse, varying significantly among different ethnic groups, which requires detailed cover-

age. However, due to its complexity, it is beyond the scope of this article. This piece provides a brief historical overview, highlighting the key milestones that have led to the development and growth of child healthcare services and pediatric specialties in Ethiopia.

Modern Child Healthcare in Ethiopia

During the Italian occupation (1935-1941), the Italians had a pediatric center named after Graziani's mother (Amelia Clemente Graziani), which primarily catered to Italian children, but also treated 'natives' with trachoma (20). The prevention and treatment of diseases in children was not a specialized discipline in Ethiopia until 1957, but was integrated into the general health services in the country (21). There was one outpatient department in Addis Ababa, catering to about fifty children daily. However, training in pediatrics and childcare was provided at the five nursing schools across the country and at the Public Health College and Training Center (PHC&TC) in Gondar, Northwest Ethiopia, which was part of Haile Selassie I University. PHC&TC was training health officers, nurses, and sanitarians, who were deployed in teams to staff health centers throughout the country, with a primary focus on preventing diseases in children and safeguarding maternal and child health as one of their major roles and responsibilities.

Gondar Public Health College and Training Center

During their five-year occupation of Ethiopia, the Italians built two hospitals, one clinic for emergency cases, and one recovery center in the city of Gondar. One of the hospitals was “blacks only” and was located at ‘Samuna Ber’, and the other was a “whites only” hospital in Qusquam (Che Che la) (22). In the immediate post-invasion period and for some time after, the former was looted and got dilapidated over time, and the Qusquam hospital remained the only medical service center providing midwifery and healthcare for adults and children, though the services were overburdened and remained inadequate.

The Adababay Iyasus clinic was opened for emergency purposes in 1939, which was located at the center of the city, in the former Italian commissariat building (western corner of ‘Fasil Gimb’, or “Fasilladas Castle”). In 1944, Che Che la hospital, with limited hospital facilities, was transferred to the hands of Ethiopians. It was overwhelmed with the then-rampant diseases, including “fibre correntee” (relapsing fever), typhoid fever, rabies, meningitis, malaria, and typhus epidemics. A study conducted in the region in the early 50’s indicated that 45% of children above the age of six months suffered malnutrition, 85% had malnutrition, and over 60% had trachoma (23).

Despite the enormous health problems in the forties and early fifties, Gondar and the rest of the country had no medical doctors. All 80

physicians existing in the country were foreigners. This was partly the impetus for establishing the Public Health College and Training Center (PHC and TC) in Gondar. The Adababay Iyasus and Charqos clinics (established later) were staffed with personnel supplied by the college, who provided maternal and child health care services in addition to the free midwifery services in the city. Outside the city, two other rural health centers were opened at Qolla Diba and Dabat sometime in 1950. The Schools of Nursing and the PHC& TC were established in Gondar in 1954, and taught pediatrics as an important subject. Yet, healthcare services in the city failed to match the increase in population.

During the military rule regimes, the name PHC& TC was changed to Gondar Medical School, and the multi-disciplinary training program was revived in 1972. It subsequently changed to Gondar College of Medical Sciences, until 2003 when the college/medical school became part of the so-called Amhara Regional University (Figure 1), which comprised the Bahir Dar Polytechnic Institute and the Pedagogical Academy. Meanwhile, waterborne diseases, malaria, and above all, AIDS were taking their toll upon the city’s population. Either unable to afford paying for medicine, which is getting expensive and unavailable, or because of losing hope in modern medicine, people increasingly turned to traditional medicine and “healers.”



Figure 1. University of Gondar (Amhara Regional University)

Ethio-Swedish Collaboration Projects in Health

As part of the Swedish Agency for International Assistance projects in Ethiopia, three projects in the field of health—the ESPC, the Health Centers Project, and the Children’s Nutrition Unit—were agreed and initiated as part of the general plan of Ethiopia’s Ministry of Health in 1957. The country at the time was an empire with a total population

(including Eritrea) of 20.9 million (24).

Ethio-Swedish Pediatric Clinic:

By the time ESPC, the first project, was planned, there was no facility specifically dedicated to providing pediatric service or training anywhere in the country. Such a service was introduced in Addis Ababa in 1957, when the country’s first facility for children,

ESPC, was initiated through a collaboration between the Ethiopian Government and the Swedish International Development Cooperation Agency (SIDA) (25). ESPC was inaugurated in

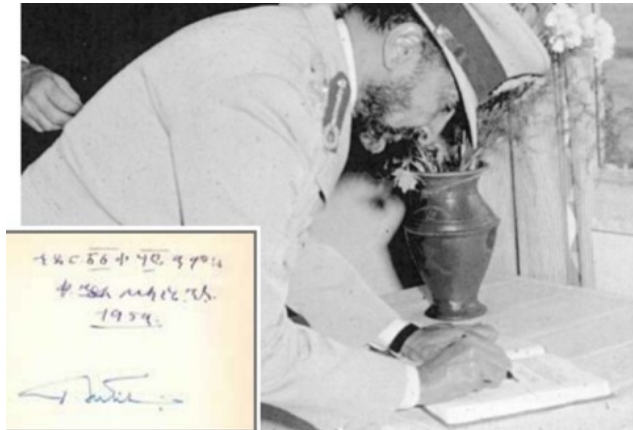


Figure 2. Emperor Haile Selassie and signing guestbook at the event of the ESPC on December 2, 1959

1959 within the premises of the former Princess Tsehai Hospital by Emperor Haile Selassie in the presence of Prince Bertil, representing the Swedish Government (Figures 2 and 3).



Figure 3. Emperor Haile Selassie and Prince Bertil being introduced to staff by Professor Mannheimer

Adopted from Hofvander Y (25)

ESPC Inaugural Speech of Emperor Haile Selassie. Dec. 2, 1959: On this day, when we inaugurate the ESPC, it is a source of great pleasure to find in our midst His Royal Highness Prince Bertil, Duke of Halland, who has made a long and arduous journey to be among us on this memorable occasion. This clinic is devoted to the preservation and protection of the health and well-being of infants and young children — those too young, too frail to help themselves. Our Lord Jesus Christ said, “Suffer the little children to come unto me,” and surely no endeavor of mankind’s can more confidently count upon the benevolent blessing of Our Father in Heaven than that which has found expression in this building

and the purposes to which it is dedicated Our concern for all of our people, and particularly for the young and those in need, has found expression in the educational and public health programs which We have inaugurated throughout Our Empire. We have not failed to note, during the few months which it has been in operation, the praiseworthy results already achieved, and We are pleased to inaugurate it as a distinguished addition to the health facilities of Our nation.”

The clinic was initiated by a Swedish pediatrician, Professor Edgar Mannheimer, who was recruited as head of the mission. He was a famous pediatric cardiologist who edited

several books on child behavior. He was the first director of the ESPC, 1958–1965. In Figure 4, he was with Margit Phillis, an efficient and well-reputed nurse and matron. Professor

Mannheimer died in a car accident while he was on a visit to Uganda, laid to rest at the cemetery in Gulele, Addis Ababa.



Figure 4. Professor Edgar Mannheimer with Matron, Margit Phillis. Adopted from Hofvander Y. (25)

The ESPC, along with the Ethiopian Nutrition Institute (ENI) established in 1962, was a historical landmark in the initiation of an organized institutional care for sick and malnourished children and the mapping of the health and nutrition profiles of children in the country. The design of the ESPC was modeled after the pediatric department of Eskilstuna county hospital, Sweden, with two wards and an outpatient department aimed at taking care of 10–15 outpatients daily but shortly it increased to more than 100 patients daily. The 45-bed hospital was inaugurated in 1959 and was expanded to 100 bed capaci-

ty in 1966, partly to accommodate the teaching-learning needs of students from the Faculty of Medicine, in the then Haile Selassie I University (HSIU) (26).

The ESPC treatment portfolio covered diseases rampant among children, including malnutrition. In its early days, ESPC conducted rounds (Figure 5) followed by hectic consultation sessions in the mornings. It had a large outpatient department (OPD) managing about 13,000 new patients and 70,000 patient visits annually.



Figure 5. In-patient round/care at ESPC

Child welfare services at the OPD included supervision of healthy babies, vaccinations, advice regarding feeding, health education, and curative services. Its social units advised and supported children with socio-economic problems, placing orphans in families and children's homes, and created opportunities for children to play (Figure 6). Ethiopian and Swedish nurses working in pairs made a first screening of the severity of the child's conditions in the OPD.

Much effort was devoted to instructing the parents about the danger of the commonly practiced traditional operations – cutting of the uvula, extraction of the canine teeth, circumcision of both boys and girls, and burning of the skin over the abdomen, the chest, around the eyes and ears, if aching or being inflamed. The parents usually did not stay with their children, as was the custom these days, but came on visiting

hours. There was often a problem in convincing the parents to have the children stay long enough to complete their treatment, e.g., TB cases. Oftentimes the sick children were taken home too early. The first five years, decrease in spite of very competent staff and good resources. the mortality among in-patients only slowly decreased from a high level of about 23%.

In the 1960s, the Lideta Maternal and Child Health Center (Lideta MCH Clinic) was established not far from ESPC with funding from the Swedish branch of Save the Children, led by pediatrician Dr. Ulla Larsson. This clinic provided services that improved child health and nutrition in Addis Ababa attracting large numbers of expecting mothers and pre-school children to the facility.



Figure 6. Children playing outside the Tsehai Hospital (left), ESPC (center) and ENI (right). Adopted from Hofvander Y.

Based on a model from Kampala, Uganda, ESPC started an outdoor child health center in 1960/61. It was intended for small children under three years of age and their mothers with who were gathered in school yards in the vicin-

ity of their homes, get examined and treated for minor illnesses, and vaccinated (BCG, Triple, smallpox) under a tree, hence, the name “Under three under tree” session (Figure 7).



Figure 7. “Under three under tree” health education. Adopted from Hofvander Y. (25)

In addition, a week’s ration of about 300 grams of Dried Skim Milk (DSM) was distributed (Figure 8) to the attendants, which enhanced their participation in the vaccination program and health talks. However, its benefits remained

unascertained, and in about a year, United Nations Children’s Fund (UNICEF) stopped the supplies, and the program was terminated (27).



Figure 8. Distribution of DSM– the final “post” in the “under tree under three” session. Adopted from Hofvander Y. (25)

Five Ethiopian nurses had been trained at the Swedish Red Cross nursing school in Stockholm for 2–3 years “postgraduate” training (25). Training of pediatric nurses (Figure 9)

was not initiated along with the training of pediatricians training until 2012 under school of nursing at AAU, and neonatal nurses in 2018.



Figure 9. A trained nurse providing neonatal care. Adopted from Hofvander Y. (25)

ESPC taught pediatrics for three months to nurse students from Addis Ababa’s three schools of nursing, Taffari Makonnen Hospital in Wollega Province. The teaching consisted of lectures, bedside teaching, and visits to institutions related to social pediatrics. In addition, health officers, community nurses, and dressers from the School of Social Work and many other institutions were trained at ESPC. Later, when the School of Medicine started, it became the center for pediatrics education for AAU.

Of great importance in this process was undoubtedly the influx of newly graduated doctors from the American University in Beirut, and of well-trained Ethiopian nurses from the Red Cross School of Nursing in Stockholm. In 1966, a Department of Pediatrics was created in the Faculty of Medicine, AAU. Professor Yngve Larsson, who was the director of ESPC follow-

ing Professor Edgar Mannheimer organized the pediatric training and designed its content, making it applicable to the health and disease situation in the country, and also for setting the standard based on international references.

The first and longest-serving Ethiopian Director of ESCH (1973-83) was Prof. Demissie Habte (Figure 10). He completed his undergraduate medical education at the American University of Beirut, and his pediatrics training at the New York Hospital, Cornell Medical Center. He served as a clinician and the first Ethiopian director of ESPC, chairman of the DPCH, and Dean of the Faculty of Medicine. He also directed the WHO Diarrhoea Training center, and established collaborations between DPCH/ Faculty and international organization, strengthening training research, and services.



Figure 10. Professor Demissie Habte examining a child at ESPC

ESPC provided services coupled with training, education, and research, but this was an era when the application of evaluation, statistics, and research just began. However, during the period 1959–1973, some data at the ESPC were analyzed, and no less than fifty-nine articles were published, 42 of which were published in the Ethiopian Medical Journal (EMJ) 25). An

illustrative case showing the types of illnesses seen at the OPD is given in Table 1, and cases admitted and managed as inpatients in Table 2. Nearly two-thirds of patients seen at the OPD were cases with gastroenteritis and respiratory diseases, while gastroenteritis, respiratory diseases, nutritional deficiency, and accidental injuries constituted most of the in-patients.

Table 1. Disease in children seen at ESPC OPD, 1961

Disease	Number	Percent
Respiratory disease	4,048	39.9
Gastroenteritis	2,317	22.8
Skin disease	608	5.9
Eye disease	535	5.3
Ear disease	361	3.5
Parasitic disease	284	2.8
Whooping cough	120	1.1
Measles	43	0.4

Table 2. Disease by age in children at in-patients at ESPC IPD, 1961*

Disease	Age						Total	% Mortality
	0-6 mos	7-12 mos	1-2 yrs	2-3 yrs	3-4 yrs	>4 yrs		
Gastroenteritis	94	31	16	4	2	2	149	31.5
Respiratory	48	40	26	9	5	14	141	34.8
Deficiency	12	11	25	15	3	9	66	33.3
Accidents	13	13	5	10	7	10	58	15.3
Meningitis	12	13	6	4	2	8	45	46.7
Tuberculosis	0	5	3	6	1	16	31	29.0
Infectious	17	0	4	4	4	13	38	28.9
Prematurity	41	0	0	0	0	0	41	58.5
Other	39	12	11	10	11	55	138	13.0

In the 1970s, for over 50 million people, there were fewer than five Ethiopian pediatricians. As of 1975, the SIDA support to ESPC ended, and the Swedes left the country. The relationship between Ethiopia and Sweden underpinned much of the progress seen then pediatrics and child health dwindled. AAU then had a severe shortage of teaching staff. Prof Demissie Habte, Prof. Nebiat Tafari, Dr. Tekletsion Woldemariam and Dr. Belay Giorgis from the Armed Forces Hospital shouldered both the clinical work,

teaching activities, and research.

In 1974-1975, the whole ESPC was moved to the Tikur Anbessa Specialized Hospital (TASH) (Figure 11) along with other departments in Princess Tsehai Memorial Hospital. The ESPC was mainly housed on the seventh floor of TASH, with a ward on the 6th floor dedicated to newborn care. When the DPCH at the School of Medicine supplanted ESPC at TASH, the AAU became center for pediatrics training and education.



Figure 11. Street view of Tikur Anbessa Hospital, ESPC and then DPCH on the 7th Floor

To address the shortage of academic staff, the AAU launched postgraduate programs in various fields, including clinical medicine. The DPCH enrolled the first batch of postgraduate students in 1979. Dr Hagos Beyene and Dr. Efreem Alemayehu were the first Pediatric specialists who graduated in 1982. In the ensuing years, the pediatric graduate program progressively expanded. The number of graduates, academic staff, and research activities has substantially increased. Currently, 22 medical schools run residency programs in pediatrics in Ethiopia. As a result, numerous studies were conducted, and the results published, mainly in the EMJ. Between 1975 and 2009, about 200 articles were published, most of them in the EMJ (25). The studies served as a basis for improving the quality of medical education and enhancing the development of the faculty.

Pediatric education, research, and services were further strengthened with sub-specialty training at the AAU and other universities in major regions of the country. The first pediatric surgeon was Dr. Girma Melaku, who was trained in the United Kingdom and assisted in the training of other pediatric surgeons. In 2009, the Fellowship Program in cardiology was launched at AAU in collaboration with the Children's Heart Fund of Ethiopia. In the following year, a fellowship in hemato-oncology was started in collaboration with Aslan, an American organization linked to George Town University, and two radiologists were trained in pediatric radiology, in collaboration with the Children's Hospital of Philadelph-

ia, USA, with support from Professor Kassa Darge. In collaboration with the University of Toronto, Canada, a staff was trained in child and adolescent psychiatry.

Ethio-Swedish Health Center Project:

The Ethio-Swedish Health Center Project (ESHCP) was a public health initiative that had its headquarters at the ESPC, sharing a common director. The project aimed to support the construction of health centers and health stations in two of the 13 provinces of the country, and establish public health departments as well as provide supervision to all health facilities in the two provinces. The project also assisted in decentralizing health services to the rural areas. Pediatrics constituted an important service area and primarily focused on preventive activities.

Children's Nutrition Unit:

The Children's Nutrition Unit (CNU) was founded in 1962 as the third component of the joint Ethio-Swedish project. The unit functioned under the Ministry of Health with support staffing and financial support from SIDA. Its activities mainly include the collection of food samples from foods eaten by children in both urban and rural areas, and analyzing the food components. Nutritional status was assessed for groups of and supplementary plans were developed based on assessment results and implemented. Many scientific investigations were made and published in the "CNU series." Examples of this are a study on the effects of the iron overload in the tef diet,

comparison between privileged and non-privileged children concerning their growth, effects on the brain growth of severe malnutrition, the prevalence of iodine deficiency, et cetera.

It became the Ethiopian Nutrition Unit (ENI) in 1968, when the Ethiopian Government took over responsibility for and increased the scope of the nutrition program to include pregnant and lactating women, school-age children, and other

adult groups. It carried out nutrition and food science-related research and interventions, as well as providing nutrition training and laboratory services to the public, universities, and other organizations. This was realized by specialist teams working on medical nutrition, community nutrition, food production, training, and information, and through its well-equipped Food Science and Nutrition laboratories.

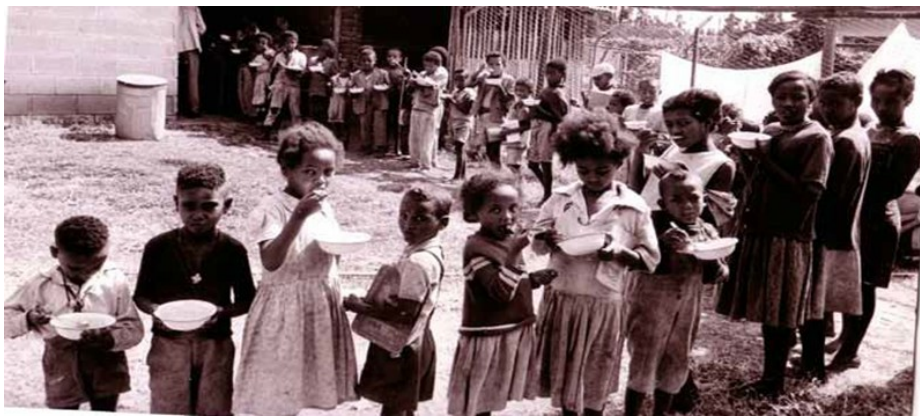


Figure 11. FAFFA School lunch in Ijaji, Chelia. Oromia Adopted from Hofvander Y (22).

ENI's nutrition program involved a wide range of research into causes and mitigation of malnutrition as well as development of supplementary feeding for children. The Institute developed nutritious porridge, "FAFFA" ("grow strong and healthy") based on locally available ingredients, which became a nation-wide success in feeding needy school children (Figure 11) and is still produced today and particularly for use in famines and in times of disaster.

Child Healthcare in Other Pioneer Facilities

Birla at Yekatit 12 Hospital, Addis Ababa:

In 1969, pediatric service was opened in a separate building on the compound of Yekatit 12 Hospital, which was built with the support of the

Indian community in Addis Ababa. It was named Birla after the Indian philanthropist who took the initiative for the construction of a separate building for pediatric and child health services. Birla was inaugurated in the presence of Emperor Haile Sellasie, who made the opening speech at the ceremony. This pediatric service was also supported by staff deployed from ESPC until the Yekatit 12 hospital established a medical college (Figure 12). In addition, Armed Forces and Police hospitals delivered pediatric services. Later when private practice was allowed more private centers sprout in the country staffed by graduates from the AAU, Faculty of Medicine residency program.



Figure 12. Nurses providing pediatric care at Birla

Dessie Children Hospital, Dessie:

Dessie Children Hospital was established by Dr. Tamrat Retta late in 1970s in Dessie Town, Wollo Province. Later on, it was taken over by the MoH. This hospital was supported by physicians and nurses assigned from the ESPC for a few years with Dr. Tamirat to establish the hospital based on the ESPC model.

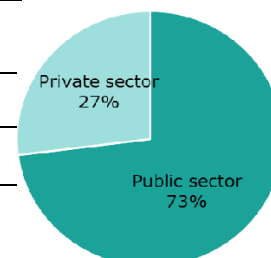
Public and Private Pediatric Facilities and Services Expansion, 1975-2024

Over the last five decades, Ethiopia's health services have evolved significantly, with a focus on expanding access to healthcare, particularly in rural areas, through initiatives like the Health Service Extension Program (HSEP) (28) and the

Health Sector Development Program (HSDP) (29). The country has a three-tier healthcare delivery system with public hospitals, health centers, and health posts, which has steadily expanded over the years (30). The private health sector catering for children is relatively small and fragmented (approximately 20% of total market share), serving mostly the high- and middle-income groups in large urban areas (31). The health infrastructure, both public and private, is distributed unequally and is concentrated in the most populous and urban areas. The total number of public and private facilities by level as of 2017 is shown in Table 3.

Table 3. Number of health facilities by level and ownership (2016/17)

Facility level	Public	Private	Subtotal	% Private
Hospitals (including specialty and referral)	302	62	364	17
Specialty centers/Specialty clinics	0	867	967	100
Health Centers/Medium clinics	3,724	1,308	5,032	26
Health posts/primary and lower clinics	17,187	5,401	22,588	24
Subtotal	20,598	7,638	28,236	27



Source of public data: NOH- Health Indicators Data 2016/17 functional facilities

Source for private data: Private specialty center and clinics

Ethiopian Private Health Facilities Owners Association 2017. Data for health centers and posts are from MOH Health Indicators report 2016/17.

The most recent data available from the MOH HRH in 2023/24 indicate that the private sector operates and manages nearly half of all medical training institutions and plays an important role in producing nurses, midwives and allied health professionals (Table 4).

Ethiopia has made major strides in reducing the infant and childhood mortality rates. Indeed,

Ethiopia has achieved its Millennium Development Goal (MDG) to reduce the mortality rate for children under the age of five (Table 6). Under-five mortality dropped from 202 in 1990 to 67 with 5% annual rate of reduction, and infant mortality from 129 to 64 per 1,000 live births (32).

Table 6. Trends in Childhood Mortality (1990 to 2015)

Rate (per 1,000 live births/year)	1900	1995	2000	2005	2010	2016
Neonatal mortality (<1 mos)	63	68	49	39	37	29
Post-neonatal mortality (2-12 mos)	70	62	48	38	22	19
Infant mortality (Birth-1 year)	129	111	97	77	59	48
Child mortality (1-5 years)	96	94	77	59	31	20
Under-five mortality (Birth-5 years)	202	172	166	123	88	67

Sources: EDHS 2016

The disease pattern has remained basically as it was during the preceding period (1959-1975), although HIV/AIDS, COVID-19, and different types of cancer have been new developments. Common childhood illnesses in-

clude acute respiratory infections, diarrhea, fever, pneumonia, malaria, and malnutrition, which are major contributors to high under-five mortality rates (33,34). With the expansion of public and private pediatric teaching

institutions and services in Addis Ababa and the rest of the country since 1975, publications on maternal, newborn, and child health (MNCH) in Ethiopia have increased significantly, with a substantial portion published within the last decades (35). Major issues covered included infectious diseases, malnutrition, maternal and child health, and the impact of social determinants on child health, with a particular focus on areas like immunization, neonatal care, and adolescent health. Groundbreaking research outputs were produced, and with the pediatric residency program expanding, more research was done at the DPCH, AAU, and in most medical schools in the country. Some of the publications contributed to child health programs globally, including programs on neonatal health, diarrheal and respiratory diseases, Integrated Management of Neonatal and Childhood Illness (IMCI), possible serious bacterial infections (PSBI), and more. A summary of publication categories is given in Table 3, Section V below.

The Ethiopian Pediatric Society

Ethiopian Pediatric Society (EPS) is a voluntary professional association established in 1995, representing pediatricians, pediatric subspecialists, pediatrics residents, and other people who work with and care for children (36). The EPS was established through the leadership and initiative taken by Professor Sileshi Lulseged, and the draft constitution was drafted in consultation with Dr. Azeb Tamrat, pediatrician and the then State Minister of Health, and other senior pediatricians at the Department of Pediatrics and

Child Health of the College of Health Sciences, Addis Ababa University. Dr. Abubaker Bedri served as the first president of EPS, and the Society was re-registered with the Ethiopian Charities and Society Agency (CSA) on April 24, 2013, as an Ethiopian Resident Charity Non-Governmental Organization, based on the government's new regulation (37).

EPS is a member of the Union of All African Pediatric Societies and Associations (UNAPSA) since 1995 and a member of the International Pediatric Society (IPA) since 1996. As a national association/ society of pediatricians, EPS has worked together with governmental and non-governmental organizations on children and youth by nurturing excellence in healthcare, advocacy, education, research, and support of its members (38). The EPS played an advisory role in the planning and implementation of policies and regulations related to child health, which are anchored in contemporary knowledge and evidence. Spanning over the last three decades, the society has been active in bringing members under its umbrella and organizing and providing sessions on continued medical education and workshops relevant to children and youth in Ethiopia. It has worked closely with Ethiopia's Ministry of Health and other national and international stakeholders. Its membership has increased progressively over the years, and, currently, it has 250 paid-up members and six regional chapter offices.

Society has played key roles in promoting research in pediatrics and child health, and fostering and enhancing professional development for its members through continued medical education and workshops relevant to the health and well-being of children.

Among its major core mission, EPS established the Ethiopia Journal of Pediatrics and Child Health in 2005, and published and disseminated research outputs to its members and other stakeholders in Ethiopia and beyond. A working group of pediatricians led by Professor Sileshi Lulseged drafted the bylaw governing the relationship between the Journal and its parent association based on the EPS constitution (36). The bylaw was endorsed by the EPS General Assembly at its second annual meeting in 1996.

The first editorial Board of EJPCH consisted of Professor Amha Mekasha (Editor-in-Chief), Dr. Abubaker Bedri, Dr. Tilahun Teka, Dr. Tesfaye Tessema, and Dr. Abebe Gebremariam, who led the journal during its early and formative years.

The Journal published one issue per year until 2016 and two issues per year from 2016 onwards (39). Over the two decades of its lifetime, EJPCH published 185 articles in 24 issues in 19 volumes. Of the articles published in EJPCH, two-thirds were on HIV, TB/respiratory diseases, and neurologic/mental health, asthma/other respiratory cardiovascular, and renal diseases constituted three-quarters of non-communicable diseases published (Table 3).

Table 3. Disease categories in EJPCH publications (2005-2024)*.

Topic	Number*	Percent
Neonatal problems	37	1.4 [‡]
Infectious diseases		
HIV and other STDs	14	34.1
Vaccine preventable diseases	7	17.1
TB and other respiratory diseases	7	17.1
Malaria	3	7.3
Parasitic infections	3	7.3
Other infections	7	17.1
Total	41	100
Non-communicable diseases		
Neurological & mental health	11	20.4
Asthma and other respiratory	10	18.5
Cardiovascular diseases	10	18.5
Renal and urinary diseases	9	16.6
Neoplastic diseases	7	13
Diabetes and other endocrine	3	5.6
Gastrointestinal disorders	3	5.6
Anemia and other hematologic diseases	1	1.8
Total	54	100
Other conditions		
Health systems research	22	53.7
Nutrition/Malnutrition	10	24.4
Ophthalmic/dental/ENT	3	7.3
Ped Surgical problems	2	4.9
Community-based surveys	2	4.9
Growth and development	1	2.4
Violence against children	1	2.4
Total	41	100

* Adopted From History of EJPCH (25)

** Does not include topics covered by the 22 editorials, while the editorials were counted and included in the published articles.

[‡]N=173 - neonatal problems [37 (21.4%), infectious diseases 42 (23.7%), non-communicable diseases 54 (31.2%), other conditions 41 (23.7%)

Challenges and Prospects

Ethiopia faces significant challenges in child health with a high infant mortality rate and common health concerns like lower respiratory infections and diarrheal diseases (40). Malnutrition, including stunting, underweight, and wasting, remains a significant problem, affecting a substantial portion of children under five. Infections, including diarrhea, fever, and pneumonia, are major causes of morbidity and mortality in children. In recent years, the country has been through several challenges, including COVID-19, conflict, internal displacement, and other public health emergencies like cholera and malaria epidemics. The country faces significant challenges in human resources for health, including shortages of skilled personnel, uneven distribution, and high attrition rates, particularly in rural areas, impacting access to healthcare and health outcomes (41). Geographic, economic, and gender inequities remain significant barriers to reducing mortality among children under five (42).

Though the country has made significant strides in reducing under-five mortality, challenges remain, particularly in neonatal mortality and child malnutrition. More emphasis needs to be made on early childhood development, integrated management of newborn and child illnesses, and community-based interventions. The Health National Adaptation Plan (43), and the National Early Childhood Development and Education Policy Framework (44) support the nurture and development of children and stipulate the necessary care and protection for children from social,

economic, and political problems, and specific care, support and rehabilitation services for children in difficult situations. The National Newborn and Child Survival Strategy, which is part of the Health Sector Transformation Plan (HSTP) (45) aims to reduce under-five and infant mortality rates.

In addition, though child health nursing has improved in the last few decades, many advancements are needed to enhance and uplift the standards of pediatric nursing in Ethiopia by strengthening pediatric nursing specialty program, enhancing nurses' career advancement and recognition as well their remuneration, increasing the nurse-patient ratio and creation of multidisciplinary and intersectoral research forums with the active involvement of pediatric nurse specialists. As we move forward, these and related policies and strategies in place are instrumental in strengthening and improving pediatric and child healthcare in Ethiopia.

References

1. Wikipedia. Pediatrics. Available from: <https://en.wikipedia.org/wiki/Pediatrics>).
2. Dallas J. The Sibbald Library. Classics of Child Care. Available from <https://web.archive.org/web/20110727192812/http://www.rcpe.ac.uk/library/exhibitions/child-care/>.
3. B. Lee Ligon-Borden. Abraham Jacobi, MD: father of American pediatrics and advocate for children's health. *Sem Pediatr Infect Dis.* 2003;14(3): 245-249.

4. L'Hôpital Des Enfants-Malades, the world's first children's hospital, founded in Paris in 1802. *Pediatrics*. 1981;67(5):670. PMID: 7019843.
5. Ferrero F. El hospital de niños más antiguo de América [The oldest children's hospital in the Americas]. *Rev Fac Cien Med Univ Nac Cordoba*. 2012;69(3):133-4. Spanish. PMID: 23286573.
6. Late-Nineteenth and Early-Twentieth Century Pediatrics. *Penn. Nursing*. Available from: <https://www.nursing.upenn.edu/nhhc/home-care/late-nineteenth-and-early-century-pediatrics/>.
7. Smith, Yolanda. (2019, March 25). A Brief History of Pediatrics. Retrieved on September 06, 2023 from <https://www.news-medical.net/health/A-Brief-History-of-Pediatrics.aspx> [Crossref][PubMed] [Google Scholar].
8. Gill DW. Theology of Care for the Vulnerable, Ch 7 in *Women, HIV, & the Church: In Search of Refuge* ed Arthur J. Ammann & Julie Ponsford Holland Wipf and Stock Publishers, 2012. chrome-extension://efaidnbnmnnibpcajpcglcfindmkaj/<https://www.gordonconwell.edu/wp-content/uploads/sites/19/2019/04/GillD.TheologyofCarefortheVulnerable.pdf>.
9. Taher N, Overview of Health Care in Islamic History and Experience. Available from: <https://ethnomed.org/resource/overview-of-health-care-in-islamic-history-and-experience/>.
10. Verma M, Jyoti, Khatri A, Kumari P, Akram H, Jadaun S. Child Health Care: Past, Present, and Way Forward Available from: DOI:<https://doi.org/10.17511/ijpr.2024.i01.01>.
11. Nightingale, F/Skretkowicz V. (1859/1992). *Florence Nightingale's Notes on Nursing. (Revised, with additions)*. London: Scutari Press (Original work published in 1859) [Crossref][PubMed] [Google [Crossref][PubMed][Google Scholar].
12. Population of Ethiopia from 1800 until 2020. Statista. Published by Asrin O'Neil. Aug 9, 2024. Available from: <https://www.statista.com/statistics/1066913/population-ethiopia-historical/>.
13. UN Population Division Data Portal Interactive access to Global Demographic Indicators [Internet]. 2023. Available from: <https://population.un.org/dataportal/home>.
14. Central Statistical Agency (2007). *The 2007 Population and Housing Census of Ethiopia*. Addis Ababa: Central Statistical Agency.
15. Worldometer. Ethiopia Population. Available from: <https://www.worldometers.info/world-population/ethiopia-population/>
16. Engdaw A. SCRIBD. Health Policy. Uploaded on May 1924. Available from: <https://www.scribd.com/presentation/733977071/HEALTH-POLICY>.

17. Pankhurst R. Series: Ethiopia's Historic Quest for Medicine. Available from: <https://twlethiopia.org/article/1-ethiopias-historic-quest-for-medicine/>
18. Abdurahman A. History of Nursing in Ethiopia. *Nursing History Review*. 2011;19:158-60.
19. Health policy of the transitional government of Ethiopia. Addis Ababa: Federal Democratic Republic of Ethiopia; 1993. Available from: https://www.cmpethiopia.org/media/health_policy_of_ethiopia_1993.
20. Pankhurst R. 1990. An introduction to the Medical History of Ethiopia. Chapter XIX, p227. The Red Sea Press. Trenton, New Jersey.
21. Mannheimer E. Pediatrics in Ethiopia. *Clinical Pediatrics*. 1965;4(3):181-185. Available from: <https://journals.sagepub.com/doi/epdf/10.1177/000992286500400311>.
22. Pankhurst R, History of Ethiopian towns from the middle ages to the early 19th century (Wiesbaden: Steiner, 1982), p. 259.
23. Gondar Health Series, No.5, p. 118.
24. Worldmeter. Population of Ethiopia (2025 and historical), Available from: <https://www.worldometers.info/world-population/ethiopia-population/>.
25. Hofvander Y. 50 years of Ethio-Swedish Collaboration in child health and nutrition: A chronicle with recollections and personal experiences. July 2010. Available from: chrome-extension://efaidnbmninnibpcajpcgclclefindmkaj/https://cdn.sida.se/publications/files/sida61350en-50-years-of-ethio-swedish-collaboration-in-child-health-and-nutrition.pdf.
26. Child health in Ethiopia: A special issue on child health. G. Sterky (edit). *Ethiop Med J* 1973;11:1.
27. Hofvander Y. A survey of 3000 children attending mobile health center, Addis Ababa. *Ethiop Med J*. 1963;1(3).
28. Assefa, Y., Gelaw, Y.A., Hill, P.S. et al. Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. *Global Health* 15, 24 (2019). Available from: <https://doi.org/10.1186/s12992-019-0470-1>
29. Mohan, P. C.. 2007. Ethiopia Health Sector Development Program. Africa Region Findings & Good Practice Infobriefs; No. 141. © World Bank. <http://hdl.handle.net/10986/9549> License: CC BY 3.0 IGO.
30. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Development Program IV 2010/11 – 2014/. October 2010. Available from: <https://www.healthynewbornnetwork.org/hnn-content/uploads/HSDP-IV-Final-Draft-October-2010-2.pdf>.

31. Ministry of Health, Global Financing Facility, World Bank. Ethiopia Health Private Sector Assessment. October 2-19. Available from: https://www.globalfinancingfacility.org/sites/gff_new/files/documents/Ethiopia-health-private-sector-assessment.pdf.
32. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF. Available from: BIC.-FINAL-June-1-2015.pdf.
33. Chilot D, Diress M, Yismaw Gela Y, Sinamaw D, Simegn W, Andualem AA, et al. Geographical variation of common childhood illness and its associated factors among under-five children in Ethiopia: spatial and multilevel analysis. *Sci Rep.* 2023 Jan 17;13 (1):868. Available from: doi: 10.1038/s41598-023-27728-8. PMID: 36650192; PMCID: PMC984523.
34. Adenew, Yohannes Mehretie, S. Feleke, Z. Mengesha, and S. Workie. Childhood Mortality: Trends and Determinants in Ethiopia from 1990 to 2015—A Systematic Review. *Advances in Public Health* Volume 2017, Article ID 7479295. Available from: <https://doi.org/10.1155/2017/7479295>
35. Chan GC, Daniel J, Getnet M, Kennedy M, Olowojesjku R, Hunegnaw BM, et al. Gaps in maternal, newborn, and child health research: a scoping review of 72 years in Ethiopia. 2021;5. *J Glob Health Rep.* Available from: 2021;5:e2021033. Available from: doi:10.29392/001c.22125.
36. The Constitutional Law of the Ethiopian Pediatrics Society. 1995, Addis Ababa.
37. Federal Democratic Republic of Ethiopia. Proclamation No. 1113/2019 Organizations of Civil Societies Proclamation. 25th Year No.33 ADDIS ABABA 12th March 2019..
38. Wisdom Consult plc . Ethiopian Pediatrics Society Strategic Plan (2016 – 2020). Available from: chrome-extension://efaidnbmnnnibpcajpcgclefindmkaj/<https://www.epseth.com/updates-on-immunization/home/files/Final-sp.pdf>.
39. Lulseged S., Mekasha A., Shimelis D., Worku B., *Ethiopian Journal of Pediatrics and Child Health: Reminiscing its 20-year journey.* *Ethiop J Pediatr Child Health.* 2025;20 (1):85-98
40. Mekasha A, Lemma F, Shiferaw T. Child Health Problems in Ethiopia. EPHA Expert Group Report. *Ethiopian Journal of Health Development.* 1995;9:189-192. Available from: <https://www.scirp.org/reference/referencespapers?referenceid=1680632>).
41. Teklehaimanot, H.D., Teklehaimanot, A. Human resource development for a community-based health extension program: a case study from Ethiopia. *Hum Resour Health* 2013;11, 39. Available for: <https://doi.org/10.1186/1478-4491-11-39>.

42. Tessema ZT, Tebeje TM, Gebrehewet LG (2022) Geographic variation and factors associated with under-five mortality in Ethiopia. A spatial and multilevel analysis of Ethiopian mini demographic and health survey 2019. PLoS ONE 17(10): e0275586. Available from: <https://doi.org/10.1371/journal.pone.0275586>.
43. Ministry of Health. Health National Adaptation Plan-II (Revised Version). Addis Ababa. June 2024. Available from: https://www.atachcommunity.com/fileadmin/uploads/atach/Documents/Country_documents/Ethiopia_HNAP_II.pdf
44. Federal Democratic Republic of Ethiopia National Early Childhood Development and Education Policy Framework. Addis Ababa. 2022/23. Available from: <https://www.unicef.org/ethiopia/media/8081/file/Final%20ECDE%20Policy%20Framework.pdf>.
45. Ministry of Health. Health Sector Transformation Plan II HSTP II 2020/21-2024/25 (2013 EFY - 2017 EFY). February 2021. Available from: <https://ethiopiadup.jsi.com/wp-content/uploads/2022/07/HSTP-II.pdf>

Guidelines for Authors

The Ethiopian Journal of Pediatrics and Child Health (EJPCH) is the official Journal of the Ethiopian Pediatrics Society (EPS) and devoted to the advancement and dissemination of knowledge pertaining to the broad field of medicine in Ethiopia and other developing countries. Prospective contributors to the Journal should take note of the instructions of Manuscript preparation and submission to EJPCH, as outlined below.

Article Types accepted by EJPCH

- Original Articles (vide infra) on experimental and observational studies with clinical relevance.
- Brief Communications
- Case Series
- Case Reports
- Systematic Review
- Teaching Articles
- Editorial
- Correspondences/Letters to the Editor
- Monographs or set of articles on specific themes appearing in Special Issues of the Journal

N.B. Articles are acceptable only if NOT previously published or submitted elsewhere in print or electronic format, except in form of abstracts in proceedings of conferences.

Content and format of articles:

1. Original Art

- 2500 words, excluding Abstracts, References, Figures and Tables. The manuscript of the Article, should appear under the following headings:
 - A) Abstract** (vide infra)
 - B) Introduction:** should provide necessary information and Background of the topic. It should not be a review of the subject
 - C) Patients or (Materials) and Methods:** should contain details to enable reproducibility of the study by others. This section must include a clear statement specifying that a free and informed consent of the subjects or their legal guardians was obtained and that the study was approved by relevant institutional and/ or national ethics review board. For manuscripts on clinical trials, a copy of an ethical approval letter from the concerned body should be submitted with the manuscript. Photos of patients should be disguised or have a written consent.

D) Results: should present the experimental or observational data in text, tables or figures. The data in Tables and Figures should not be described extensively in the text.

E) Discussion: The first paragraph should provide a summary of key finding that will then be discussed one by one in the paragraphs to follow. The discussion should focus on the interpretation and significance of the Results of the study with comments that compare and describe their relation to the work of others (with references) to the topic. Do not repeat information of Results section in this section.

- **Abstract:** The Abstracts of an Article is prepared on a separate page and contain 250 words; it should be structured under the titles: a) Background; b) Methods; c) Results; d) Conclusions. Briefly summarize the essential features of the article under above headings, respectively. Mention the problem being addressed in the study; how the study was conducted; the results and what the author(s) concluded from the results. Statistical method used may appear under the Methods paragraph of the Abstract, but do not insert abbreviations or References in the Abstract section.
- **Keywords:** Three to six key words, or short phrases at the end of abstract page should be provided. Use terms from medical subject heading of Index Medicus to assist in cross indexing the Article.
- **Title page:** This should be on a separate page. It should be descriptive and should not exceed two line or 25 words or 150 characters including space. Include the name(s), qualification of the author(s); the department or Institution to which the study/research is attributed; and address of the corresponding Editor.
- **Tables and Figures:** together, these should not total more than six. Tables should be typed in triplicate on separate sheets and given serial Arabic numbers. They should be titled and labeled clearly. Unnecessary and lengthy tables and figures are discouraged. The same result should not be presented in more than one form (either figure or table should be chosen). Units should appear in parentheses in captions but not in the body of the table. Statistical procedures, if not in common use, should be detailed in the METHODS section or supported by references. Legends for figures should be typed on separate sheets, not stapled or coupled to the figures. Three dimensional histograms are discouraged. Recognizable photographs of patients should be disguised.
- **Acknowledgements:** Appropriate recognition of contributors to the research, not included under the list of authors should be mentioned here; also add a note about sources of financial or research funding, when applicable.

- **References:-**

- The titles of journals should be abbreviated according to the style used in MEDLINE (www.ncbi.nlm.nih.gov/nlmcatalog/journals)
- References should be numbered consecutively in the order in which they are first mentioned in the text and identify references in text, tables, and legends by Arabic numerals in parentheses.
- Type the references on a separate sheet, double spaced and keyed to the text.
- Personal communications should be placed NOT in the list of references but in the text in parentheses, giving name, date and place where the information was gathered or the work carried out (e.g. personal communication, Alasebu Berhanu, MD, 1984, Gondar college of Medical Sciences). Unpublished data should also be referred to in the text.
- References with six or less authors should all be listed. If more than six names, list the first three, followed by et al.
- Listing of a reference to a journal should be according to the guidelines of the International Committee of Medical Journal Editors ('Vancouver Style') and should include authors' name(s) and initial(s) separated by commas, full title of the article, correctly abbreviated name of the journal, year, volume number and first and last page numbers.
- Reference to a book should contain author's or authors' name(s) and initials, title of chapter, names of editors, title of a book, city and name of publisher, year, first and last page numbers.

The following examples demonstrate the acceptable Reference styles.

Articles:

- Gilbert C, Foster A. Childhood blindness in the context of Vision 2020: the right to sight. *Bull World Health Org* 2001; 79:227-32
- Teklu B. Disease patterns amongst civil servants in Addis Ababa: an analysis of outpatient visits to a Bank employees' clinic. *Ethiop. Med J* 1980; 18:1-6
- Tsega E, Mengesha B, Nordenfelt E, Hansen B-G; lindberg J. Serological survey of human immunodeficiency virus infection in Ethiopia. *Ethiop Med J* 1988; 26(4):179-84
- Laird M, Deen M, Brooks S, et al. Telemedicine diagnosis of Diabetic Retinopathy and Glaucoma by direct ophthalmoscopy (Abstract). *Invest Ophthalmol Vis Sci.* 1996; 37:104-5

Books and chapters from books:

- Henderson JW. *Orbital Tumors*, 3rd ed. Raven Press New York, 1994
- Clipard JP. Dry Eye disorders. In Albert DM, Jakobiec FA (Eds). *Principles and Practice of Ophthalmology*. Philadelphia: W.B Saunders: 1994. pp. 257-76

Website:

David K Lynch; laser History: Masers and lasers.

<http://home.achilles.net/~jtalbot/history/massers.htm> Accessed 19/04/2001

2. Brief Communication

Short versions of Research and Applications articles, often describing focused approaches to solve a particular health problem, or preliminary evaluation of a novel system or methodology.

- Word count; up to 2000 words.
- Abstract up to 200 words; excluding: Abstract, Title, Tables/Figures and References
- Tables and Figures up to five.
- References (Vide supra- Original Article)

3. Case Series

- Minimum of three and maximum of 20 case reports.
- Up to 1000 words; excluding: Abstract, Title, Tables/Figures and References
- Abstracts of up to 200 words; unstructured; (vide supra)
- Statistical statements here are expressed as 5/8 (62.5%)
- Tables and Figures: no more than three
- References: maximum of 20

4. Case Report

Report on a rare case or uncommon manifestation of a disease of academic or practical significance.

- Up to 750 words; excluding: Abstract, Title, Tables/Figures and References
- Abstract of up to 100 words; unstructured;
- Tables and Figures: no more than three
- References: maximum of 10

5. Systematic Review

Review of the literature on topics of broad scientific interest and relevant to EJPCCH readers

- Abstract structured with headings as for an Original Article (vide supra)
- Text should follow the same format as the one required of an Original Article
- Word count: up to 8,000 words, excluding abstract, tables/Figures and references
- Structured abstract up to 250 words
- Tables and Figures up to 8

6. Teaching Article

A comprehensive treatise of a specific topic/subject, considered as relevant to clinical medicine and public health targeting EJPCCH readers.

- By invitation of the Editorial Board; but an outline of proposal can be submitted

- Word limit of 8,000; excluding abstract, tables/Figures and references
- Unstructured Abstract up to 250 words

7. Editorial

- By invitation of the Editorial Board, but an Editorial topic can be proposed and submitted.
- Word limit of 1000 words: excluding references and title; no Abstract;
- References up to 15.

Preparation of manuscripts

- Manuscripts must be prepared in English, the official language of the Journal.
- On a single separate sheet, there must be the title of the paper, with key words for indexing if required, and each author's full name and professional degrees, department where work was done, present address of any author if different from that where work was done, the name and full postal address of the corresponding author, and word count of the manuscript (excluding title page, abstract, references, figures and tables). Each table/figures/Boxes or other illustrations, complete with title and footnotes, should be on a separate page.
- All pages should be numbered consecutively in the following order: Title page; abstract and keywords page; main manuscript text pages; reference pages; acknowledgement page; Figure-legends and Tables.
- The Metric system of weights and measures must be used; temperature is indicated in degrees Centigrade.
- Generic names should be used for drugs, followed by propriety brand name; the manufacturer name in parenthesis, e.g. diazepam (Valium, Roche UK).
- Statistical estimates e.g. mean, median proportions and percentages should be given to one decimal place; standard deviations, odds ratios or relative risks and confidence intervals to two decimal places.
- Acronyms/Abbreviations should be used sparingly and must be given in full, at all first mention in the text and at the head of Tables/ foot of Figure, if used in tables/ figures. Eg. Blood Urea Nitrogen (BUN). Intestinal Lung Disease (ILD).
- Use the binomial nomenclature, reference to a bacterium must be given in full and underlined-underlining in typescript becomes italics in print (e.g. *Haemophilus influenzae*), and later reference may show capitalized initial for the genus (e.g. *H. influenzae*).
- In the text of an article, the first reference to any medical phrase must be given in full, with the initials following in parentheses, e.g. blood urea nitrogen (BUN); in later references, the initials may be used.
- Manuscript for submission should be prepared in Microsoft Word document file format.

Submission of manuscript

- As part of the submission process, authors are required to check off their submission's compliance with journals requirement.
- All manuscripts must be submitted to the Editor-in-chief of the Journal with a statement signed by each author that the paper has not been published elsewhere in whole or in part, and is not submitted elsewhere while offered to the Ethiopian Journal of Pediatrics and Child Health. This does not refer to abstracts of oral communications at conferences/ symposia or other proceedings.
- It is the author's responsibility to proof-read the typescript or off-print before submitting or re-submitting it to the Journal, and to ensure that the spelling and numerals in the text and tables are accurate.

Manuscript review procedures

The procedures for manuscripts review include:

- Within one week of receipt of a manuscript, the Editorial Board will review it in reference to (i) conformity with the journal's "guidelines to authors (revised version available in all issues starting July 2020)" (ii) relevance of the article to the objectives of the EJPOCH, (iii) clarity of presentation, and (iv) plagiarism by using appropriate software.
- The Editorial Board has three options; accept manuscripts for external review, return it to author for revision, or reject it. A manuscript not accepted by a board member is blindly reviewed by another board member. If not accepted by both, the manuscript is rejected by Editorial Board. Decision will be made by the suggestion of a third Editorial Board member if the decisions of the first two do not concur.
- Once accepted for external review, the Editorial Board identifies one (for Brief communication, Case reports and teaching articles) or two (for original articles) reviewers with appropriate expertise. The reviewers will be asked to review and return manuscripts with their comments online within two weeks of their receipt. Reviewers have four options; accept, accept with major revision, accept with minor revision or reject.
- A manuscript accepted subject to revision as suggested by reviewers will be returned to the corresponding author. Author(s) will be given four weeks to respond to reviewers' comments, make necessary changes, and return the manuscript to the Editorial Board. A manuscript not returned in time will be considered withdrawn by the author(s).
- Manuscripts with minor revisions will be cleared by the Editorial and accepted for publication. Those with major revisions will be returned to external reviewers and follow the procedures as outlined for the initial review.

General information

- The Editorial Board reserves the right of the final acceptance, rejection or editorial correction of papers submitted.
- Accepted papers are subject to Editorial revisions as required and become the copy-right of the EPS.
- Twenty-five reprints of published articles are supplied free to the first/corresponding author
- The Editorial Board welcomes comments on the guidelines from Journal readers.

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