

Integrated Management of Childhood Illness (IMCI) Approach in management of Children with High Grade Fever $\geq 39^{\circ}$

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Abstract

Background: Fever is one of the most frequently encountered pediatric problems, accounting for 25% of visits to pediatric emergency room. There is no specific standardized approach to reach to a final diagnosis in children with fever as this may be difficult and individualized for each child. The integrated management of childhood illness (IMCI) approach is an approach designed to reach a classification rather than a specific diagnosis.

Objective: Comparison between IMCI and Non-IMCI approaches in management of children with high grade fever $\geq 39^{\circ}$.

Patients and methods: This is a prospective study carried out on 50 children less than five years old presented with fever $\geq 39^{\circ}$ attended the outpatient clinic of Minia university hospital from September 2012 to May 2014. These 50 children divided into 2 groups: group I (25 children) subjected to the (IMCI) approach and group II (25 children) subjected to the traditional approach.

Results: Most of children according to the IMCI approach (64%) were classified and diagnosed during the first day, while most of children in traditional approach were diagnosed by the fourth (34%) or fifth day (20%). Sixty percent of children treated according to IMCI approach were improved clinically compared to 12% in traditional approach. Forty percent of children treated according to traditional approach had worse outcomes compared to 16% treated according to the IMCI.

Conclusion: The IMCI approach can be applied upon children under five years old with high grade fever to reach to a classification, early diagnosis, much better outcomes and less daily cost than the traditional approach.

Key words: Fever, Children, IMCI.

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Background

Although the fever is one of the most common presenting complaints to emergency department, the approach to the febrile child remains controversial, despite attempts to simplify and unify the approach to febrile children, the evaluation and treatment of these patients varies considerably. ⁽¹⁾ With amplification of medical information as regard all clinical presentations we should depend on evidence based medicine (E.B.M) which aims to apply the best available evidence gained from the scientific method to medical decision making, it seeks to assess the quality of evidence of the risks and benefits of management. ⁽²⁾ The WHO / UNICCF guidelines for integrated management of childhood illness (IMCI) offer simple and effective methods to prevent and manage the leading causes of serious illness and mortality in young children. ⁽³⁾ The clinical guidelines promotes evidence based assessment and treatment using an approach that support the rational, effective and affordable use of drugs, thus considered as the standardized approach. ⁽⁴⁾

The core of the IMCI strategy is integrated case management of the most common childhood problems, with a focus on the most important causes of death. When assessing a sick child, a combination of individual signs leads to one or more classifications, rather than to a specific diagnosis. The guidelines include methods for checking a child's immunization and nutritional status. The approach is designed for use in outpatient clinical settings with limited diagnostic tools, limited medication and limited opportunities to practice complicated clinical procedure. ⁽⁵⁾ IMCI classifications are action oriented and allow health care providers to determine if a child should be urgently referred to another health facility, if the child can be treated at the first level facility or if the child can be safely managed at home. ⁽⁶⁾

Objective: the main aim of this study is comparison between IMCI and Non-IMCI approaches in management of children with high grade fever $\geq 39^{\circ}$ and which one of them is better for application in children under five years old as regards early diagnosis, better outcomes and daily cost.

Patients and methods

This is a prospective study carried out on 50 children less than five years old complaining of high grade fever $\geq 39^{\circ}$ attended the outpatient clinic of Minia university hospital for children during the period from September 2012 to May 2014. These 50 children were 28 males and 22 females divided into 2 main groups: group I included 25 children subjected to the (IMCI) approach of management designed with limited diagnostic tools, limited medications and opportunities to reach a classification rather than a specific diagnosis and group II : included 25 children subjected to the traditional (Non-IMCI) approach of management which designed to use serial investigations and procedures with medications to reach a final specific diagnosis.

Sample selection:

Only children less than five years old with fever $\geq 39^{\circ}$ were included in the study, they were selected randomly through choosing every third child with high grade fever came to the outpatient clinic of pediatrics to be included in group I and each fifth child with the same criteria to be included in group II. Children with anemia (either clinical or laboratory), malnutrition, collagen disease or with metabolic disorders were excluded from the study. Neonates less than 28 days of age were excluded from this study.

All children included in this study were subjected to complete history taking and clinical examination. Only those of group II were subjected to more investigations according to the case as complete blood count (CBC) using Sysmax-kx-21N, Japan, ESR using Westergren method, CRP using fully automated chemical auto-analyzer Dimension-ES, USA, urine and stool analysis. Some children in this group were subjected to chest x-ray when pneumonia was suspected, lumbar puncture and CSF analysis when meningitis was suspected. Blood sampling: Five mls of venous blood were aspirated under complete a septic condition by sterile venipuncture and divided as follows: 1 ml on tube containing EDTA for complete blood count, 1.6 ml on tube containing 0.4 ml of sodium citrate for ESR and 2.4 ml of venous blood on plain tube for other tests needed. All children either group I or Group II were admitted and followed up until discharge with the total cost in Egyptian

pounds was calculated since time of admission till discharge. The total cost included the cost needed for admission, feeding, investigations needed for diagnosis and treatment. We calculated the daily cost for each child by dividing the total cost by the number of days in the hospital.

Statistical methods

The collected data were coded, tabulated and statistically analyzed using SPSS program (Statistical package for social science) software version 20. Descriptive statistics were done for numerical data by mean and standard deviation, while they were done for categorical data by number and percentage. Analysis was done for normally distributed quantitative variables using independent sample t test to determine the statistical differences between the two groups. Analysis was done for not

normally distributed quantitative variables using Mann Whitney U test to determine the statistical differences between the two groups. Analysis was done for qualitative data using Chi square test. The level of significance was taken at P value less than 0.05.

Results

Most of children according to the IMCI approach (64%) were classified and diagnosed during the first day, while most of children in traditional approach were diagnosed by the fourth (34%) or fifth day (20%). Sixty percent of children treated according to the IMCI approach were improved clinically compared to only 12% of children treated according to the traditional (Non-IMCI) approach. Forty percent of children treated according to traditional approach had worse outcomes compared to 16% of children treated according to the IMCI.

Table (1): Time needed to reach a diagnosis in the studied approaches

Time	IMCI (N= 25)	Non-IMCI (N=25)	P-value
1 st day	16(64%)	2(8%)	0.02*
2 nd day	7(28%)	3(12%)	0.15
3 rd day	2(8%)	6(24%)	0.12
4 th day	0	9(36%)	0.008**
5 th day	0	5(20%)	0.01*

*Significant difference

**Highly Significant

Table (2): The outcome after 48 hours of admission and the daily cost in the studied approaches

Item	IMCI (N= 25)	Non-IMCI (N=25)	P-value
Improved cases	15(60%)	3(12%)	0.003**
The same condition	6(24%)	12(48%)	0.22
Worse or deteriorated	4(16%)	10(40%)	0.01*
The daily cost in Egyptian pounds	72	153	0.004**

*Significant difference

** Highly significant

Table (3): Final diagnoses in the studied groups

Final diagnosis	IMCI (N= 25)	Non-IMCI (N=25)	P-value
Tonsill-pharyngitis	10(40%)	9(36%)	0.76
Pneumonia	7(28%)	9(36%)	0.75
Otitis media	5(20%)	4(16%)	0.71
Meningitis	2(8%)	3(12%)	0.81
Measles	1(4%)	0(40%)	000

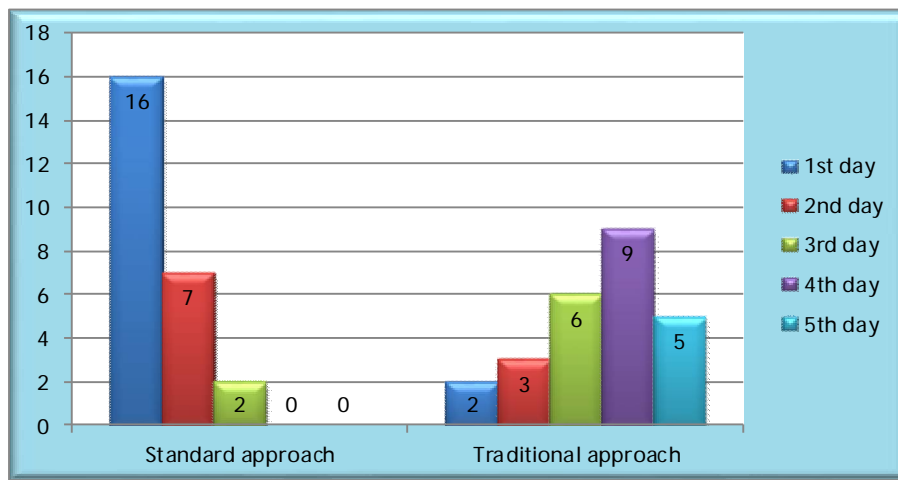


Fig. (1): Distribution of the time needed for diagnosis in studied approaches

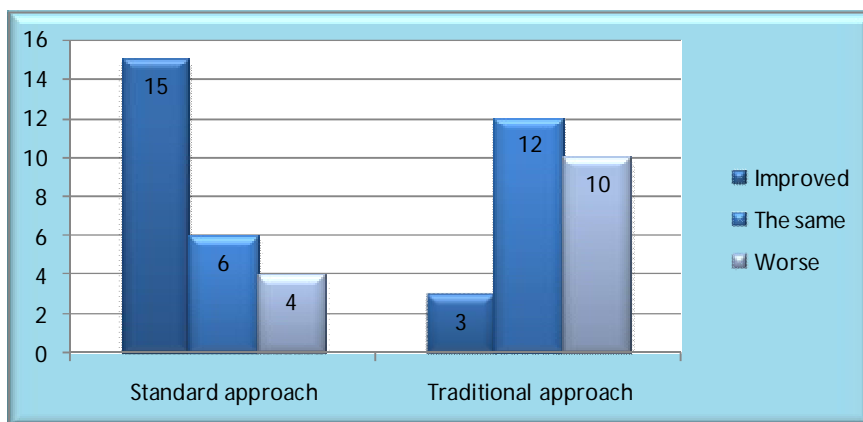


Fig. (2): Distribution of the outcome after treatment in studied approaches

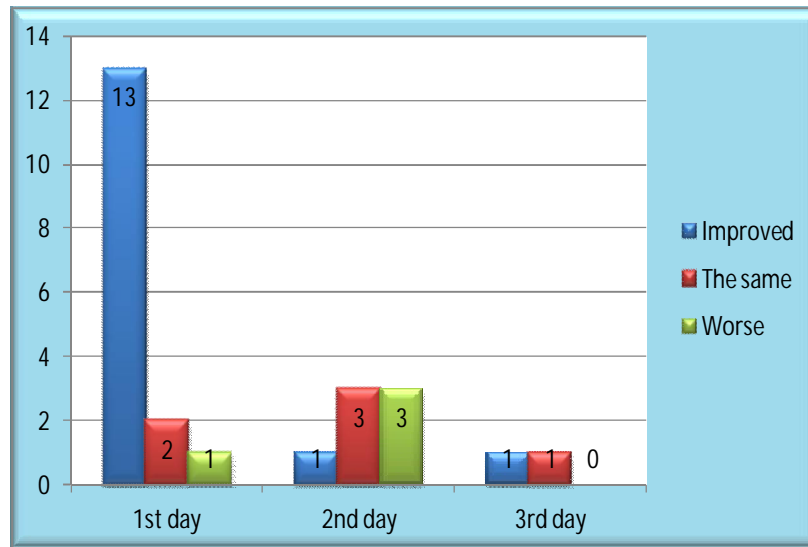


Fig. (3): Distribution of the outcome after treatment to time of diagnosis in IMCI approach

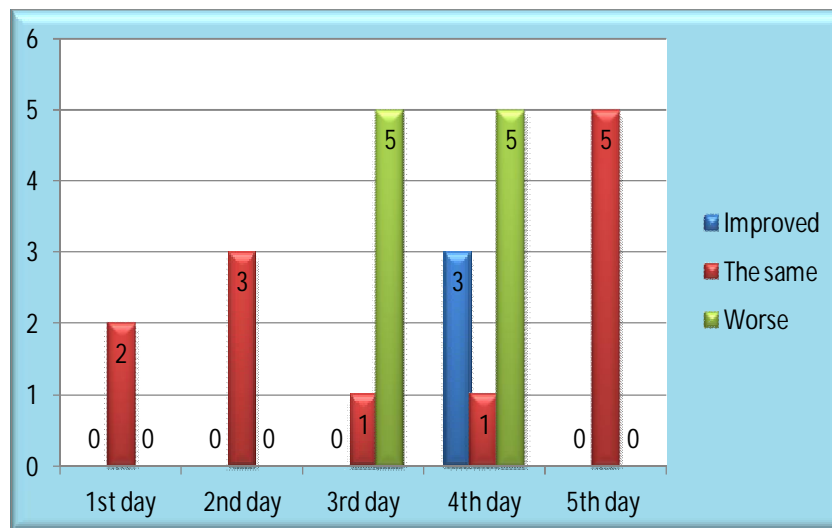


Fig. (4): Distribution of the outcome after treatment to time of diagnosis in Non-IMCI approach

Discussion

Fever is the primary presentation for a host of childhood illnesses and its underlying cause is generally benign. Fever may have a beneficial effect in terms of fighting the infection, although its value in the recovery process is far from clear, since in vivo data are largely lacking.⁽²⁾

As a part of the child survival strategy, WHO and UNICEF, in 1999 initiated the integrated management of childhood illnesses (IMCI) to assist developing countries to reduce childhood mortality caused by most childhood killer diseases like diarrhea, acute respiratory infections, malaria, measles and malnutrition.⁽⁵⁾ IMCI provides an efficient approach that is

likely to have a higher impact in reducing childhood mortality compared with previous vertical disease specific programs. ⁽⁴⁻⁶⁾

Fever is part of the assessment steps on the IMCI algorithms. A history of fever or presence of fever by palpation or measured temperature is required as a reason for the assessment of fever, which will lead to specific classifications that are linked to treatment protocols.

In the present study, fifty children less than 5 years old, presented with high grade fever, were enrolled for management using the standard IMCI approach or the traditional Non-IMCI approach.

In this study, upper respiratory tract infections were the main cause of fever in children in the form of tonsillo-pharyngitis and otitis media followed by lower respiratory tract infection (pneumonia) with the tonsillo-pharyngitis was the most common diagnosis for high grade fever in 8 (32%) children managed by IMCI approach and 9 (36%) children managed by traditional non-IMCI approach.

Streptococcal tonsillo-pharyngitis according to IMCI approach defined by congested throat in addition to presence of pus or follicles on the tonsils and/or presence of enlarged tender cervical lymph nodes were present in 7 out of 8 cases with tonsillo-pharyngitis.

It is well known that although most cases of tonsillo-pharyngitis are caused by viral agents especially in developed countries, group A- β -hemolytic streptococci (GABHS) are the most common bacterial cause especially in developing countries like Egypt and responsible of high incidence of rheumatic heart disease and post streptococcal nephritis. ⁽⁷⁾ Less common causes are pneumococcal infection and other groups of β hemolytic streptococci. Cytokines, particularly interleukin-6 (IL-6) and tumor necrosis factor- α (TNF- α), play an important role in the pathogenesis of the inflammatory process of tonsillo-pharyngitis with positive correlations between high fever and increased levels of these two cytokines. ⁽⁸⁾

The study by Factor et al., (2001) ⁽⁹⁾ aimed to determine whether the fever module in the WHO/UNICEF guidelines for the IMCI identifies febrile children with bacterial infections in an area of low malaria prevalence (Dhaka, Bangladesh), they found the majority of children with meningitis (100%), pneumonia

(95%), otitis media (95%) and urinary tract infections (83%); and 50% or less of children with bacteraemia (50%), dysentery (48%), and skin infections (30%). They did not include pharyngitis or tonsillo-pharyngitis as a bacterial infection in their study, although this condition may be a bacterial infection.

The IMCI guidelines, which community health workers use to make classifications, define pneumonia as cough or difficult breathing and fast breathing. The classification of fast breathing is based on age-specific thresholds of breath counts which could not be ascertained based on the caregiver reports. It was not possible to take the baseline assessments of respiratory rates in the children because they were located on day one of treatment-seeking and for some of the children the illness may have changed by the time they were seen. In addition, the community health workers records could not be used for classification of pneumonia because in the control arm, they do not assess and classify pneumonia symptoms. They had no record of which children had presented with pneumonia symptoms. ⁽¹⁰⁾

In the present study, pneumonia was the second most common cause of fever in 7(28%) of children managed by standard approach and 8(32%) of children managed by traditional approach (30% of all children).

In developing countries, the causes and patterns of pneumonias are affected by malnutrition, poor housing, lack of early medical attention and immunization. Pneumococci, streptococci, coliforms, H. influenzae and staphylococci are the most common causes of pneumonia with high mortality. ⁽¹¹⁾

Use of caregiver's reports to classify pneumonia symptoms has been used by Multiple Indicator Cluster Surveys (MICS) and Demographic and Health surveys (DHS) as well as other studies to identify children with possible pneumonia in the community but it is likely to over-estimate the proportion of children with true pneumonia ⁽¹²⁾. Therefore, the results of appropriate treatment obtained may reflect over-treatment with antibiotics in those children. ⁽¹³⁾

In a recent study by Kalyango et al., (2013), ⁽¹⁴⁾ they found that IMCI approach for malaria and pneumonia management increases prompt and appropriate treatment for

pneumonia symptoms in children under five years in Eastern Uganda.

In the present study, otitis media (OM) was the third most common cause of fever in 5 (20%) of children managed by standard approach and 4 (16%) of children managed by traditional approach (18%) of all children.

Otitis media is one of the commonest infections in children, particularly during the first 2 years of life, affecting about 60% of all children.⁽¹⁵⁾ At risk are those who attend day care centers and those whose parents smoke at home. The infection usually arises from a URTI, which spreads to the middle ear through the short and straight Eustachian tube. *Streptococcus pneumoniae* accounts for most of the bacteria recovered by tympanocentesis. In neonates and infants during the first 6 months of life, the most frequent bacteria are *E. coli*, *Klebsiella*, group B streptococci and *staphylococcus aureus*. A temperature of < 39°C occurs in about 25% and a temperature of > 39°C in about 75%. The highest fever is recorded in children less than 2 years of age.⁽¹⁶⁾

In the present study, for the purposes of our analysis, children were assigned only one diagnosis, although many children had more than one diagnosis recorded by the examining physicians. Many children fulfilled the criteria for several different IMCI classifications. The assignments to multiple classifications may represent misclassifications or may accurately reflect the presence of more than one clinical problem (e.g. a child with pneumonia may also have had otitis media).

In the present study, meningitis was the fourth most common cause of fever in 3(12%) of children managed by standard approach and 3(12%) of children managed by traditional approach (12% of all children).

Meningitis is one of the most important infectious causes of neurodisability and death in childhood. Ninety percent of reported cases occur below 5 years of age. There are several cytokines, particularly IL-1 β , TNF- α , and IL-6, are increased in children with meningitis and responsible for fever.⁽¹⁶⁾

The study by Lozano et al., (2010)⁽¹⁷⁾ reported that regional heterogeneity highlights the importance of sound epidemiological assessments of the causes of death on a regular basis.

According to IMCI classification, children with active measles were classified as measles, measles with eye and mouth complications, or severe complicated measles. Measles is defined as generalized maculopapular rash with fever and cough, coryza or conjunctivitis. Severe complicated measles is defined as measles with any general danger sign (child unable to breastfeed, vomiting, lethargic or convulsions), clouding of cornea or deep and extensive mouth ulcers.⁽¹⁸⁾ In the present study, only one case was diagnosed as severe complicated measles was present according to the standard IMCI approach. The study by Hussain et al. (2009)⁽¹⁹⁾ in Karachi, Pakistan found that the IMCI case definitions for measles is reasonable but may overestimate measles incidence.

The main finding of the present study is the high frequency of improvement after applying the standard IMCI approach when compared to traditional Non IMCI approach (60% versus 12%); this may be due to early diagnosis or classification using simple signs in IMCI approach allowing early intervention and treatment which in turn prevent morbidity and mortality in many cases. On the contrary, in Non-IMCI approach, intervention and treatment may be delayed until a list of investigations is completed to be sure of diagnosis (Is it viral or bacterial?).

The significant improvement of illness with IMCI standard approach helps reduction of pediatric morbidity outcomes which have been similarly reported in a number of studies from different countries.

A recent study from Egypt by Rakha et al., (2013)⁽²⁰⁾ showed that IMCI implementation was associated with a doubling in the annual rate of under-five mortality reduction (3.3% vs 6.3%). This mortality impact is plausible, since substantial improvements occurred in quality of care provided to sick children in health facilities implementing IMCI. Therefore, further prospective studies are needed in order to clarify the true impact of IMCI on child mortality.

In health facilities, the IMCI strategy promotes the accurate identification of childhood illness in the outpatient settings, ensures appropriate combined treatment of all major illnesses and speeds up the referral of severely ill children.

The IMCI clearly offers several benefits to children in areas where it is implemented. It improves health-worker performance and leads to better quality of care and rational drug use at costs that are lower or similar to investments in routine child health services. ⁽²¹⁾

In this study the daily cost per child admitted to hospital was greatly less for children managed according to the IMCI approach when compared to those managed according to non-IMCI approach and this is in agreement with other studies ^(22, 23) reported that the annual cost of care per Tanzanian child in IMCI districts was \$11.19 compared to \$16.09 in non-IMCI districts. In a study by Khan et al., (2002) ⁽²⁴⁾ in Bangladesh, a health economics investigation found that national IMCI implementation would save the country over \$4 million (\$7 million savings minus \$2.7 million implementation costs).

In a study by Wammanda et al., (2003) ⁽²⁵⁾ in Nigeria, IMCI guidelines were associated with a decrease in total drug costs from 118 to 24 Dollars per child, a nearly fivefold reduction in drug and treatment costs. These results are in agreement with us.

In Egypt, El-Mahalli and Akl (2011) ⁽²⁶⁾ showed that correct drug choice, dose, dosage form and route of administration were significantly higher in the clinic adopting IMCI (89.3%, 87.3%, 91.3%, and 91.3% respectively) than in the clinic not adopting it (78% each) reflected upon the cost of therapy per child.

In Egypt, the Ministry of Health and Population adopted the IMCI strategy in 1997 in the context of its efforts to integrate vertical program activities. In March 1998, the IMCI working group developed a detailed national plan of activities addressing all components of the IMCI strategy. ⁽²⁷⁾ IMCI has been included in the basic package of services to be delivered at the Primary Health Care (PHC) facilities, an initiative supported by WHO, UNICEF, USAID, and the World Bank. ^(28, 29)

In the present study, there were no cases of mortality in both approaches of management which may be due to small sample size and admission for all cases with high grade fever and management of the in hospital, so further prospective studies are needed in order to clarify the true impact of IMCI on child mortality.

These findings confirm the evidence in literature supports applying of IMCI for management of children infectious diseases in developing countries, as since its introduction, multi-country evaluations of IMCI (MCE-IMCI) in Uganda, Tanzania, Bangladesh, Brazil, and Peru have shown benefits in health service quality as well as reductions in mortality and health care costs. ^(30, 31) Based on this evidence, over 113 countries have since introduced IMCI to their health systems with varying levels of comprehensiveness. ⁽³²⁾

However, there were several constraints to national implementation of IMCI, including training, health system, and financial constraints. As a result, many countries have only implemented the training components of IMCI without complementary reform of health systems or policy to support national expansion. ⁽³³⁾

Despite reports of long-term cost savings resulting from IMCI, the WHO analytic review (AR) of IMCI showed that many countries perceived training to be too long and expensive, ⁽³⁴⁾ but this may be understood in the light of Goga et al., (2009) ⁽³⁵⁾ study, in which subsequent evaluation of IMCI case-management training (ICMT) in 24 countries revealed that all the countries offer shorter ICMT than the recommended 11- day duration, with the most common duration being 5–8 days. Throughout this evaluation, the four concerns regarding training were that it was perceived to be too long and expensive, that advocacy around IMCI should increase, that content should be regularly updated, and that new content areas should be introduced with more attention to skills-building rather than knowledge accumulation. ⁽³⁶⁾

Conclusion

The IMCI approach can be applied effectively upon children under five years old who have high grade fever $\geq 39^{\circ}$ to reach to a classification, early diagnosis and much better outcomes than the traditional (Non-IMCI) approach. The total and daily cost per child for hospital admission and therapy were much less when the IMCI approach was applied than the traditional (Non-IMCI) approach which makes this approach more suitable for developing countries like Egypt.

Competing interests:

Authors declared they have no conflict of interest.

Authors' contributions:

SAS and AE: Conception and design, interpretation of data, revision of the manuscript. AME: interpretation of data, revision of the manuscript and drafting the paper. MAB: follow up of patients and analysis of data, revision of the manuscript. AMO: interpretation of the biochemical results, conception and design. All authors shared in and approved the final manuscript revision.

References:

- McIntyre J. Management of fever in children. *Arc Dis Child*, 2011; 96:1173-1174.
- Neto G. Fever in the young infant. In: Moyer VA, Elliott EJ, Gilbert R, Klassen T, Logan S et al (Ed). Evidence-based pediatrics and child health (2nd ed). BMJ Books/Blackwell publishing 2004:257-66.
- Geneva: WHO; 1999. WHO. IMCI information package. Integrated Management of Childhood Illness and Health Sector Reform. UNICEF; pp.1-4. WHO/CHS/CAS/98.1L. REV1.
- Tulloch J. Integrated approach to child health in developing countries, *lancet*, 1999; 354:S116-S120.
- WHO, UNICEF. IMCI (integrated management of childhood illness); Chart Booklet. WHO; MCA 2011.
- Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S. An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa. *PLoS ONE*, 2009; 4:e5937.
- Sullivan JE, Farrar HC. Fever and antipyretic use in children. *Pediatrics*, 2011; 127:580-587.
- McDougall P, Harrison M. Fever and feverish illness in children under five years. *Nursing Standard*, 2013; 28:49-59.
- Factor SH, Schillinger JA, Kalter HD, Saha S, Begum H, Hossain A, et al. Diagnosis and management of febrile children using the WHO/UNICEF guidelines for IMCI in Dhaka, Bangladesh. *Bull World Health Organ*, 2001; 79:1096-1105.
- Bassat Q, Machevo S, O'Callaghan-Gordo C, Sigauque B, Morais L, et al. Distinguishing malaria from severe pneumonia among hospitalized children who fulfilled integrated management of childhood illness criteria for both diseases: a hospital-based study in Mozambique. *Am J Trop Med Hyg*, 2011; 85:626-634.
- NICE clinical guideline. Feverish illness in children. Assessment and initial management in children younger than five years. NICE 2014. NSW Department of Health 2010.
- Diaz T, George A, Rao S, Bangura P, Baimba J, McMahon S, et al. Healthcare seeking for diarrheas, malaria and pneumonia among children in four poor rural districts in Sierra Leone in context of free health care: results of a cross-sectional survey. *BMC Public Health*, 2013; 20:13-157.
- Campbell H, El-Arifeen S, Hazir k, O'Kelly J, Rudan I, Qazi SA. Measuring Coverage in MNCH: challenges in monitoring the proportion of young children with pneumonia who receive antibiotic treatment. *PLOS Medicine*, 2013; 10:e1001421.
- Kalyango JN, Alfven T, Peterson S, Mugenyi K, Karamagi C, Rutebembwa E. Integrated community case management of malaria and pneumonia increase prompt and appropriate treatment for pneumonia symptoms in children under five years in Eastern Uganda. *Malaria Journal*, 2013; 340:1-13.
- Powell KR. Fever. In: Kliegman RM, Stanton BF, Geme JW, Schor NF, Behrman Re (Eds). *Nelson textbook in pediatrics* (19th ed). Elsevier, 2012:1084-1087.
- El-Radhi AS, Carroll J, Klein N (Eds) *Clinical Manual of Fever in Children*. Springer-Verlag, Heidelberg, 2009:1-24.
- Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 2012; 380:2095-2128.
- WHO. Recommendations for management of common childhood conditions. Evidence for recommendations on treatment of fever conditions. WHO, 2012; 52-65.

19. Hussain H, Omer SB, Khan AJ, Bhurgri A, Memon A, Halsey NA. Endemic measles in Karachi, Pakistan and validation of IMCI criteria for measles. *Acta Paediatr*, 2009; 98:720-4.
20. Rakha MA, Abdelmoneim AN, Farhoud S, Cousens S, Daelmans B, Nahl R. Does implementation of the IMCI strategy have an impact on child mortality? A retrospective analysis of routine data from Egypt. *BMJ*, 2013; 3:e001852.
21. Mason E, Scherpbier R, Lawe-Davies O. WHO position statement on IMCI. *The Lancet*, 2009; 374:782-783.
22. Adam T, Edwards SJ, Amorim DG, Amaral J, Victora CG, Evans DB. Cost implications of improving the quality of child care using integrated clinical algorithms: evidence from Northeast Brazil. *Health Policy*, 2009; 89:97-106.
23. Adam T, Manzi F, Armstrong-Schellenberg JR, Mgalula L, de Savigny D, Evans DB. Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania. *Bull World Health Org*, 2005; 83:369-77.
24. Khan MM, Saha KK, Ahmed S. Adopting Integrated Management of Childhood Illness module at local level in Bangladesh: implications for recurrent costs. *J Health Popul Nutr*, 2002; 20:42-50.
25. Wammanda RD, Ejembi CI, Lorlian T. Drug treatment costs: projected impact of using the Integrated Management of Childhood illnesses. *Trop Doct*, 2003; 33:86-88.
26. El-Mahalli AA, Akl OA. Effect of adopting Integrated Management of Childhood Illness guidelines on drug use at a primary health care center: A case study from Egypt. *Journal of Family and Community Medicine*, 2011; 18:118-123.
27. Tulloch J. Integrated approach to child health in developing countries, *lancet*, 1999; 354:S116-S120.
28. WHO, UNICEF. IMCI integrated management of childhood illness; Chart Booklet. WHO; MCA 2011.
29. WHO, UNICEF. IMCI integrated management of childhood illness; Handbook. WHO; CAH 2014.
30. El-Arifeen SE, Bryce J, Gouws E, Baqui AH, Blak RE, Hoque DM, et al. Quality of care for under-fives in first-levels health facilities in one district Bangladesh. *Bulletin WHO*, 2004; 38:260-267.
31. Masanja H, Schellenberg JR, Savigny D, Mshinda H, Victora CG. Impact of integrated management of childhood illness on inequalities in child health ruler Tanzania. *Oxford Journal; Health Policy Plane*, 2005; 20:i77-i84.
32. El-Arifeen S, Emdadul DM, Akter T, Rahman M, Enamul M, Begum K, et al. Effect of the Integrated Management of Childhood Illness strategy on childhood mortality and nutrition in a rural area in Bangladesh: a cluster randomized trial. *Lancet*, 2009; 374:393-403.
33. Ahmed HM, Mitchell M, Hedt B. National implementation of Integrated Management of Childhood Illness (IMCI): policy constraints and strategies. *Health Policy*, 2010; 96:128-33.
34. WHO. The analytic review of the integrated Management of Childhood Illness strategy. WHO; MCA 2003.
35. Goga AE, Muhe LM, Forsyth K, Chopra M, Aboubakr S, Martinez J, et al. Results of a multi-country exploratory survey of approaches and methods for IMCI case management training. *Health Res Policy and Syst*, 2009; 7:18
36. Kiplagat A, Musto R, Mwizamholya D, Morona D. Factors influencing the implementation of integrated management of childhood illness (IMCI) by healthcare workers at public health centers & dispensaries in Mwanza, Tanzania. *BMC Public Health*, 2014; 14:277.