Designing tools for healthcare in low-income regions

Brian DeRenzi

http://change.washington.edu

6 August 2012
Population (per doctor)

USA 374 (2004)
Cuba 156 (2007)
Tanzania 125,000 (2006)

World Bank http://data.worldbank.org/indicator/SH.MED.PHYS.ZS
Rural, Sparsely Populated
INTEGRATED MANAGEMENT OF CHILDHOOD

SICK CHILD
AGE 2 MONTHS UP TO 5 YEARS

ASSESS AND CLASSIFY THE SICK CHILD
 Assess, Classify and Identify Treatment
 Check for General Danger Signs...............................2
 Then Ask About Main Symptoms:
 Does the child have cough or difficult breathing?.........2
 Does the child have diarrhoea?..............................3
 Does the child have fever?..................................4
 Classify malaria..............................................4
 Classify measles.............................................4
 Does the child have an ear problem?.........................5
 Then Check for Malnutrition and Anaemia.................6
 Then Check the Child’s Immunization Status..............6
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TREAT THE CHILD
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 Give Extra Fluid for Diarrhoea and Continue Feeding
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 Food
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SICK YOUNG INFANT
AGE 1 WEEK INFANT UP TO 2 MONTHS

ASSESS, CLASSIFY AND TREAT THE SICK YOUNG INFANT
 Assess, Classify and Identify Treatment
 Check for Possible Bacterial Infection.....................22
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 Then Check for Feeding Problem or Low Weight..........24
 Then Check the Young Infant’s Immunization Status.....25
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 Local Bacterial Infection...................................29
 Dysentery........................................................29
 Feeding Problem.............................................30
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 Thrush............................................................30

RECORDING FORMS
 SICK YOUNG INFANT........................................31
 SICK CHILD....................................................33

WEIGHT FOR AGE CHART.......................................on back cover
Range of Health Workers
Community Health Workers

Photo: Amelia Sagoff
Home Visits
Health Education
e-IMCI
GIVE EXTRA FLUID FOR DIARRHOEA AND CONTINUE FEEDING

(See FOOD advice on COUNSEL THE MOTHER chart)

➢ Plan A: Treat Diarrhoea at Home
Counsel the mother on the 3 Rules of Home Treatment:
Give Extra Fluid, Continue Feeding, When to Return

1. GIVE EXTRA FLUID (as much as the child will take)
   ➢ TELL THE MOTHER:
   - Breastfeed frequently and for longer at each feed.
   - If the child is exclusively breastfed, give ORS or clean water in addition to breastmilk.
   - If the child is not exclusively breastfed, give one or more of the following: ORS solution, food-based fluids (such as soup, rice water, and yoghurt drinks), or clean water.
   
   It is especially important to give ORS at home when:
   - the child has been treated with Plan B or Plan C during this visit.
   - the child cannot return to a clinic if the diarrhoea gets worse.

➢ TEACH THE MOTHER HOW TO MIX AND GIVE ORS. GIVE THE MOTHER 2 PACKETS OF ORS TO USE AT HOME.

➢ SHOW THE MOTHER HOW MUCH FLUID TO GIVE IN ADDITION TO THE USUAL FLUID INTAKE:
   - Up to 2 years: 50 to 100 ml after each loose stool
   - 2 years or more: 100 to 200 ml after each loose stool

Tell the mother to:
   - Give frequent small sips from a cup.
   - If the child vomits, wait 10 minutes. Then continue, but more slowly.
   - Continue giving extra fluid until the diarrhoea stops.

2. CONTINUE FEEDING
3. WHEN TO RETURN } See COUNSEL THE MOTHER chart

➢ Plan B: Treat Some Dehydration with ORS
Give in clinic recommended amount of ORS over 4-hour period
➢ DETERMINE AMOUNT OF ORS TO GIVE DURING FIRST 4 HOURS.

<table>
<thead>
<tr>
<th>AGE*</th>
<th>Up to 4 months</th>
<th>4 months up to 12 months</th>
<th>12 months up to 2 years</th>
<th>2 years up to 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 6 kg</td>
<td>400 - 600</td>
<td>600 - 700</td>
<td>700 - 900</td>
<td>900 - 1400</td>
</tr>
<tr>
<td>6 - &lt; 10 kg</td>
<td>400 - 600</td>
<td>600 - 700</td>
<td>700 - 900</td>
<td>900 - 1400</td>
</tr>
<tr>
<td>10 - &lt; 12 kg</td>
<td>700 - 900</td>
<td>700 - 900</td>
<td>700 - 900</td>
<td>900 - 1400</td>
</tr>
<tr>
<td>12 - 19 kg</td>
<td>900 - 1400</td>
<td>900 - 1400</td>
<td>900 - 1400</td>
<td>900 - 1400</td>
</tr>
</tbody>
</table>

* Use the child’s age only when you do not know the weight. The approximate amount of ORS required (in ml) can also be calculated by multiplying the child’s weight (in kg) times 75.

➢ If the child wants more ORS than shown, give more.
➢ For infants under 6 months who are not breastfed, also give 100-200 ml clean water during this period.

➢ SHOW THE MOTHER HOW TO GIVE ORS SOLUTION.
   - Give frequent small sips from a cup.
   - If the child vomits, wait 10 minutes. Then continue, but more slowly.
   - Continue breastfeeding whenever the child wants.

➢ AFTER 4 HOURS:
   - Reassess the child and classify the child for dehydration.
   - Select the appropriate plan to continue treatment.
   - Begin feeding the child in clinic.

➢ IF THE MOTHER MUST LEAVE BEFORE COMPLETING TREATMENT:
   - Show her how to prepare ORS solution at home.
   - Show her how much ORS to give to finish 4-hour treatment at home.
   - Give her enough ORS packets to complete rehydration. Also give her 2 packets as recommended in Plan A.
   - Explain the 3 Rules of Home Treatment:
      1. GIVE EXTRA FLUID
      2. CONTINUE FEEDING
      3. WHEN TO RETURN } See Plan A for recommended fluids and See COUNSEL THE MOTHER chart

UNICEF

WHO
Cough, diarrhea, fever, ear pain, malnutrition
Mortality 13% Lower
(in Tanzania)

95% CI: -7%, 30%

Armstrong Schellenberg, J. et al., Effectiveness and cost of facility-based Integrated... The Lancet, 2004
IMCI Not Often Followed

- Expense of training ($1150 - $1450) per person
- Not sufficient supervision
- Chart booklet:
  - Takes a long time to use
  - Natural tendency to be less rigorous
  - Social pressure

Tuesday, August 7, 12
Does the child have cough or difficult breathing?

**IF YES, ASK:**

- For how long?

**LOOK, LISTEN, FEEL:**

- Count the breaths in one minute.
- Look for chest indrawing.
- Look and listen for stridor.

**Classify COUGH or DIFFICULT BREATHING**

CHILD MUST BE CALM

**If the child is:**

- 2 months up to 12 months
- 12 months up to 5 years

**Fast breathing is:**

- 50 breaths per minute or more
- 40 breaths per minute or more

Tuesday, August 7, 12
Does the child have cough or difficult breathing?

**IF YES, ASK:**

- For how long?

**LOOK, LISTEN, FEEL:**

- Count the breaths in one minute.
- Look for chest indrawing.
- Look and listen for stridor.

**Classify COUGH or DIFFICULT BREATHING**

If the child is: | Fast breathing is:
--- | ---
2 months up to 12 months | 50 breaths per minute or more
12 months up to 5 years | 40 breaths per minute or more
<table>
<thead>
<tr>
<th>SIGNS</th>
<th>CLASSIFY AS</th>
<th>TREATMENT</th>
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</thead>
</table>
| • Any general danger sign or  
  • Chest indrawing or  
  • Stridor in calm child. | SEVERE PNEUMONIA OR VERY SEVERE DISEASE | ➢ *Give first dose of an appropriate antibiotic.*  
➢ Refer URGENTLY to hospital.* |
| • Fast breathing. | PNEUMONIA | ➢ *Give an appropriate antibiotic for 5 days.*  
➢ Soothe the throat and relieve the cough with a safe remedy.  
➢ Advise mother when to return immediately.  
➢ Follow-up in 2 days. |
| No signs of pneumonia or very severe disease. | NO PNEUMONIA: COUGH OR COLD | ➢ If coughing more than 30 days, refer for assessment.  
➢ Soothe the throat and relieve the cough with a safe remedy.  
➢ Advise mother when to return immediately.  
➢ Follow-up in 5 days if not improving. |
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➢ Advise mother when to return immediately.  
➢ Follow-up in 5 days if not improving. |
### Give an Appropriate Oral Antibiotic

#### FOR PNEUMONIA, ACUTE EAR INFECTION OR VERY SEVERE DISEASE:

**FIRST-LINE ANTIBIOTIC:**

**SECOND-LINE ANTIBIOTIC:**

<table>
<thead>
<tr>
<th>AGE or WEIGHT</th>
<th>ADULT TABLET</th>
<th>PEDIATRIC TABLET</th>
<th>SYRUP</th>
<th>TABLET</th>
<th>SYRUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>80 mg trimethoprim + 400 mg sulphamethoxazole</td>
<td>20 mg trimethoprim +100 mg sulphamethoxazole</td>
<td>40 mg trimethoprim +200 mg sulphamethoxazole per 5 ml</td>
<td>250 mg</td>
<td>125 mg per 5 ml</td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>1</td>
<td>3</td>
<td>7.5 ml</td>
<td>1</td>
<td>10 ml</td>
</tr>
</tbody>
</table>

- Give two times daily for 5 days
- Give three times daily for 5 days
> **Give an Appropriate Oral Antibiotic**

For Pneumonia, Acute Ear Infection or Very Severe Disease:

<table>
<thead>
<tr>
<th>AGE or WEIGHT</th>
<th>ADULT TABLET</th>
<th>PEDIATRIC TABLET</th>
<th>SYRUP</th>
<th>TABLET</th>
<th>SYRUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>80 mg trimethoprim + 400 mg</td>
<td>20 mg trimethoprim + 100 mg sulphamethoxazole</td>
<td>40 mg trimethoprim + 200 mg sulphamethoxazole per 5 ml</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>sulphamethoxazole</td>
<td></td>
<td>per 5 ml</td>
<td>2</td>
<td>5 ml</td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>1</td>
<td>3</td>
<td>7.5 ml</td>
<td>1</td>
<td>10 ml</td>
</tr>
</tbody>
</table>

- **COTRIMOXAZOLE** (trimethoprim + sulphamethoxazole)
  - Give two times daily for 5 days

- **AMOXYCILLIN**
  - Give three times daily for 5 days

---

Tuesday, August 7, 12
## Give an Appropriate Oral Antibiotic

**FOR PNEUMONIA, ACUTE EAR INFECTION OR VERY SEVERE DISEASE:**

<table>
<thead>
<tr>
<th>AGE or WEIGHT</th>
<th>FIRST-LINE ANTIBIOTIC</th>
<th>SECOND-LINE ANTIBIOTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ADULT TABLET</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80 mg trimethoprim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ 400 mg sulphamethoxazole</td>
<td></td>
</tr>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td><strong>PEDIATRIC TABLET</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 mg trimethoprim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+100 mg sulphamethoxazole</td>
<td></td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>SYRUP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 mg trimethoprim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+200 mg sulphamethoxazole</td>
<td>per 5 ml</td>
</tr>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>5.0 ml</td>
<td>5 ml</td>
</tr>
<tr>
<td></td>
<td><strong>TABLET</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>250 mg</td>
<td></td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>7.5 ml</td>
<td>10 ml</td>
</tr>
<tr>
<td></td>
<td><strong>SYRUP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>125 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>per 5 ml</td>
<td></td>
</tr>
</tbody>
</table>
Give an Appropriate Oral Antibiotic

FOR PNEUMONIA, ACUTE EAR INFECTION OR VERY SEVERE DISEASE:

FIRST-LINE ANTIBIOTIC:  
SECOND-LINE ANTIBIOTIC:  

<table>
<thead>
<tr>
<th>AGE or WEIGHT</th>
<th>COTRIMOXAZOLE (trimethoprim + sulphamethoxazole)</th>
<th>AMOXYCILLIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Give two times daily for 5 days</td>
<td>Give three times daily for 5 days</td>
</tr>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>ADULT TABLET 80 mg trimethoprim + 400 mg sulphamethoxazole</td>
<td>TABLET 250 mg</td>
</tr>
<tr>
<td></td>
<td>PEDIATRIC TABLET 20 mg trimethoprim + 100 mg sulphamethoxazole</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYRUP 40 mg trimethoprim + 200 mg sulphamethoxazole per 5 ml</td>
<td></td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5 ml</td>
</tr>
<tr>
<td></td>
<td>5.0 ml</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>10 ml</td>
<td>10 ml</td>
</tr>
</tbody>
</table>

Tuesday, August 7, 12
## Give an Appropriate Oral Antibiotic

**FOR PNEUMONIA, ACUTE EAR INFECTION OR VERY SEVERE DISEASE:**

**FIRST-LINE ANTIBIOTIC:**

**SECOND-LINE ANTIBIOTIC:**

<table>
<thead>
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<th>SYRUP</th>
<th>TABLET</th>
<th>SYRUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months up to 12 months (4 - &lt;10 kg)</td>
<td>1/2 80 mg trimethoprim + 400 mg sulphamethoxazole</td>
<td>2 20 mg trimethoprim +100 mg sulphamethoxazole</td>
<td>5.0 ml 40 mg trimethoprim +200 mg sulphamethoxazole per 5 ml</td>
<td>1/2 250 mg</td>
<td>5 ml 125 mg per 5 ml</td>
</tr>
<tr>
<td>12 months up to 5 years (10 - 19 kg)</td>
<td>1 80 mg trimethoprim + 400 mg sulphamethoxazole</td>
<td>3 20 mg trimethoprim +100 mg sulphamethoxazole</td>
<td>7.5 ml 40 mg trimethoprim +200 mg sulphamethoxazole per 5 ml</td>
<td>1 250 mg</td>
<td>10 ml 125 mg per 5 ml</td>
</tr>
<tr>
<td>SIGNS</td>
<td>CLASSIFY AS</td>
<td>TREATMENT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Any general danger sign or                                         | SEVERE PNEUMONIA OR VERY SEVERE DISEASE | ➢ *Give first dose of an appropriate antibiotic.*  
                                                                                     |                                    | ➢ *Refer URGENTLY to hospital.*  |
| • Chest indrawing or                                                 |                                    |                                                                           |
| • Stridor in calm child.                                             |                                    |                                                                           |
| • Fast breathing.                                                    | PNEUMONIA                          | ➢ *Give an appropriate antibiotic for 5 days.*  
                                                                                     |                                    | ➢ Soothe the throat and relieve the cough with a safe remedy.  
                                                                                     |                                    | ➢ Advise mother when to return immediately.  
                                                                                     |                                    | ➢ Follow-up in 2 days.  |
| No signs of pneumonia or very severe disease.                        | NO PNEUMONIA: COUGH OR COLD        | ➢ If coughing more than 30 days, refer for assessment.  
                                                                                     |                                    | ➢ Soothe the throat and relieve the cough with a safe remedy.  
                                                                                     |                                    | ➢ Advise mother when to return immediately.  
                                                                                     |                                    | ➢ Follow-up in 5 days if not improving.  |
**EXAMINE:** Does the child have sunken eyes?

- [ ] No
- [ ] Yes
<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start classification</td>
<td>Ok</td>
</tr>
<tr>
<td>Diarrhoea duration</td>
<td>Less than two weeks</td>
</tr>
<tr>
<td>Bloody stool</td>
<td>No</td>
</tr>
<tr>
<td>Offer fluid</td>
<td>Ok</td>
</tr>
<tr>
<td>How drinking</td>
<td>Drinking, but not eagerly</td>
</tr>
</tbody>
</table>

**EXAMINE:** Does the child have sunken eyes?
- No
- Yes
<table>
<thead>
<tr>
<th></th>
<th>Ok</th>
<th>Less than two weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start classification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diarrhoea duration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bloody stool</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Offer fluid</strong></td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td><strong>Examine:</strong> Does the child have sunken eyes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**How drinking**
Drinking, but not eagerly
<table>
<thead>
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[Image of a mobile application interface showing a form with fields for assessing diarrhea.]
Adherence Increase with e-IMCI

All Investigations
- Conventional Practice (61.0%)
- e-IMCI (84.7%)

Advice to Mother
- Conventional Practice (56.9%)
- e-IMCI (77.4%)

p < 0.01

(24 children, N=299) (27 children, N=359)
Community Health Workers

Photo: Amelia Sagoff

Tuesday, August 7, 12
Uttar Pradesh, India

Newborn Deaths down 54%

Kumar, V., et al., Effect of community-based behaviour change management... The Lancet 2008
Missed visits

Late visits
Reminders
for CHWPs
Day before

Day of

One day late

Two days late

Tuesday, August 7, 12
Two days late

Three days late

Four days late

Five days late

Tuesday, August 7, 12
CHW Performance Over Time

Mean Ratio of on time clients

Oct 1  Nov 1  Dec 1  Jan 1  Feb 1  Mar 1  Apr 1  May 1  Jun 1
2010  2011

Tuesday, August 7, 12
Study 1
Intervention

Study 2
Intervention

CHW Performance Over Time

Mean Ratio of on time clients

SMS + Supervisor
Control

SMS-Only

CHW Performance Over Time

Tuesday, August 7, 12
Day before
Day of
One day late
Two days late
Two days late
SMS
Three days late
SMS
Four days late
SMS
Five days late
SMS
More projects

- Performance feedback: completing the loop
- Decision support: breath counter, sensors
- Computer vision: read rapid diagnostic tests
- Videos: health worker mediated videos
- Breast milk: HIV+ milk pasteurization