Adherence to management guidelines in acute respiratory infections and diarrhoea in children under 5 years old in primary health care in Botswana

EELCO BOONSTRA1, MORTEN LINDBÆK1 AND ENOCH NGOME2

1University of Oslo, Department of General Practice and Community Medicine, Oslo, Norway, and 2University of Botswana, Department of Population Studies, Gaborone, Botswana

Abstract

Objective. To evaluate health care providers’ adherence to management guidelines for acute respiratory infection and diarrhoea in children under 5 years old in Botswana primary health care.

Design. Cross-sectional prospective field survey. Data collection was carried out through observation of consecutive consultations at 30 randomly assigned clinics and health posts in three purposely chosen districts.

Study participants. This study comprises 185 cases of acute respiratory infection and 85 cases of diarrhoea.

Main measures. Criteria for acceptable standards of history taking and physical examination for acute respiratory infection and diarrhoea were defined as well as criteria for categorizing the appropriateness of antibiotic prescription. The percentage of oral dehydration salts provided in cases of diarrhoea was calculated.

Results. Acute respiratory infection and diarrhoea accounted for 270 (including 15 missing cases) of all main diagnoses (n = 539). In 262 cases (97%) health care providers were nurses or enrolled nurses; in 3% family welfare educators. Acceptable history taking, physical examination, and both combined in acute respiratory infection was found in 113 (63%), 32 (18%), and 28 (16%), and in diarrhoea in 45 (58%), 26 (34%) and 20 (26%) cases, respectively. Antibiotics were prescribed in 76 of 255 (30%) cases. Prescription was assessed as inappropriate in 56 of 76 (74%) of all cases; in 41 of 52 (79%) cases with acute respiratory infection, in none of the pneumonia cases, and in all 15 cases of diarrhoea. Oral rehydration salts were prescribed in 74 (87%) of the diarrhoea cases.

Conclusions. Health care providers’ adherence to guidelines on history taking was suboptimal in acute respiratory infection and diarrhoea but poor on examination in both conditions. A high level of inappropriate antibiotic prescription was found in acute respiratory infection and diarrhoea. Overall, there is considerable scope for improving diagnostic and therapeutic management of these major childhood diseases in Botswana primary health care.

Keywords: acute respiratory infections, adherence, Botswana, children under 5 years old, diarrhoea, management guidelines, primary health care

Introduction

In low-income countries acute respiratory infection and diarrhoea account for 27% and 23%, respectively, of childhood mortality and are leading causes of childhood morbidity [1,2]. In acute respiratory infections, it is assumed that 80–90% of deaths are caused by pneumonia [1].

In both developed [3] and developing [4,5] countries, inappropriate management and prescription of medications by health workers is common, as well as misclassification of illness by health workers. A study in Kenya showed that only 8% correctly diagnosed severe pneumonia [6].

Overprescription and abuse of antibiotics in the treatment of acute respiratory infections [7,8] and diarrhea [9] is a worldwide problem, potentially leading to widespread antibiotic resistance.

Poor access to medical services, and inadequate referral and treatment are important determinants in infant mortality.
The aim of this study was to evaluate health care providers’ adherence to national diagnostic and antibiotic treatment guidelines for acute respiratory infections and diarrhea in children below the age of 5 years in Botswana primary health care.

**Methods**

Sampling took place at two levels: a purposeful selection was made of three of the country’s 22 health districts, representing an urban, a semi-urban, and a rural setting. Within each of these districts 10 primary health care facilities were randomly selected (Table 1). The target number of consecutive consultations per health facility was relative to 1996 attendance. The surveyors stayed at the selected health facility until the target number was reached. The patient encounter was the unit of sampling and study.

Inclusion criteria: all consultations, both first visits and controls; oral consent for participation in the study by the parent. Exclusion criteria: weight control and vaccination of healthy children; antenatal control and family planning in healthy women; direct observed treatment of tuberculosis.

At clinics consultations are carried out by nurses (3–5 years of training), at health posts by a nurse (3–4 years), or enrolled nurse (2 years). When there were staff shortages, family welfare educators (3 months training) sometimes carry out consultations. Only one health worker carried out ill-child consultations at each of the health facilities.

The survey was carried out by a team of two nurses and a pharmacy technician, who were trained before and during the pilot survey. The first nurse observed the consultation process with minimal interference. The pharmacy technician observed the dispensing process. The second nurse interviewed the caretaker about her/his knowledge of the medicines dispensed. The nurse–surveyor, an experienced family nurse practitioner, recorded the main diagnosis, which the consulting nurse entered in the outpatient register. This register is compatible with the International Classification of Health Problems in Primary Care.

**Table 1**Sampling scheme

<table>
<thead>
<tr>
<th></th>
<th>Ngami (n = 1000)</th>
<th>Gaborone (n = 997)</th>
<th>Kgalagadi (n = 997)</th>
<th>Total (n = 2294)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population number</td>
<td>63 651</td>
<td>192 845</td>
<td>12 575</td>
<td>269 071</td>
</tr>
<tr>
<td>Sampling frame of primary HCF</td>
<td>19</td>
<td>13</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>Number of clinics included in the survey (total number in brackets)</td>
<td>2 (5)</td>
<td>10 (13)</td>
<td>2 (5)</td>
<td>14 (23)</td>
</tr>
<tr>
<td>Number of health posts included in the survey (total number in brackets)</td>
<td>8 (14)</td>
<td>0 (0)</td>
<td>8 (13)</td>
<td>16 (27)</td>
</tr>
<tr>
<td>Sample fraction</td>
<td>0.53</td>
<td>0.77</td>
<td>0.56</td>
<td>0.60</td>
</tr>
<tr>
<td>No. of sampled children &lt;5 years old</td>
<td>251</td>
<td>154</td>
<td>134</td>
<td>539</td>
</tr>
</tbody>
</table>

The sampling levels are the district and the primary health care facility. Sampling characteristics by health district.


2The primary sampling unit is the consultation.
Acute respiratory tract infections

Diarrhoea

Adherence to management guidelines

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>History taking (%)</th>
<th>Examination n (%)</th>
<th>History and examination n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute respiratory tract infections (n = 178) [95% CI]</td>
<td>113 (63) [57–71%]</td>
<td>32 (18) [12–24%]</td>
<td>28 (16) [13–19%]</td>
</tr>
<tr>
<td>Diarrhoea (n = 77) [95% CI]</td>
<td>45 (58) [48–68%]</td>
<td>26 (34) [24–44%]</td>
<td>20 (26) [16–36%]</td>
</tr>
</tbody>
</table>

1Defined acceptable quality: history taking: duration of cough and fever; physical examination: taking the temperature, respiratory rate, and/or looking for chest indrawing.
2Defined acceptable quality: history taking: duration of the diarrhoea and presence of blood in the stools; physical examination: taking of temperature, performing skin pinch, and/or weight taken.

Research and ethical clearance was obtained from the Ministry of Health in Botswana and the Regional Committee for Medical Research Ethics in Norway. The survey was carried out from June to November 1998.

A Data Set Dictionary was designed and all data from 2994 questionnaires were entered into EPI-Info 6. Conversion of the Epi-Info data set to Statistical Package for the Social Sciences [20] (SPSS) was done, but both Epi-Info and SPSS were used in the analysis of the data. Confidence intervals were calculated for levels of adherence to diagnostic guidelines. One-level and multilevel logistic regression analysis of factors independently associated with the defined acceptable standard of diagnosis was performed in Epi-Info, SPSS, and MLwiN (http://multilevel.ioe.ac.uk/index.htm), using the following independent variables: geographical district, type of health facility, sex, and designation of health worker.

Results

Materials

The data comprise 539 encounters of children under 5 years old, comprising 18% of all 2994 consultations (country-wide 15% [15]). The mean age of this cohort was 1.70 years. Acute respiratory infection comprised 185 (34%), and diarrhoea 85 (16%) cases (Table 3). In eight and seven cases of acute respiratory infection and diarrhoea, respectively, no check-lists had been filled in.

Staff and referrals

Of 270 cases, 231 (86%) were carried out by nurses; 31 (11%) by enrolled nurses, and eight (3%) by family welfare educators. None of the diarrhoea cases was referred. Of four cases with acute respiratory infection (2.2%), two were referred to the hospital and two to the Senior District Medical Officer. However, none of these cases was diagnosed as pneumonia.
Adherence to guidelines on history taking and physical examination

Table 4 gives the number of items checked out in the consultations for acute respiratory infection and diarrhoea. In acute respiratory infection the most frequent symptoms asked for were duration of cough (97%) and fever (64%), and the most frequent signs looked for were temperature (88%) and chest indrawing (16%). The respiratory rate was registered in 11 (6%) only. In diarrhoea the symptoms most frequently asked for were duration (82%) and the presence of blood in the stools (83%). The temperature was registered in 88% of the cases. The skin pinch was carried out in one-third of the cases and the weight taken in only 14%.

In acute respiratory infection and diarrhoea, an acceptable standard of history taking was reached in 63% and 58%, of examination in 18% and 34%, and of both history and examination in 16% and 26%, respectively (Table 2).

One-level logistic regression analysis showed a significant association with the district [Gaborone: OR = 4.7 (95% CI: 2.0–11.2), \( P < 0.0001 \); Ngami: OR = 1.7 (95% CI: 0.6–4.4), \( P = 0.3 \)] and type of health facility [clinics: OR = 0.3 (95% CI: 0.1–0.7), \( P = 0.009 \)]. In the multilevel logistic regression analysis, the single health facility was used as level 2. However, while tendencies remained, the effects that were found to be statistically significant in the one-level logistic regression were now non-significant.

Table 3 Main diagnosis groups in children <5 years old (\( n = 539 \)) by sex, compared with 1998 outpatient statistics for Botswana (\( N = 687,653 \))

<table>
<thead>
<tr>
<th>Diagnosis group</th>
<th>Total ( n (%) )</th>
<th>1998 Outpatient statistics Botswana, ( n (%) )</th>
<th>Statistical significance, ( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the respiratory tract(^1)</td>
<td>185 (34)</td>
<td>233,907 (34)</td>
<td>0.9</td>
</tr>
<tr>
<td>Diarrhoecal diseases</td>
<td>85 (16)</td>
<td>92,467 (13)</td>
<td>0.2</td>
</tr>
<tr>
<td>Symptom diagnosis</td>
<td>74 (14)</td>
<td>107,377 (16)</td>
<td>0.3</td>
</tr>
<tr>
<td>Other</td>
<td>158 (29)</td>
<td>176,830 (26)</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>539 (100)</td>
<td>687,653 (100)</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)This figure includes nine cases of pneumonia.

Table 4 Health workers’ adherence to national algorithms for acute respiratory infection (ARI) and diarrhoea, by history taking and physical examination

<table>
<thead>
<tr>
<th>ARI(^1) (( n = 178 ))</th>
<th>( n (%) )</th>
<th>Diarrhoea(^2) (( n = 77 ))</th>
<th>( n (%) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>History: symptoms asked for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of cough</td>
<td>173 (97)</td>
<td>Duration of diarrhoea</td>
<td>68 (82)</td>
</tr>
<tr>
<td>Duration of fever</td>
<td>114 (64)</td>
<td>Blood in the stools</td>
<td>69 (83)</td>
</tr>
<tr>
<td>Loss of appetite</td>
<td>73 (41)</td>
<td>Thirstiness</td>
<td>37 (45)</td>
</tr>
<tr>
<td>Reduced fluid intake</td>
<td>60 (34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheezing</td>
<td>21 (12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convulsions</td>
<td>13 (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drowsiness</td>
<td>10 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examination: signs looked for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature registered</td>
<td>157 (88)</td>
<td>Temperature registered</td>
<td>68 (88)</td>
</tr>
<tr>
<td>Chest indrawing</td>
<td>29 (16)</td>
<td>Skin turgor (skin pinch)</td>
<td>24 (31)</td>
</tr>
<tr>
<td>Respiratory count</td>
<td>11 (6)</td>
<td>Weight taken</td>
<td>11 (14)</td>
</tr>
<tr>
<td>Stridor</td>
<td>5 (3)</td>
<td>Sunken fontanel</td>
<td>7 (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sunken eyes</td>
<td>6 (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presence of tears</td>
<td>6 (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dry tongue</td>
<td>3 (4)</td>
</tr>
</tbody>
</table>

\(^1\)No questionnaire filled in: 7.
\(^2\)No questionnaire filled in: 8.
Antibiotic prescribing

Antibiotics were prescribed in 61 of 178 (34%) cases with acute respiratory infection and in 15 of 77 (19%) diarrhoea cases.

Acute respiratory infections. In 41 (79%) of the non-pneumonia cases, but in none of the pneumonia cases, antibiotic prescription was inappropriate. The antibiotics most commonly prescribed were phe noxy-methylpenicillin and amoxicillin.

Diarrhoea. The nurse—surveyor assessed 83 (98%) of the diarrhoea cases as mild, one (1%) as moderate, and one (1%) as severe. No diarrhoea cases were referred. All antibiotic prescriptions were assessed as inappropriate (Table 5). Co-trimoxazol was the most frequently prescribed antibiotic. In 24 (28%) cases metronidazole was prescribed. Oral rehydration salts were prescribed in 74 (87%) of the cases.

Discussion

This survey shows that health care providers’ adherence to guidelines on history taking was suboptimal, but poor on examination in both acute respiratory infection and diarrhoea cases. The level of inappropriate antibiotic prescription was high.

Limitations of the study

Limitations. One of the weaknesses of this study is the risk of observer bias. We tried to minimize this by not announcing the visits by the research team. Even though the process of being observed by a surveyor may have resulted in improved performance, we assume this to be unlikely, because health workers in Botswana are used to being visited by health officials, in this case by a nurse who was one of their own.

During the consultation there was only minimal interference by the surveyors. Only in cases where clinical mismanagement posed a serious threat to the health of the child, was information to correct this given to the consulting nurse before the child left the health facility. This, together with observer bias may have resulted in overestimation of adherence to management guidelines.

The survey was carried out in the period June–November 1998. This period covers about 4 months of the winter and 2 month of the summer season. This may have resulted in over-representation of acute respiratory infections, which are more prevalent during the winter season, and towards under-representation of diarrhoeal diseases, which are more prevalent during the summer season.

Among the additional diagnoses were 12 cases of acute respiratory infection or diarrhoea. Six patients with an acute respiratory infection or diarrhoea as the main diagnosis also had an additional diagnosis of diarrhoea or acute respiratory infection, respectively. Since no check-list was filled in these cases, we do not know the quality of diagnosis of 18 cases. However, missing information from these cases (7%) is unlikely to have affected our main results.

Validity. The reason why we opted for a disproportionate sample was based on a compromise between available staff and transport resources, time frame, and access to the health facilities. We opted for quite a big sample size in order to allow for meaningful statistical analyses. Conversely, this choice may have affected representativity: health facility sample fraction by district differs as well as the number of encounters relative to the district population. However, the encounter, not prevalence of diagnoses, was the subject of study. Similar age distribution and prevalence of acute respiratory infection and diarrhoea, compared with national outpatient figures [12], support our belief that this study is representative of primary health care in Botswana.

Since verification of the diagnosis against a gold standard was not the subject of this survey, the level of uncertainty about the validity of the diagnosis and treatment is considerable.

The WHO-based algorithm for acute respiratory infections has a specificity of only 80% [21]. Cough and tachypnoea may be interpreted as pneumonia but are also caused by severe anaemia or malaria [22]. The IMCI algorithm appears to be

Table 5 Adherence to guidelines on antibiotic prescription in children <5 years old

<table>
<thead>
<tr>
<th></th>
<th>ARI, n = 169, n (%)</th>
<th>Pneumonia, n = 9, n (%)</th>
<th>Diarrhoea, n = 77, n (%)</th>
<th>Total, n = 255, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of antibiotic prescription¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescription appropriate²</td>
<td>41 (79)</td>
<td>0 (0)</td>
<td>15 (20)</td>
<td>56 (74)</td>
</tr>
<tr>
<td>Prescription doubtful³</td>
<td>4 (8)</td>
<td>1 (11)</td>
<td>0 (0)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Prescription inappropriate⁴</td>
<td>12 (19)</td>
<td>8 (89)</td>
<td>0 (0)</td>
<td>20 (13)</td>
</tr>
<tr>
<td>Encounters with antibiotics prescribed (%)</td>
<td>52 (100)</td>
<td>9 (100)</td>
<td>15 (100)</td>
<td>76 (100)</td>
</tr>
</tbody>
</table>

¹Includes all systemic antibiotics apart from metronidazole prescribed in 24 diarrhoea cases.
²Criteria of appropriate prescription: ARI and pneumonia: temperature >37.5°C. Diarrhoea: all cases with moderate or severe diarrhoea. All cases treated with anti-parasitic medication (metronidazole) were regarded as appropriate, but are not included.
³Criteria of doubtful prescription: ARI and pneumonia: temperature not measured. Diarrhoea: cases not classifying for ² or ⁴.
⁴Criteria of appropriate prescription: ARI: temperature ≤37.5°C; pneumonia: no fever. Diarrhoea: all mild cases of diarrhoea.
We could not find a significant association with relevant explanatory variables in the multilevel logistic regression analysis. This may be related to the relatively small number of encounters. However, we have in a previous paper [14] shown that for all age groups (n = 2994), clinic staff, who are better qualified than health post staff, adhered significantly better to national treatment guidelines than health post staff. All nurses (including enrolled nurses) have been trained in the management of acute respiratory infection and diarrhoea since the introduction of these programmes.

Adherence to national treatment guidelines

Acute respiratory infection. The level of inappropriate antibiotic prescription in acute respiratory infection was too high. In general, only a minority of all lower respiratory tract infections should be treated with antibiotics; upper respiratory infections should not. Most respiratory tract infections are self-limiting and antibiotic treatment only slightly modifies their course—according to systematic reviews of randomized controlled trials [27].

Diarrhoea. All antibiotic prescription in the diarrhoea cases, which mostly were not severe, was assessed as inappropriate. In mild cases of diarrhoea antibiotic treatment has no effect and may enhance the development of resistant strains [28]. However, prescription of metronidazole was assessed as appropriate because of the lack of laboratory facilities for diagnosing amoebiasis and giardiasis, both of which are prevalent in Botswana.

Improving the quality of management

The quality of management of acute respiratory infection and diarrhoea probably depends on a variety of factors, such as health workers’ knowledge, case management skills, motivation, supervision, the existence of incentives for health workers, the provision of necessary supplies and essential drugs, laboratory facilities, and the validity of the algorithm [23]. To improve the quality of management, strategies which target the specific obstacles identified should be applied. While some studies have been unable to show improvement of health workers’ performance by guidelines only [29], others have shown an effect by using clinical training units for the integrated management of sick children [30].

Conclusion

In Botswana primary care, health care providers’ adherence to guidelines on history taking was suboptimal in acute respiratory infection and diarrhoea, but poor on physical examination. The level of inappropriate antibiotic prescription seems too high. There is considerable scope for improving diagnostic and therapeutic management of these important childhood illnesses.

Acknowledgement

Our thanks go to the nursing staff at the health facilities for their hospitality towards the field team and for their co-operation. We
acknowledge the contributions of the field surveyors who were part of the study team. We thank Ingvild Dalen, statistician at the Institute of General Practice and Community medicine, University of Oslo, for her statistical analyses; and Per Fugelli, professor of Social Medicine at the Institute of General Practice and Community Medicine, University of Oslo, who was one of the initiators of the Drug Utilization Study and who has contributed to the design of the survey. This study is part of the 1998 Botswana Drug Utilization Study, which has been carried out under a 4-year Health Sector Agreement between Norway (Institute of General Practice and Community Medicine, University of Oslo) and Botswana (Health Research Unit, Ministry of Health), which co-operate on health systems research. The study is financed jointly by both institutions.

References
