Tested Changes and Applied Evidence-Based Clinical Interventions to Improve Care of Respiratory Infections Among Children in Georgia's Imereti Region

Background

In February 2012 the USAID Health Care Improvement Project (HCI) and in July 2014 the USAID Applying Science to Strengthen and Improve Systems (ASSIST) Project implemented by University Research Co., LLC began to address challenges related to quality, consistency, and continuity of care of pediatric respiratory infections in Georgia.

To improve the quality of RTI diagnostic and treatment practices, HCI and ASSIST supported the formation of several quality improvement (QI) teams in Georgia's Imereti Region. This document summarizes tested changes to improve ambulatory and hospital care of acute upper (rhinitis, sinusitis, pharyngitis) and lower (bronchitis, pneumonia) respiratory infections (RTIs) among children attending health care facilities (ambulatory and hospital) in Imereti. The purpose of the tested changes was to ensure correct and consistent use of evidence-based clinical interventions for every relevant pediatric patient every time.

Appendix 1 provides illustrative gaps, changes tested, implemented and routinely monitored by the facility QI teams to improve RTI care. **Appendix 2** provides best practices for diagnosis, treatment, prevention and follow-up while implementing the improvement intervention (2012-2014) per each clinical condition. **Appendix 3** provides indicators for routine monitoring of the quality of outpatient care of respiratory tract infections in children.

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Appendix 1: Illustrative gaps and changes introduced by the QI teams to improve the quality of diagnosis and management of acute upper (rhinitis, sinusitis, pharyngitis) and lower (bronchitis, pneumonia) respiratory infections among children attending health care facilities (ambulatory and hospital)

Problem addressed	Change tested by a team	How change was tested and implemented	Evidence of success
Change Concept: Clinical Competence			
Poor knowledge and skills of care providers to manage acute pediatric respiratory tract infections according to evidence-based guidelines	Involved care providers in regular coaching visits	• Formation of improvement team comprised of facility managers and medical personnel • Assessing gaps in quality of RTI diagnosis and management by regular peer-review of medical charts • Condition-specific "change packages" focused on essential, high-impact, cost-effective interventions developed indicators to measure the progress in QI developed • Assigning different roles and switching the roles to regularly monitor the progress on QI (case presentation, case review and discussion, filling the routine monitoring sheet) through medical chart review and directly observed consultations • Participate in regular clinical, on-job and QI trainings, organized by the project and Respiratory Care Association • Promoting high performing providers within network of Geo-Hospitals by assigning higher responsibilities (e.g. clinical supervision of other care providers) • Participating in quarterly meetings with other QI team members to learn from each-others' experience	Provider interview results before and after 18 months of project interventions revealed that in addition to improved clinical practice, basic knowledge and skills of providers have also been significantly improved (e.g., at the intervention facilities the ratio of doctors who answered correctly on all four knowledge assessment multiple-choice questions about pneumonia and respiratory tract infections management increased from 3.6% (April, 2012) to 96.8% (November, 2013)).

Problem addressed	Change tested by a team	How change was tested and implemented	Evidence of success
Poor knowledge of medical care providers to search and appraise recommendations in terms of strength of evidence and its applicability to their clinical practice	Engaged health care providers to search international evidence, critically appraise the literature and share the evidence summaries to the QI team members and larger group of providers in the district	• Inviting QI team members to participate in Translating Research into Practice (TRIP) on-the-job trainings, conducted by the project, in collaboration with NYU nursing school • Conducting regular case study discussions and review of evidence-based medical literature during the QI team meetings • Incentivizing care providers to search and appraise medical literature by their participation in regional learning sessions and medical conferences at local, regional and national levels; Facility QI teams organizing workshops for other care providers and share the evidence updates on management of particular RTIs, co-morbidities, rare and interesting cases	Routine monitoring results of quality improvement for ambulatory management of pediatric respiratory tract infections show, that after 32 months (through April 2012 - January 2015) of interventions average compliance Index[1] to the best RTI care practice improved by 54% from the baseline 45% and reached 100% level; Average compliance with RTI management best practices at hospital level improved by 58% from the baseline 40% and reached 98%; Similarly, during April 2012 - November 2013) after the intervention, the use **of first line antibiotic** at the endline assessement increased from 36.2% to 89.2% (attributable difference 32.9%, p<0.001). In intervention facilities, the use of aminoglycosids decreased from 43.08% to 7.69% (attributable difference 33.99%, p<0.001). At the baseline in 24.8% of cases, **administered dosage** was not compliant to modern recommendations, whereas at the endline assessment, this kind of gap was not detected in any of the reviewed medical charts (attributable difference 16.88%, p=0.002).

[1] Composite index is an average of all selected percentage process indicators and shows average compliance with the best clinical practice. Results are aggregated from all multi-facility QI teams

Problem addressed	Change tested by a team	How change was tested and implemented	Evidence of success
Change Concept: Improving Efficiency			
Overutilization of unnecessary diagnostic tests and non-evidence-based medications, including antibiotics both at ambulatory clinics and hospitals	Engaged care providers in rational use of medications and diagnostic tests	• Identifying and discussing the latest evidence of using X-rays and other tests to diagnose pneumonia and assess its severity during the QI meetings and coaching visits • Identifying and discussing the latest available evidence on the evidence-based medications to treat different RTIs (including evidence on first line antibiotic use, use of antipyretics, cough medications, β2-agonists, corticosteroids and etc.) during the QI meetings and coaching visits • Conducting several team meetings, coaching visits and on-the-job trainings where the team focused on detailed assessment of history of illness, review of systems and physical exams to improve diagnosis and assessment of severity of the illness and determine further need of diagnostic tests • Conducting several team meetings, coaching visits and on-the-job trainings on patient follow up after the first line empirical therapy to determine further need of additional medications (including antibiotics)	Cost-effectiveness study conducted by the project showed that after 30 months of quality improvement interventions, incremental cost-saving per patient in case of ambulatory management of pediatric RTI was 5.2 USD due to a decreased number of unnecessary diagnostic tests and medications, when the intervention cost only 0.9 USD per patient. In other words, the intervention saved 5.7 times more than the cost of the intervention itself. Assessment of incremental cost-savings using a decision-tree analysis for each selected indicator showed that intervention dominates on business-as-usual alternative. In parallel with the increase of evidence-based practice, there was a **decrease in frequency of use of non-evidence based medications** (steroids, short-acting methylxantines, vitamines, so called metobolics etc.) Specifically the ration of medical charts with administration of at least one non-EB medication decreased from 100% at April 2012 to 40.77% (attributable difference -61%, p<0.001) at November 2013.

Problem addressed	Change tested by a team	How change was tested and implemented	Evidence of success
Limited availability of evidence-based (EB) medications in the hospitals, included in a recommended dosage and form (e.g., Amoxicillin)	Engaged hospital manager and Geo-Hospitals Corporation management to improve access to EB medications	• Discussing the issue with corporate and facility management to purchase the first choice antibiotics instead of wide spectrum of antibiotics (e.g. amoxicillin) • Proactively identifying the need of purchasing evidence-based medications in guideline recommended dose and form	During the focus group interviews, the QI team reported that since identifying the problem, the management was regularly purchasing EB medications
Change Concept: Patient/Parent Education			
Misconception among parents on the need to prescribe antibiotics and antipyretic medications to treat pediatric RTIs: it is believed that excess intravenous manipulations, parenteral medications, polypragmasis and antiobiotic prescription is partly driven by the demand and expectations of parents	Improved parent counselling on importance of rational use of antibiotics, other medications and challenges associated with inappropriate/access use of medications, including self-treatment of their children with RTIs	• Discussing during the QI team meetings on the best strategies to communicate to parents on the importance of the rational use of antibiotics, other medications and challenges associated with inappropriate/access use of medications, including self-treatment of their children with RTIs • Counselled patients/parents of the children with RTIs about rational medication use at every patient visit • Counselled parents on when to give antipyretic medication and danger signs that require follow up with care provider • Discussed the issue of irrational use of medications at medical conferences meetings and shared the success of their efforts reducing non-EB medications • Shared the massages via local media and TV by well-respected clinicians, including head of respiratory care association	The results of phone interview of patients' parents indicated improved knowledge and practice of respiratory tract infection self-management after 18 months of project interventions (from April 2012 to November 2013). Particularly, the number of respondents naming medications prescribed by the doctor that are relevant to the parent-reported diagnosis increased 28.4% (attributable difference +20.1%, $p<0.006$); Average number of medications prescribed by ambulatory care provider not relevant to diagnosis reported by patients/parents decreased from 3.8 to 1.5. Survey result also show desirable change in the prescription practice of oral antibiotics and antihistamines, as well as improved overall satisfaction. Despite the assumed non-popularity of interventions(s) at the endiline, % of parents very satisfied with the the ambulatory care and hospital services provided increased from 35.6% to 55.7% while this has not changed by more than 5% in control facilities

Appendix 2: Essential care elements/evidence-based interventions for ambulatory and hospital management of respiratory tract infections in children

1. Essential Care Elements

1.1. Diagnosis

- History of illness:
    - Duration of respiratory symptoms (cough, fever, sore throat, earache), any sick exposures
    - *Past Medical History:* any relevant history (e.g. asthma, prior pneumonia, immune compromised status, etc.)
- Review of Systems:
    - Vital signs (HR, RR, temperature)
    - Fever (extent & duration)
    - Fluid intake and urination (especially infants/young children)
    - Breathing trouble
- Physical Exam:
    - Respiratory status recorded (RR, accessory muscle use, pulsoximetry, if available)
    - Pulmonary auscultation exam: Location and extent of any rales, rhonchi or wheezes
    - Pharyngoscopy, otoscopy, if needed

1.2. Diagnostic criteria for each acute RTIs among children

- **Pneumonia**
  Main criteria: 1) symptoms: cough, difficult breathing, age-adjusted tachypnea: (age 0-2 months ≥60, 2–12 months, ≥50/min; 1–5 years, ≥40/min; ≥5 years, >20 breaths/min), fever. 2) diagnostic criteria: focal findings on auscultation (rales, decreased resonance); fever, lower chest indrawing, nasal flaring, or grunting, cyanosis, in presence of focal consolidation finding. Possible associated symptoms: inability to drink or vomiting everything, or lethargy/unconsciousness/convulsions (Harris et al., 2011).
- **Bronchitis**
  Main clinical criteria – 1): cough with or without sputum production with duration more than 3 days; 2) physical examination findings: rhonchi; absence of focal rales (to support pneumonia diagnosis); additional criteria to be assessed: fever, or vomiting in infants after swallowing sputum.
- **Pharyngitis**
  Main criteria: 1) at least one of following reported symptoms: sore throat, dysphagia; 2) at least one of following physical examination findings: tonsillitis (increased erythema/edema of posterior pharynx), tonsillar exudate, beefy red swollen uvula, and palatal petechiae, tender enlarged anterior cervical nodes. Additional criteria to be assessed for diagnosis: absence of cough, fever, weakness, headache.
    - **Suspected bacterial pharyngitis**
      Sudden onset of sore throat, Age 5–15 years, fever, headache, nausea, vomiting, abdominal pain, tonsillopharyngeal inflammation, patchy tonsillopharyngeal exudates, palatal petechiae, Aanterior cervical adenitis (tender nodes), scarlatiniform rash. Suspected viral pharyngitis: Conjunctivitis, coryza, cough, diarrhea, hoarseness, viral exanthema

- **Sinusitis**
  Main criteria: 1) at least one of following reported symptoms: blocked nose/ purulent nasal drainage x at least 2 weeks; facial pain or sinus pain particularly if aggravated by postural changes or by valsalva maneuver; additional criteria to be assessed for diagnosis: fever, maxillary or toothache, facial edema, headache, hyposmia/anosmia, nausea, cough, ear pain/feeling of pressure.
- **Otitis Media**
  Main criteria: at least one from following symptoms: 1) ear pain (especially in infants crying while swallow), fever; 2) physical exam findings: retracted or bulging Tympanic membrane with decreased mobility; ear effusion, additional criteria to be assessed for diagnosis: irritability, or fever, lethargy, anorexia or vomiting, symptoms of rhinitis in 90% of early childhood.

1.3. Treatment

1.3.1. In case of pneumonia

- Age appropriate antibiotic with appropriate dose:
  - Amoxicillin (80-100 mg/kg daily). Alternatives are Amoxicillin-clavulanate (20 mg/5 mg/kg/day to 60 mg/15 mg/kg/day for children <40kg, or 500mg/125mg for children >40kg);), oral cefalosporin,or macrolide (azithromycin (10mg/kg daily) and clarithromycin)
  - Macrolide antibiotics may be added to amoxicillin if there is no response to first-line empirical therapy
  - Macrolide should be used if mucoplasm or clamidial pneumonia is suspected;
  - In flu-associated pneumonia, first choice medication is Amoxicillin-clavulanate.
- Intravenous antibiotics (cefuroxime, cefotaxime or ceftriaxone (e.g.ceftriaxone 50-75mg/kg in 24 hours)) should be used when the child is unable to absorb oral antibiotics (e.g., because of vomiting) or presents with signs of complicated pneumonia with severe distress.
- Antipyretic: Paracetamol or Ibuprofen with age appropriate dose
- Chest X-ray referral if:
  - If symptoms not improving within 2-3 days on antibiotics
  - Known T.B. exposure or risk factor
  - Suspected foreign body (e.g. child swallowed something)

1.3.2. In case of bronchitis

- Calm comfortable environment;
- Additional liquids;
- Antipyretics;
- Effectiveness and benefit of mucolytics in children not proven;
- Cough medications do not decrease duration of disease in children, meanwhile if the phlegm evacuation depressed, bacterial complications may develop;
- There is no evidence for effectiveness of β2-agonists in case of acute bronchitis;
- Antihistamines are not recommended because they can cause dryness of phlegm and therefore reinforce cough.
- Consider antibiotic therapy if:
  - General condition worsens;
  - Fever duration more than one week;

- "Second wave" of fever present;
- Profuse or purulent phlegm;
- Mycoplasma, Chlamydia infection or Pertussis suspected due to epidemiologic situation;
- Sinusitis or Otitis at the same time with bronchitis present;
- Co-morbid conditions that may increase risk of pneumonia (immunodeficiency, chronic heart failure, chronic pulmonary disease).

1.3.3. In case of pharyngitis

- Adequate analgesia (Paracetamol or ibuprophen);
- Initiation of antibiotics if centor score >4 (fever, tonsillar exudates, enlargement and pain of cervical lymph nodes, fever, age<15) due to high probability of bacterial infection;
- Choice antibiotic in case of bacterial pharyngitis:
  - Amoxicillin, oral 50 mg/kg once daily (max = 1000 mg) for 10 days;
  - For individuals with penicillin allergy: Cephalexin,b oral 20 mg/kg/dose twice daily (max = 500 mg/dose) 10 days; Azithromycin,c oral 12 mg/kg once daily (max = 500 mg) 5 days; Clarithromycin,c oral 7.5 mg/kg/dose twice daily (max = 250 mg/dose) 10 days;
  - If patient unlikely to complete a full 10-day course of oral therapy: Penicillin G (Benzathyn Penicillin) single dose i/m, 1.200.000U in children >27 kg, and 600.000U in children with body weight under 27kg (Shulman et al., 2012)

1.3.4. In case of sinusitis

- Antibiotic therapy if following clinical symptoms:
  - Persistent symptoms (e.g. if clinical symptoms continue more than7-10 days);
  - Severe symptoms e.g. profuse purulent nasal discharge, facial pain and signs of system impairment);
  - Deterioration of patients' symptoms and condition.
- Amoxicillin-clavulanate rather than amoxicillin alone is recommended as empiric antimicrobial therapy for ABRS in children in dosage 90 mg/kg/day orally twice daily (Chow et al., 2012)

1.3.5. In case of otitis

- Assessment of pain in case of acute otitis and if pain, use of appropriate analgesic (Paracetamol Ibuprofen).
- Avoid ear drops if perforation of tympanic membrane suspected.
- Routine use of antibiotics in children under 6 months;
- From 6 months to 2 years old, antibiotic should be prescribed if bilateral otitis present.
- Children over 2 years should receive antibiotics if diagnosis clear and severe condition. If diagnosis is not clear, or clear but condition not severe, observation during 72 hours and use of analgesics is reasonable.
- Antibiotic of first choice is Amoxicillin (80-90mg/kg/day divided by 2 times). If child's age over 2 years, he/she not organized in collective and antibiotic has not been used during past 3 months, recommended dose is 40mg/kg/day.
- If treatment ineffective after 72 hours, or allergic reaction to first choice antibiotic, amoxicillin/clavulanic acid or cephalosporins are recommended.
- If symptoms persist after amoxicillin/clavulanic acid, or child unable to take oral medication, intramuscular injections of cephalosporins (cefuroxim, ceftriaxon) are reasonable.

- High-dose amoxicillin n (80–90 mg/ kg per day in 2 divided doses) is recommended as the first-line treatment. In children who have taken amoxicillin in the previous 30 days, therapy should be initiated with high-dose amoxicillin-clavulanate (90 mg/kg/day of amoxicillin, with 6.4 mg/kg/day of clavulanate. Alternative initial antibiotics include cefdinir (14 mg/kg per day in 1 or 2 doses), cefuroxime (30 mg/kg per day in 2 divided doses), cefpodoxime (10 mg/kg per day in 2 divided doses), or ceftriaxone (50 mg/kg, administered intramuscularly) (Lieberthal et al., 2013).

1.4. Severity Classification & Decision for Ambulatory versus Hospital Management

1.4.1. Ambulatory Treatment all children with <u>suspected pneumonia</u> unless:

- Age < 2 month
- Pulsoxymetry < 92%
- Respiratory Distress (Age-specific increase of RR [<2 month - >60/min, 2-12 month->50/min, 1-5 year > 40/min, >5 year>30/min], accessory muscle use, etc.)
- Dehydration or lethargy
- Inability to take oral medication
- Significant co-morbid conditions (e.g. congenital heart disease, HIV, T.B.) or uncertain diagnosis

1.4.2. In case of bronchitis ambulatory treatment of all children unless:

- Co-morbid conditions (congenital heart disease, chronic lung disease, neurologic impairment);
- Social problems – lack of care in family, absence of transportation ability
- Duration of symptoms more than 2-3 weeks;
- Signs of toxicosis
- Presence of danger signs;
- Inability to take food and liquids.

1.4.3. In case of bronchitis ambulatory treatment of all children unless:

- Stridor or shortness of breath with pain.

1.4.4. In case of sinusitis:

- Complications: orbital (orbital cellulites), local (mucocelle or mucopyocelle), intracranial (bacterial meningitis, cerebral abscesses, epidural abscesses, osteomyelitis etc.)
- Ineffective treatment with medications of second choice;
- Recurrence of disease (more than 3 episodes per year);
- Congenital anomaly of upper respiratory tract of child

1.4.5. In case of otitis:

- Appearance of purulent discharge, especially if pulsating
- Development of complications such as facial paralysis or mastoiditis.
- Three or more episodes of acute otitis during 6 months or four episodes during 12 months.
- Suspicion on hearing deficiency after treatment

1.5. In case of Ambulatory Management:

- Specific follow-up specified (time and place)
- Medication & dehydration prevention instructions documented (esp. infants/young children)
- Danger sign & urgent follow-up counseling documented

- Sequential visits or parent communication documented in chart per follow up plan
- Specific immunization advice documented

1.6. If Hospital Care, Referral & Stabilization in Clinic prior to Hospital transfer

- Standard referral form completed according to protocol including: reason for referral, treatments given in ambulatory center
- Communication with hospital documented in chart
- Transport plan documented in chart
- Age-appropriate Oxygen applied by face mask if pulsoximetry < 92% or if significant respiratory distress and no pulsoximetry measure
- Follow up plan documented in chart as communicated to family
- Follow up of patient documented in chart (e.g., phone call to family or hospital)

Appendix 3: Indicators for routine monitoring of the quality of outpatient care of respiratory tract infections in children

- % of medical charts of children with RTI related ambulatory visit in the last month for whom diagnosis is supported by medical chart documentation: at least one symptom with duration and at least one objective symptom criteria & diagnosis2 is relevant with all symptoms/objective findings recorded
- % of medical charts of children diagnosed with respiratory tract infection in last month for whom vital signs (HR, RR, temperature) are documented in the medical chart
- % of medical charts of children treated with antibiotic for RTI in last month for whom chart documentation supports antibiotic use
- % of medical charts of children treated with antibiotic for RTI in last month with first-line antibiotic (Co-amoxiclav for sinusitis and amoxicillin for all other conditions) used
- Average # of antibiotics administered for each child treated for RTI with an antibiotic
- Average number of non-evidence based medications prescribed per child with acute RTI diagnosis (except antibiotic, antipyretic and justified by documented condition/symptom)
- % of medical charts of children RTI-related ambulatory visit in last month where counselling on influenza vaccination is recorded in the chart
- % of medical charts of children RTI-related ambulatory visit in last month with adequate follow-up visit recorded in the chart
- % of medical charts of children RTI-related ambulatory visit in last month with the signs of severe disease where referral to the hospital is recorded based on severity assessment
- % of medical charts of children RTI-related ambulatory visit in last month with parenteral medications prescribed
- % of medical charts of children RTI-related ambulatory visit in last month with recommendations, prescribed medications with dosage and duration recorded in the chart

[2] For diagnostic criteria, justified antibiotic use and recommended first line treatment, see Appendix 2

References

Chow, A. W., Benninger, M. S., Brook, I., Brozek, J. L., Goldstein, E. J., Hicks, L. A., ... & File, T. M. (2012). IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. *Clinical Infectious Diseases,* cir1043.

Harris, M., Clark, J., Coote, N., Fletcher, P., Harnden, A., McKean, M., & Thomson, A. (2011). British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. *Thorax*, 66 (Suppl 2), ii1-ii23 Available at: https://www.brit-thoracic.org.uk/document-library/clinical-information/pneumonia/paediatric-pneumonia/bts-guidelines-for-the-management-of-community-acquired-pneumonia-in-children-update-2011/

Lieberthal, A. S., Carroll, A. E., Chonmaitree, T., Ganiats, T. G., Hoberman, A., Jackson, M. A., ... & Tunkel, D. E. (2013). The diagnosis and management of acute otitis media. *Pediatrics*, 131(3), e964-e999.

Shulman, S. T., Bisno, A. L., Clegg, H. W., Gerber, M. A., Kaplan, E. L., Lee, G., ... & Van Beneden, C. (2012). Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clinical infectious diseases*, cis629.