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# Bronchiolitis diagnosis, treatment, and prevention in children: an evidence-based clinical practice guideline adapted for the use in Egypt based on the 'Adapted ADAPTE' Methodology

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## Abstract

**Background:** The presented evidence-based clinical practice guideline (CPG) is proposed as a National CPG using an evidence-based and formal CPG adaptation methodology. The purpose of this study was to adapt the international CPGs' recommendations for children with bronchiolitis to suit the healthcare system in the Egyptian context. This CPG, 'diagnosis, treatment, and prevention of Bronchiolitis', applies to children from 1 through 23 months of age. Other exclusions are noted. The quality of evidence, benefit-harm relationship, and strength of recommendations are indicated. This study is part of a larger collaborative initiative with the faculty staff of pediatric departments of 15 Egyptian universities and a national research center to formulate a national Committee (EPG) that aims to define the topics of, assign authors to, and assist in the adaptation of pediatric evidence-based CPGs according to a national strategic plan. The committee is guided by a formal CPG adaptation methodology: the 'Adapted ADAPTE'.

**Results:** The Bronchiolitis Guideline Adaptation Group (BGAG) reviewed the results of the AGREE II assessment and decided to adapt mainly the Australasian (PREDICT) CPG and for the questions not answered in PREDICT we adapted the relevant recommendations from the American Academy of Pediatrics (AAP) CPG. Seven implementation tools were included: a care pathway for assessment of severity, a clinical algorithm for treatment of acute bronchiolitis in the emergency room, a separate flowchart for assessing babies with bronchiolitis, a power point slide presentation lecture for treatment of acute bronchiolitis, patient information in Arabic, a clinical score (Modified Tal Score) for prediction of bronchiolitis severity, and the criteria for admission and discharge in the hospital. A comprehensive set

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of multifaceted CPG implementation strategies was provided for the clinicians, patients, nurses, and other relevant stakeholders contextualized to the national settings

**Conclusion:** Our experience with this adaptation methodology provides useful insight into its utilization on a national level in Egypt. The BGAG recommended the next review of this adapted CPG to be after 3 years from its publication (i.e., 2022) after checking for updates in the original CPG.

**Keywords:** Bronchiolitis, Guideline adaptation, Adapted ADAPTE, Diagnosis, Treatment, Prevention, Egyptian pediatric guidelines, Pediatrics

## Background

Bronchiolitis is the leading cause of hospital admission for respiratory diseases among infants < 1 year of age and is associated with an estimated 1 of every 13 primary care visits. It is most commonly presenting in the first 2 years of life, and the diagnosis is based on clinical signs [1].

Acute bronchiolitis refers to airway inflammation and obstruction of the lower respiratory tract and is caused almost exclusively by viral infection in children younger than 2 years. Commonly, symptoms of bronchiolitis begin with rhinitis or congestion and cough and may develop into symptoms of increasing respiratory distress (tachypnea, wheezing, and accessory muscle use). Severity of bronchiolitis can vary from mild symptoms that can be managed at home to acute respiratory failure requiring invasive ventilation [2].

A subcommittee of the American Academy of Pediatrics together with the European Respiratory Society (ERS) defined bronchiolitis as a constellation of clinical symptoms and signs including a viral respiratory prodrome followed by increased lower respiratory effort and wheezing in infants < 2 years of age with a peak in infants aged 3–6 months. It is a self-limiting condition but may be severe and life-threatening [3].

History and physical examination findings are essential for the diagnosis of bronchiolitis. Hyperinflation is the most reliable clinical sign in bronchiolitis. Fever is not a constant feature of bronchiolitis. Fever above 38.5 °C is seen in 50% of the patients. Infants younger than 6 weeks may be hypothermic [2].

In Egypt, a study by El-Sadek et al. revealed that bronchiolitis represents 27.1% of children with wheezy chest admitted to El-Hussein University Hospital, Cairo, from January to December 2012 using a pre-designed questionnaire [4].

Clinical Practice Guidelines (CPGs) are defined as 'statements that include recommendations intended to optimize patient care, which are informed by a systematic review of evidence and an assessment of the benefit and harm of alternative care options [5, 6]. CPGs are considered as tools for improving the quality and safety of healthcare services [5–7].

Adaptation of CPGs is a valid and efficient alternative to de novo development of CPGs especially in resource-limited healthcare settings in order to avoid duplication of efforts, to use the available resources in a cost-effective manner, and to encourage trans-contextual customization of the CPG prepared for different economic and healthcare settings reflecting the local context and system [5–8].

The Eastern Mediterranean Regional Office of the World Health organization recommended a set of actions to help advance guideline development and/or adaptation and implementation in the region [9].

Till date, there were no published unified CPGs for management of bronchiolitis in Egypt, the presented evidence-based CPG is proposed as a National CPG using an evidence-based and formal CPG adaptation methodology. The aim of this study was to adapt the international CPGs' recommendations for children with bronchiolitis to suit the healthcare system in the Egyptian context.

This study is part of a major project by a National Egyptian Pediatrics Clinical Practice Guidelines Committee (EPG) which was formulated by an initiative in collaboration with the Faculty Staff of the Pediatrics Departments of 15 Egyptian Universities and a National Research Centre. EPG was affiliated later to the Supreme Council of the Egyptian University Hospitals aiming to define the topics of, assign authors to, and assist in the adaptation of pediatric evidence-based CPGs according to a national strategic plan (<http://epg.edu.eg>). The committee is guided by a formal CPG adaptation methodology: the 'Adapted ADAPTE' [5].

## Methods

We utilised the 'Adapted ADAPTE' CPG adaptation methodology that was proposed to enhance the utilization of the original ADAPTE method [5, 8]. This formal CPG adaptation process consists of three phases (i.e., set-up, adaptation, and finalization) and 24 steps with modifications in the steps and tools to suit the local general healthcare setting in health systems with limited resources like Egypt [5, 6, 8].

### Set-up phase

In phase 1 (set-up), bronchiolitis was selected by the EPG National Committee as one of the priority health topics for the EPG adaptation projects. An initial search was conducted to identify whether there were existing published and accessible bronchiolitis CPGs.

The Bronchiolitis Guideline Adaptation Group (BGAG) was formulated with 20 members. The BGAG was composed of faculty professors and consultants of Pediatrics from five Egyptian universities. Two members of BGAG had previous expertise in CPG adaptation methodologies and were involved in the development of the Adapted ADAPTE. There was active involvement of a Multidisciplinary Review Committee during the process of this CPG adaptation.

The target patient population for this CPG project is infants less than 2 years of age presenting with bronchiolitis in primary health care centers or emergency departments in hospitals. Excluded population include patients with life-threatening bronchiolitis necessitating intensive care unit admission, patients who have underlying respiratory illnesses such as recurrent wheezing, chronic neonatal lung disease (also known as bronchopulmonary dysplasia), neuromuscular disease, or cystic fibrosis and those with hemodynamically significant congenital heart disease. The intended users include physicians (specifically paediatricians, primary health-care physicians, and family practitioners) and nurses, and clinical pharmacists.

### Adaptation phase

In phase 2, we identified 28 clinical questions, using the PIPOH model, including 7 questions for diagnosis, 14 for treatment, and seven for prevention (Appendix Table 1). The PIPOH model included the target patient population (P), intervention(s) (I), professionals and clinical specialties (P), outcomes (O), and healthcare setting or context (H) [16]. The literature search was conducted using MEDLINE/PubMed and Google Scholar portals. Eligible Source CPGs were then critically appraised using the Appraisal of Guidelines for Research and Evaluation (AGREE II) Instrument [10]. AGREE II is a valid and reliable instrument with 23 items organized into six domains and is considered the gold standard for quality assessment of CPGs [19]. The first draft of the adapted CPG marks the last step of this phase.

### Finalization phase

In phase 3, the first draft of the adapted CPG was finalized including assessing whether it is acceptable and applicable to Egyptian healthcare context. The draft was then disseminated to a panel of external reviewers of

topic experts. Afterwards, the feedback of reviewers was revised and discussed within the BGAG with consideration of the national context. The finalized version of the adapted CPG included relevant practical implementation tools and strategies.

### Ethics approval and consent to participate

Not applicable

### Results

The BGAG was formulated by 18 Professors of Pediatric Pulmonology in addition to a Professor of Pediatrics and a general pediatrician who are well versed in evidence-based CPG adaptation methodologies. We studied several Source CPGs for diagnosis, treatment, and prevention of bronchiolitis. Two eligible Source CPGs, the Australasian (PREDICT) Guideline 2016 (<http://www.predict.org.au/download/Australasian-bronchiolitis-bedside-clinical-guideline.pdf>) [11] and the American Academy of Pediatrics (AAP) Guideline 2014–2018 (<http://pediatrics.aappublications.org/content/134/5/e1474>) [12] were identified and assessed using the AGREE II instrument. The AGREE II domains standardized domain score were presented in Appendix Table 2. BGAG reviewed the results of the AGREE II assessment and decided to adapt mainly the Australasian (PREDICT) CPG and for the questions not answered in PREDICT we adapted the relevant recommendations from the AAP CPG. We met nine times, face-to-face meetings, throughout the development of these CPGs to discuss and finalize the recommendations.

Three professors of pediatric pulmonology, a public health faculty, a head nurse, and a clinical pharmacist participated as an independent external review panel from the target audience of the CPG. Members of the BGAG and the external review groups were a good representation of multiple universities and university hospitals in Egypt.

The summary recommendations of the adapted CPG are highlighted in Table 1.

A set of CPG implementation tools were attached to the finalized adapted CPG. These tools were developed and revised by the BGAG group to be used by health-care providers and families of children with bronchiolitis for education and awareness. Seven implementation tools (i.e., four adopted or modified and three new tools) included: a care pathway and criteria for assessment of severity (Appendix Table 3), a clinical algorithm for treatment of acute bronchiolitis in the emergency room (Fig. 1), a separate flowchart for assessing babies with bronchiolitis, a power point slide presentation lecture for treatment of acute bronchiolitis, patient information in Arabic, a clinical score (Modified Tal Score) for

**Table 1** Key recommendations of the adapted bronchiolitis CPG

Qs	Health questions	Clinical recommendations	Source guideline	Evidence <sup>a</sup>
<b>Diagnosis</b>				
1 a	In infants presenting to hospital or hospitalized, how can clinician diagnose	Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination	AAP [12]	Evidence B Strong recommendation
1b	In infants presenting to hospital what factors in history and physical examination contribute to diagnosis of bronchiolitis?	The major factors which were predictive were fever, cough, tachypnea, retractions, and wheeze.	PREDICT [11]	Evidence C Weak recommendation
2	In infants presenting to hospital with bronchiolitis, what are the risk factors for admission or severe disease	Clinicians should consider as risk factors for more serious illness: gestational age less than 37 weeks; chronological age at presentation less than 10 weeks; exposure to cigarette smoke; breast feeding for less than 2 months; failure to thrive; having chronic lung disease; having chronic heart and/or chronic neurological conditions.	PREDICT [11]	Evidence C Grade: Conditional
3	In infants presenting to hospital or hospitalized with bronchiolitis, does performing a ChestX-ray beneficially change medical treatment or clinically relevant end-points?	When clinicians diagnose bronchiolitis on the basis of history and physical examination, radiographic studies should not be obtained routinely	AAP [12]	Evidence B
4	In infants presenting to hospital or hospitalized with bronchiolitis, does performing laboratory tests (blood and/or urine) beneficially change medical treatment or clinically relevant end-points?	When clinicians diagnose bronchiolitis on the basis of history and physical examination, laboratory studies should not be obtained routinely	AAP [12]	Evidence B
5	In infants presenting to hospital or hospitalized with bronchiolitis, does performing virological investigations beneficially change medical treatment or clinically relevant end-points?	In infants with bronchiolitis, routine use of viral testing is not recommended for any clinically relevant end-points.	PREDICT [11]	Evidence C
6	For infants presenting to hospital or hospitalized with bronchiolitis, does use of a bronchiolitis scoring system beneficially change medical treatment or clinically relevant end-points?	For infants presenting to hospital or hospitalized with bronchiolitis, there is insufficient evidence to recommend the use of a scoring system to predict need for admission or hospital length of stay	PREDICT [11]	Evidence D Grade: weak
<b>Treatment</b>				
7	For infants presenting to hospital or hospitalized with bronchiolitis, what criteria should be used for safe discharge?	Oxygen saturations, adequacy of feeding, age (infants younger than 8 weeks), and social support should be considered at the time of discharge as a risk for representation.	PREDICT [11]	Grade: Good Practice Point
8a	Does administration of B2 agonist improve clinically relevant outcome in infants and children with bronchiolitis?	Bronchodilators should not be used routinely in the treatment of bronchiolitis in infants and children.	PREDICT [11]	Evidence A Strong recommendation
8b	In hospitalized infants with bronchiolitis, with personal or family history of atopy, does the use of B2 agonist improve clinically relevant outcome?	Inhaled bronchodilators should be continued only if there is a documented positive clinical response to the trial using an objective means for evaluation.	PREDICT [11]	Evidence A Strong recommendation
9	Does the use of inhaled 3% saline improve clinical outcome in infants hospitalized with bronchiolitis?	Clinicians may administer nebulized hyper tonic saline to infants and children hospitalized for bronchiolitis	AAP [12]	Evidence: B Moderate recommendation
10	Does the inhaled Epinephrine improve relevant outcome?	Do not administer Epinephrine to infants presenting to hospital or hospitalized with bronchiolitis.	PREDICT [11]	Evidence B Strong recommendation
11	In hospitalized infants with bronchiolitis, does administration of combination of systemic or inhaled corticosteroids and adrenaline improve clinically relevant outcome?	Do not administer a combination of systemic or local steroids and nebulized epinephrine to infants presenting to hospital or hospitalized with bronchiolitis.	PREDICT [11]	Evidence D Weak recommendation
12	Does the use of corticosteroids improve clinically relevant outcome?	Corticosteroid (systemic or local) medication should not be used in the treatment of bronchiolitis	PREDICT [11]	Evidence B Strong recommendation

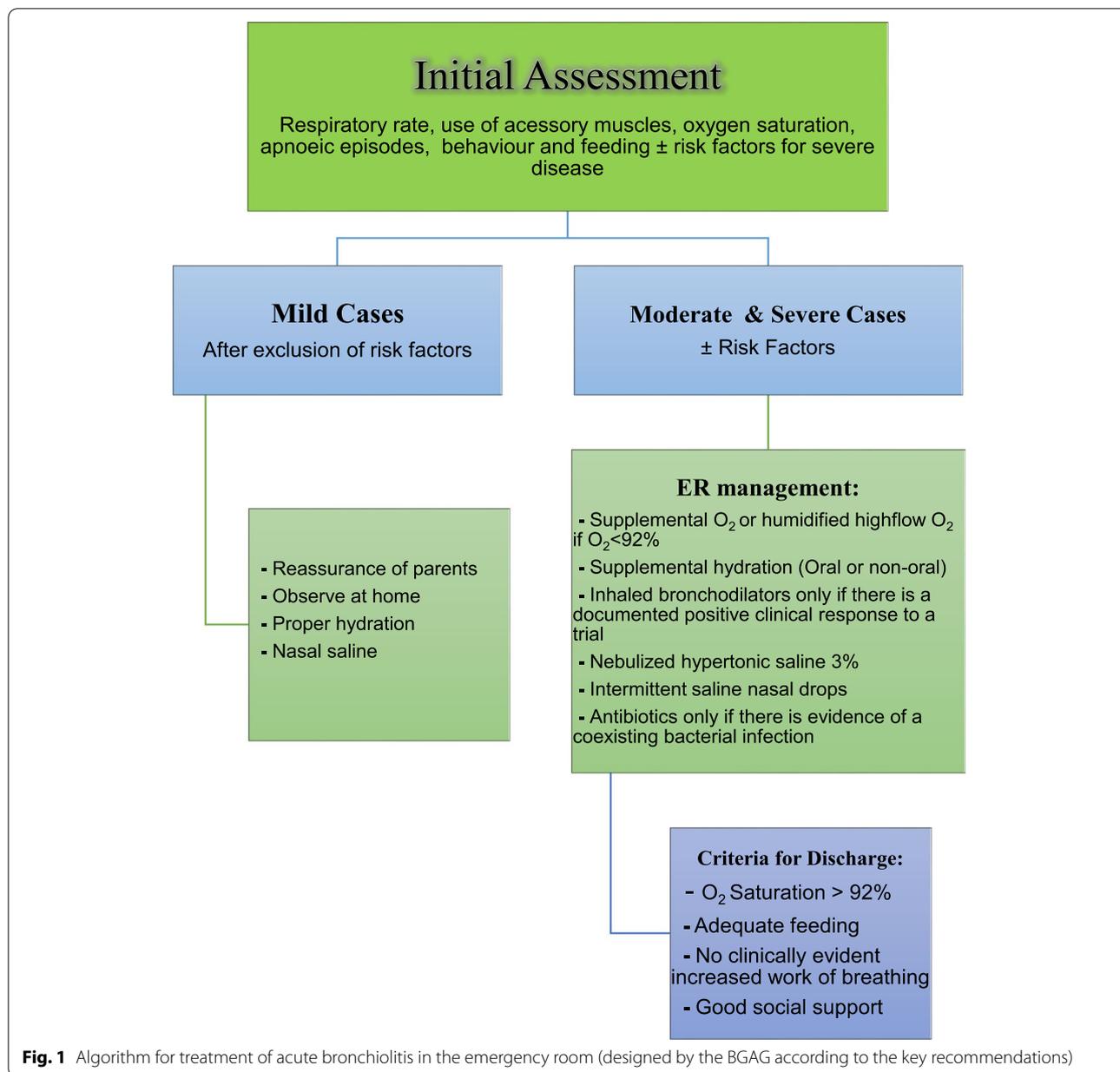
**Table 1** (continued)

Qs	Health questions	Clinical recommendations	Source guideline	Evidence <sup>a</sup>
13	Does the use of antiviral treatment improve clinically relevant outcome?	The clinician should not use routinely Ribavirin in children with bronchiolitis?	AAP [12]	Evidence B
14a	In infants presenting to hospital or hospitalized with bronchiolitis, does administration of supplemental oxygen improve clinically relevant end-points?	Consider the use of supplemental oxygen in the treatment of hypoxic (oxygen saturations less than 92%) infants with bronchiolitis.	PREDICT [11]	Evidence C
14b	In infants presenting to hospital or hospitalized with bronchiolitis, what level of oxygen saturation should lead to commencement or discontinuation of supplemental oxygen to improve clinically relevant end-points?	In uncomplicated bronchiolitis oxygen supplementation should be commenced if the oxygen saturation level is sustained at a level less than 92%. At oxygen saturation levels of greater than or equal to 92%, oxygen therapy should be discontinued.	PREDICT [11]	Evidence C
14c	In infants hospitalized with bronchiolitis does the use of heated humidified high flow oxygen, or air, via nasal cannula improve clinically relevant end-points?	The clinician should use heated humidified high flow oxygen, or air, via nasal cannula for the inpatient setting in children with bronchiolitis with hypoxia (oxygen saturations < 92%).	PREDICT [11]	Evidence C
15	In infants hospitalized with bronchiolitis does continuous monitoring of pulse oximetry beneficially change medical treatment or clinically relevant end-points?	Routine use of continuous pulse oximetry is not required for treatment of non-hypoxic infants (saturations $\geq$ 92%) not receiving oxygen, or stable infants receiving oxygen.	PREDICT [11]	Evidence C
16	In infants hospitalized with bronchiolitis, does chest physiotherapy improve clinically relevant end-points?	Chest physiotherapy is not recommended for routine use in infants with bronchiolitis.	PREDICT [11]	Evidence B
17a	In infants hospitalized with bronchiolitis, does suctioning of the nose or naso-pharynx improve clinically relevant end-points?	Nasal suction is not recommended as routine practice in the treatment of infants with bronchiolitis. Superficial suction may be considered to assist with feeding.	PREDICT [11]	Evidence D
17b	In infants hospitalized with bronchiolitis, does the use of nasal saline drops improve clinically relevant end-points?	Routine nasal saline drops are not recommended. Trial of intermittent saline drops may be considered at time of feeding.	PREDICT [11]	Evidence D Weak recommendation
18	In infants hospitalized with bronchiolitis, does the use of CPAP improve clinically relevant end-points?	Nasal CPAP for infants with bronchiolitis may be considered for the treatment.	PREDICT [11]	Evidence C
19	In infants hospitalized with bronchiolitis, is provision of home oxygen a safe alternative for treatment?	After a period of observation, infants at low risk for severe bronchiolitis can be considered for discharge on home oxygen as part of an organized 'Home Oxygen Program' which has clear 'Return to Hospital' advice.	PREDICT [11]	Evidence C
20	Does the use of antibacterial medication is beneficial in treatment of bronchiolitis and improve clinically relevant outcome?	Antibacterial medication should be used only in children with bronchiolitis who have specific indications of coexistence of bacterial infection.	PREDICT [11]	Evidence B
21a	In infants presenting to hospital or hospitalized with bronchiolitis, does the use of oral or non-oral hydration improve clinically relevant end-points?	Supplemental hydration is recommended for infants who cannot maintain hydration orally.	AAP [12]	Evidence Quality: X Recommendation Strength: Strong
21b	In infants presenting to hospital or hospitalized with bronchiolitis, what forms of non-oral hydration improve clinically relevant end-points?	Both NG and IV routes are acceptable means for non-oral hydration in infants admitted to hospital with bronchiolitis.	AAP [12]	Evidence Quality: X Recommendation Strength: Strong
21c	In infants presenting to hospital or hospitalized with bronchiolitis, does limiting the volume of non-oral hydration impact on clinical relevant end-points?	There is insufficient evidence to recommend a specific proportion of maintenance fluid. There is a risk of fluid overload. Judicious use of isotonic hydration fluid is recommended.	PREDICT [11]	Evidence D Weak recommendation

**Table 1** (continued)

Qs	Health questions	Clinical recommendations	Source guideline	Evidence <sup>a</sup>
<b>Prevention</b>				
22	What are the criteria for giving Palivizumab prophylaxis to infants and children by a clinician?	Clinicians may administer palivizumab prophylaxis to selected infants and children with chronic lung disease or a history of prematurity (less than 35 weeks gestation) or with congenital heart disease.	AAP [12]	Evidence A
23	How the clinicians prescribe the dose, frequency, and duration of the palivizumab prophylaxis to the selected infants?	The clinician should give prophylaxis with palivizumab in 5-monthly doses, usually beginning in November or December at a dose of 15 mg/kg per dose intramuscular.	AAP [12]	Evidence C
24	Does hand decontamination for clinician prevent nosocomial spread of RSV?	Hand decontamination is the most important step in preventing nosocomial spread of RSV. Hand should be decontaminated before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves	AAP [12]	Evidence B Strong recommendation
25	What is the preferred disinfectant to be used by the clinician?	Alcohol-based rubs are preferred for hand decontamination. An alternative is hand-washing with antimicrobial soap	AAP [12]	Evidence B
26	Should the clinicians educate personnel and family members on hand sanitation?	Clinicians should educate personnel and family members on hand sanitation	AAP [12]	Evidence C
27	Does tobacco smoking affect the clinical outcome in treatment of bronchiolitis in infants and children?	Infants should not be exposed to passive smoking	AAP [12]	Evidence B Strong recommendation
28	Does breastfeeding affect the risk of having lower respiratory tract disease in infants?	Breastfeeding is recommended to decrease a child's risk of having lower respiratory tract infection	AAP [12]	Evidence C

<sup>a</sup> For explanation of the classification of the level of evidence and grade of recommendations, refer to the two Source CPGs: PREDICT and AAP [11, 12]



prediction of bronchiolitis severity (Appendix Table 4), and the criteria for admission and discharge in the hospital.

Appendix Table 5 summarized the decision support record for the BGAG throughout the different phases of the Adapted ADAPTE method.

A comprehensive set of multifaceted CPG implementation strategies was provided for the clinicians, patients, nurses, and other relevant stakeholders to the national settings.

The BGAG recommended the next review of this adapted CPG to be after 3 years from its publication (i.e.,

2022) after checking for updates in the original CPG, and consulting the experts on the updated evidence and recommendations published in bronchiolitis. Moreover, the results of the national implementation should inform the content of the next update.

**Discussion**

A strength of this project is the use of the ‘Adapted ADAPTE’ method as it is clearly structured and includes a set of tools to support the process [5–8].

Involvement of multi-disciplinary groups, including pediatrics, clinical pharmacy, nursing, and public

health, from multiple universities and several governors in the CPG adaptation process is expected to promote the adherence to this adapted CPG at the national level. Moreover, we expect more collaboration and integration of services for care of children with bronchiolitis as a result of the adoption of these adapted recommendations.

The aim of this study coincides with the initiative of the World Health Organization of the Regional Office of the Eastern Mediterranean to promote CPG adaptation in the region [9]. One identified limitation was the lack of a patient or parent representative in the BGAG.

The BGAG has identified several expected facilitators and barriers to implementation and discussed their proposed solutions.

The identified barriers to implementation included the financial support to help in preparation of educational tools, also to develop a multidisciplinary working group due to shortage of the working time for the trained persons to educate healthcare providers to improve their awareness, knowledge, and understanding of the CPG recommendations.

The facilitators of implementation included the presence of CPG adaptation tools using the 'Adapted ADAPTE' approach created by Alexandria University based on the ADAPTE Manual and Resource Toolkit-Version 2.0 that was released by the Guidelines International Network-Adaptation Working Group [5, 6], and the initiative to formulate the National Pediatric CPG Committee in collaboration with the relevant faculty staff of several Egyptian universities as well as a National Research Center.

## Conclusions

The 'Adapted ADAPTE' as a formal CPG adaptation method is rigorous, practical, and intensive tool has been demonstrated to be feasible and user-friendly for national CPG projects. Our experience with this adaptation methodology provides useful insight into its utilization on a national level in Egypt. Further context-based modifications to this method is accepted with the proper rationale and documentation.

## Abbreviations

AAP: American Academy of Paediatrics; BGAG: Bronchiolitis Guideline Adaptation Group; CHD: Congenital heart disease; CPAP: Continuous positive airway pressure; CPGs: Clinical practice guidelines; ED: Emergency department; EPG: Egyptian Pediatrics Clinical Practice Guidelines Committee; ERS: European Respiratory Society; HBoV: Human bocar virus; hMPV: Human metapneumonia virus; ICU: Intensive care unit; IV: Intravenous; NRC: National Research Centre; OCS: Oral corticosteroid; PHC: Primary health care; PIBO: Post infectious bronchiolitis obliterans; PICU: Pediatric intensive care unit; RCTs: Randomized clinical trials; RSV: Respiratory syncytial virus; SABA: Short acting B2 agonists; WAVE: Wheeze associated viral episode; WHO: World Health Organization.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43054-021-00094-8>.

**Additional file 1: Appendix Table 1** Health Questions used to develop this Adapted CPG. **Appendix Table 2** AGREE II domain scores for the assessed CPGs. **Appendix Table 3** Initial clinical assessment of children with bronchiolitis. **Appendix Table 4** Modified Tal Score (a validated score for prediction of bronchiolitis severity). **Appendix Table 5** Decision support record for the BGAG using the 'Adapted ADAPTE' methodology.

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## Authors' contributions

All authors have made substantial contributions and gave final approval of the conceptions, drafting, and final version of this manuscript. YSA and TO conceptualized and designed the study. All authors contributed to the data collection, critical appraisal of guidelines. YSA, EMF, SMH, and AA have written the first draft of the manuscript. YSA, EMF, and SMH analyzed and interpreted the data and supervised the procedures in the study and reviewed the drafts and final version of this manuscript. All authors have seen and approved the final version of the manuscript.

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## Availability of data and materials

Any relevant material in addition to future revisions and updates will be made available from the official website of the Egyptian Pediatrics Clinical Practice Guidelines Committee (<http://epg.edu.eg>).

## Declarations

### Ethics approval and consent to participate

Not applicable

### Consent for publication

Not applicable

### Competing interests

The authors declare that they have no competing interests.

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