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Full Length Research Paper

Household management of acute respiratory infections in children under five years in Kampala Uganda

Kibuule Dan[1]* and Kagoya H. Rachel[2]

[1]School of Pharmacy, Faculty of Health Sciences, University of Namibia, Box 13301, Namibia.
[2]Management Sciences for Health, Makerere University Kampala, Uganda.

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Acute respiratory tract infections (ARI) are the leading cause of deaths among the under-five children in sub-Saharan Africa. The irrational self-medication of childhood ARIs at households in Uganda delays access to quality healthcare. Limited studies focus on strengthening household management of ARI. This study evaluated the household management of ARI among children under five years of age with ARIs in Kampala, Uganda. This study used a descriptive cross-sectional observational design. Households in Kampala were targeted in five divisions using the world health organization (WHO) 30 cluster method of sampling between June and July, 2011. Participants were invited to respond to a standardized questionnaire. The main outcome variable was management practices of ARI in children under-five years. Data were managed using Epidata V3.1 and exported to statistical package of social sciences (SPSS) v19 for quantitative analysis. Out of the 200 households interviewed, the majority 196 (98%) reported at least one episode of ARI in the last four weeks. The common cold with cough was the most common ARI syndrome 98 (49%; p< 0.001). 93 (46.5%; p = 0.322) cases of ARI were considered to be appropriately managed. The prescribing of antibiotics 86 (43%; p < 0.001), 25 (12.5%; p< 0.001) antimalarials and dexamethasone 10 (5%; p = < 0.001) was common. The appropriate management of the ARI at households was associated with frequency of the ARI, pneumonia symptoms, level of education of caretaker and source of the medicines. The prevalence of ARI among children under five years in Kampala is high. The management of ARIs among the under-fives in Kampala is suboptimal with misuse of antibiotics, antimalarials, dexamethasone, herbal medicines and cough remedies common. There is a need for household guidelines for management of ARI and related conditions. Community based programs are urgently required to empower parents of children in management of ARIs.

Key words: Acute respiratory infections, household management, Kampala-Uganda.

INTRODUCTION

Acute respiratory infections (ARIs) impair the breathing, and exchange of oxygen in the lungs: they are classified as upper or lower respiratory tract infections. With over 2 million deaths per year, ARIs are the leading cause of mortality among under-five year's old children in sub-Saharan Africa (Sazawal and Black, 2003; Campbell

*Corresponding author. E-mail: dkibuule@unam.na; kibuulefamily@yahoo.co.uk

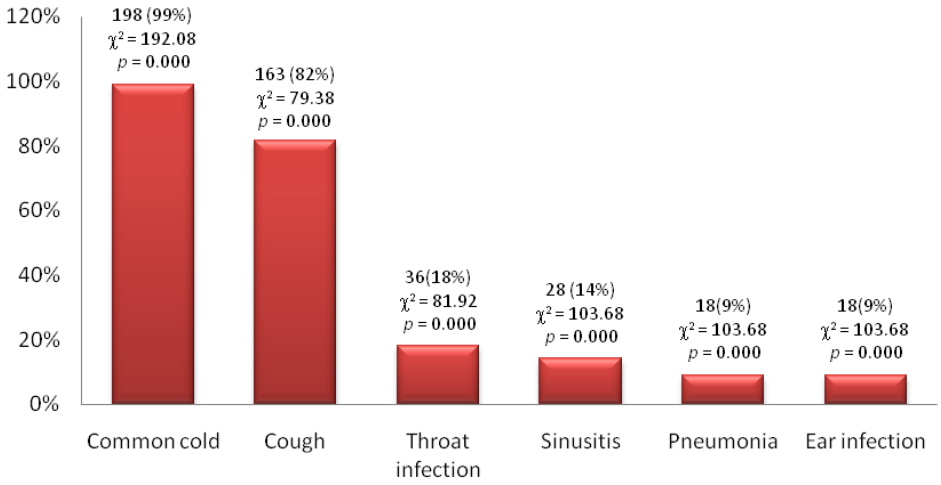

Figure 1. Prevalence of acute respiratory infections among under-five children s in Kampala.

1995; Mulholland et al., 1997; Kengeya et al., 1994). Mortality due to ARIs among the children in sub-Saharan Africa has been reported as early as within 3 days of symptoms (Campbell 1995; World Health Organization 1984; Williams, 2002; UNICEF, 2007; Källander et al., 2008; Johnson et al., 2008). In Uganda, ARIs constitute up to 40% of the patient attendances at outpatient clinics, with most children under 5 years of age suffering between four to six episodes of ARIs annually (Källander et al., 2008; Kallander et al., 2005). The Uganda demographic survey estimates the prevalence of ARI among children below the age of 5 yearsat 18.33 percent (Uganda Bureau of Statistics 2000). In Uganda, pneumonia causes about one-third of deaths amongst children with ARI who die at home without prior contact with formal health sector (Uganda Bureau of Statistics 2000; Rudan et al., 2008; Ministry of health Uganda, 2010; Kengeyaetal.,1994). In Uganda, regardless of the current situation where ARIs cause more deaths amongst the under-fives relative to malaria and diarrhea, limited primary health care programs focus on them (Rudan et al., 2008; Tupasi et al., 1989; World Health Organization 1984; WHO 1991; Kallander et al., 2004).

In Uganda it is estimated that 72% of the population lives within a distance of 5 km of a formal health facility, however, household management of ARI remains a common practice (Uganda Bureau of Statistics 2000; Kallander et al., 2005; Nantanda et al., 2013; Kengeya et al., 1994). The similar clinical presentation of malaria and ARI complicates the appropriate management of ARI at households and delays access to specialized care and quality medicines (Ukwaja and Olufemi, 2010; Kallander et al., 2004; Kengeya et al., 1994). There is a high prevalence of antimalarial and antibiotic use at household level in Uganda for treatment of childhood illnesses particularly ARI (Pariyo et al., 2005; Nantanda et al., 2013). Household based models in Asia and Uganda for management of pneumonia, malaria and fever have reduced child mortality by up to 50% and have improved access to quality treatment and medicines (World Health Organization 1984; UNICEF 2007; WHO 1991; Greer et al., 2004; Ministry of Health Uganda, 2002).The majority of these programs have focused on pneumonia other than the comprehensive ARI including nose, throat and ear infections that have an etiology similar to pneumonia or that may predispose children to secondary bacterial infections. The capacity for households in Uganda to appropriately manage ARIs has not been fully explored.

MATERIALS AND METHODS

Setting and study population

A total of 200 households were targeted from five divisions of Kampala district; Nakawa, Kampala central, Makindye, Kawempe and Rubaga using the World Health Organization (WHO)-30 cluster method. A total of 200 care takers of children under-five years were included in the study if at least one child had an episode of ARI in the past four weeks, and gave informed consent. Caretakers were interviewed by a team of five trained data collectors during the period 11th June to 10th July, 2011, a period that corresponds to the peak of ARI in the Uganda (Ministry of Health Uganda, 2010). Data on type of the ARI episode, sociodemographic and disease management were obtained using a structured interview questionnaire that was developed and validated by the researcher.

Methods

This study adopted a cross-sectional survey design to collect qualitative and quantitative data using a standardized interview questionnaire. A sample of 188 respondents was determined using the Kish and Leslie formula (1965). The sampling frame was based on household distribution in the Uganda Demographic and House survey (UDHS, 2000). The entry question to this study was whether any of the children under-five had symptoms of common cold, cough, throat infection, or ear infection or pneumonia in the past four weeks. The local terms for; cough “kifuba, lubyamira”, and

common cold “eminyila” were used. The nature of ARI was further investigated by the data collectors. The main outcome variables were the occurrence and type of the ARI, the medicines used in the management and factors associated with management of ARIs. Data were managed using Epidata v3.1 and exported to SPSS v19. Group comparisons were made using chi-square, and $\alpha = 0.05$ was considered as the level for denoting significance at the 95% confidence interval. The pearson correlation was used to identify factors associated with appropriate management of the ARI. The management of the ARI was evaluated against recommendations of the integrated management of malaria and pneumonia (WHO/UNICEF, 2006).

Ethical considerations

The study was approved as part of the field studies for Masters in Public Health of Makerere University, Kampala, Uganda. All the study respondents gave written informed consent prior to inclusion in the study. The respondents names were not requested nor recorded anywhere hence cannot associate the data to a particular respondent in this study.

RESULTS

Sociodemographic characteristic of study respondents

Of the 200 respondents, the majority were from Rubaga division 87 (43.5%; p = 0.0001); of the male sex 108 (54%; p = 0.0258); in the age category of 26 to 35 years 102 (51%; p = 0.0001); biological parents of the children 88%; reside in urban or semi-urban areas 91(45.5%; p = 0.0001) and attained formal education 186 (93%; p = 0.0001) and not in formal employment (71%;); (Table 1). Male respondents had significantly higher mean age (33.3 ± 6.9) than the female (30.4 ± 8.9; p < 0.001). The median family size was higher in rural setting (4.77 ± 1.6) compared to semi-urban (4.63 ± 2.0) or urban Kampala (4.46 ± 1.7). The majority of households had the youngest child in the age range of 3 to 5 years 87 (43.5%; p = 0.000). Most children had completed their immunization schedules.

Prevalence of acute respiratory infections among under five in children Kampala Uganda

The most common ARIs among the under-fives were common cold, coughs, throat infection, sinusitis, pneumonia and ear infections (Figure 1).

Prevalence of acute respiratory infection syndromes among the under-five children in Kampala

All respondents reported at least one ARI episode among the under-fives in the last 4 weeks. The most commonly reported ARI was the common cold and cough 98 (49%) within the past month (Figure 1). The majority of the caretakers reported episodes of a common cold 198 (99%), sinusitis 28 (14%), coughs 168 (84%), pneumonia 18 (9%), ear infection 18 (9%) and throat infection 32 (16%). The majority of respondents reported that ARIs mainly occur at a frequency of every month followed by once a year (30%) and after, 3 or 2 months in a year. The majority of respondents noticed symptoms of the ARI within 1 to 3 days of the illness (95%) yet some caretakers reportedly took over 3 to 5 days to associate symptoms to ARI (5%). The majority of care takers (82%) institute measures immediately when they notice the symptoms of the ARI on the same day.

Household management of ARIs among the under-fives in Kampala

The first line measures in the management of ARI are usually to manage the child at home by using conventional medicines or treatment by use of homemade or purchased herbs (69%); 30% of care takers will engage the health system for consultation and 1 % ignore the symptoms. Majority of the care takers of children under the age of 5 years access the medications from private settings (81%) compared to public health centers (9%) or other traditional sources (12%). Among the private sources of medicines to treat ARIs, majority of respondent’s access medicines from clinics followed by Pharmacies and drug shops located in their communities

Household management of ARIs among the under-fives in Kampala

The prevalence of use of medicines were: antibiotic 86 (43%), antimalarials 25 (12.5%), analgesic or antinflammatory drug 84 (42%), herbal remedies 52 (26%), decongestants or expectorants 96 (48%), and vitamin supplements 49 (24.5) (Table 2). Amoxicillin (13.5%) and cotrimoxazole (13%) were the most commonly used antibiotics for ARIs reported. Artemesinin therapy was the most used antimalarials. Some households used corticosteroids (5%) and aspirin in the management of ARIs. Herbal medicines were used in 45 (22.5%) of the ARI episodes. The remedies used in the initial treatment were obtained mainly from private clinics (32.5%) and drug outlets (46%). Most care takers perceive their empiric therapy to be effective. Only (29%) of the children were admitted for further care. Half of caretakers (51%) reported that they know how to manage the ARI; other respondents were not sure whether they gave the right or wrong treatment.

Factors associated appropriate management of ARIs among the under-fives in Kampala

Factors that showed a positive correlation with appropriate management of ARIs among the under-fives

Table 1. Sociodemographic characteristics of study respondents (n=200).

Characteristic	Frequency (%)	χ^2	*p* -value
Division of Kampala			
Nakawa	26 (13)	-	-
Kawempe	42 (21)	-	-
Rubaga	87 (43.5)	-	-
Kampala central	28 (14)	-	-
Makindye	17 (8.5)	77.050	0.000*
Care taker			
Mother	92 (46.2)	-	-
Father	84 (42.2)	-	-
Guardian	23 (11.5)	42.945	0.000*
Sex of respondent			
Male	92 (46)	-	-=
Female	108 (54)	1.280	0.258
Age category of respondent			
15 - 25 years	46 (23)	-	-
26 - 35 years	102 (51)	-	-
36 - 45 years	43 (21.5)	-	-
46 - 56 years	9 (4.5)	89.0	0.000*
Location of residence			
Urban	83 (41.5)	-	-
Rural	25 (12.5)	-	-
Semi-urban	91 (45.5)	29.116	0.000*
Education level			
No education	14 (7)	-	-
Primary	19 (9.5)	-	-
Secondary	80 (40)	-	-
Tertiary	87 (43.5)	90.52	0.000*
Employment status			
Formal employment	57 (28.5)	-	-
Casual employment	34 (17)	-	-
Self-employment	77 (38.5)	-	-
Unemployed	32 (16)	27.160	0.000*
No of under 5 children per family			
1 - 2 children	93 (46.5)	-	-
3 - 4 children	78 (39)	33.61	0.000*
5 - 8 children	29 (14.5)	-	-
Age of youngest child			
<12 months	44 (22)	-	-
1 – 3 years	69 (34.5)	13.99	0.000*
3 – 5 years	87 (43.5)	-	-

*: α = 0.005 was considered as the level for denoting significance.

included the level of education of the caretaker (r = 0.201; *p* = 0.004), the presence of pneumonia-related symptoms (r = 0.153; *p* = 0.030), the frequency of ARI episodes in the home (r = 0.159; *p* = 0.024), the ability to suspect an ARI infection (r = 0.183; *p* = 0.009), the use of an antibiotic (r = 0.747, p< 0.001), the source of the initial

Table 2. Home based management of ARIs among the under-fives in Kampala.

Empiric treatment initiated	Frequency (%)	χ^2	P-value
Antibiotic empiric therapy initiated			
Amoxicillin	27 (13.5)	-	-
Ampiclox	1 (0.5)	-	-
Chloramphenicol/cotrimoxazole	2 (1)	-	-
Erythromycin	10 (5)	-	-
Cotrimoxazole	26 (13)	-	-
Amoxicillin/cotrimoxazole	5 (2.5)	-	-
Gentamicin/ceftriaxone	1 (0.5)	-	-
Gentamicin/amoxicillin	2 (1)	-	-
Ampiclox/erythromycin	1 (0.5)	-	-
Amoxicillin/cotrimoxazole	11 (5.5)	-	-
No antibiotic used	114 (57)	606.2	0.0008
Antimalarial empiric therapy initiated			
Artemesinin Combination Therapy	19 (9.5)	-	
Quinine	1 (0.5)	-	-
Unspecified antimalarial	4 (2)	-	-
Fansidar	1 (0.5)	-	-
No antimalarials	175 (87.5)	575.100	0.000
Analgesic/antinflammatory initiated			
Paracetamol	73 (36.5)	-	-
Dexamethasone	10 (5)	-	-
Aspirin/paracetamol combination	1(0.5)	-	-
No analgesic	116 (58)	177.72	0.000
Herbs or home remedy initiated			
Rehydration	4 (2)	-	-
Arm clothing	3 (1.5)	-	-
Herbal medicine	45 (22.5)	-	-
No herbal remedies	148 (74)	375.05	0.000
Cough remedy initiated			
Expectorant	13 (6.5)	-	-
Decongestant	81(40.5)	-	-
Asthma syrup	2 (1)	151.000	0.000
No decongestant or expectorant	104 (52)	-	-
Vitamin supplements initiated			
Vitamin C	47 (23.5)	-	
Multivitamin	2 (1)	175.210	0.000
No multivitamin	151 (75.5)	-	-
Source of remedy used for treatment			
Public health facility	17 (8.5)	-	-
Private clinic	65 (32.5)	-	-
Pharmacy	49 (24.5)	-	-
Drug shop	43 (21.5)	-	-
Herbalist	21(10.5)	-	-
Market	5 (2.5)	119.41	0.000

*: $\alpha = 0.005$ was considered as the level for denoting significance.

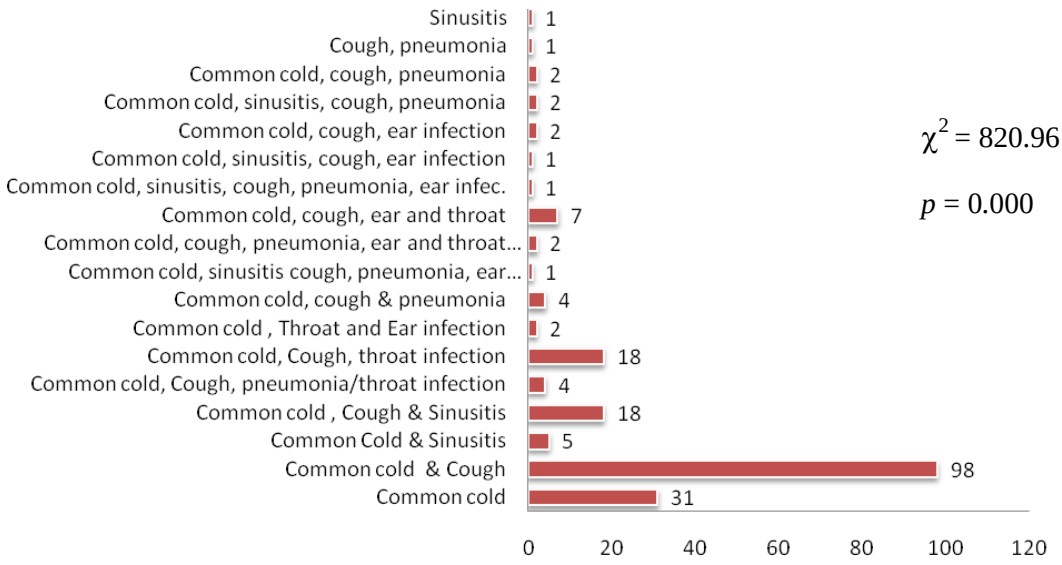

Figure 1. Prevalence of syndromes of ARI among under-fives in Kampala.

treatment (r = - 0.240, p< 0.001), and use of non-pharmacological approaches (r = 0.318, p = 0.000).

Treatment seeking behaviors for ARI

The majority (77%) of caretakers of children below the age of 5 years did not seek treatment from the health facility after initiating the first treatment compared to 23% who did seek health professional advice after the initial treatment. The majority of respondents (78%) reported that the severity of the ARI was the major determinant on how soon the child was taken to a health facility. Other factors that were associated with treatment seeking practices included the advice from family members, and prior medical advice as well the presence or absence of a fever and the time of the day at which the ARI occurred.

DISCUSSION

This study found that majority of the care takers were mothers, and had attained at least a primary level education. Most households in this study had an average of 1 to 2 children under the age of 5 years, were mostly of the age range 3 to 5 years and had completed their immunization schedules. Tupasi, (1989), report the most care takers in ARI were mothers and those of low socioeconomic status.

In this study, the prevalence of ARI at households in the past four weeks was 98%. This finding is higher than that of Mbonye, (2004) who found a prevalence of upper respiratory tract infection to be 37.4% among children in Ssembabule district in Uganda (Mbonye, 2004; Simoes et al., 2006). The difference could be due to Kampala being an urban setting compared to Ssembabule that is a rural setting. The most common ARI reported in households in Kampala in the current study were common cold, cough, throat infection, and pneumonia and ear infections respectively. Common colds and coughs were the most prevalent ARI syndrome at households. A study by Kallander et al. (2005) in Uganda and Johnson et al. (2008) in Nigeria showed similarly types of ARIs in Nigeria (Campbell 1995; Mulholland et al., 1997; Kengeya et al., 1994; Uganda Bureau of Statistics 2000; Kallander et al., 2005; Tupasi et al., 1989). The majority of care takers recognized ARI symptoms within the first 1 to 3 days, and reported that the symptoms were self-limiting within a period of 7 days. However, most care takers initiated treatment within 24 h of recognizing ARI symptoms. The majority of caretakers did not seek health care advice after initiating treatment; among those who did seek advice the majority only did so after 3 to 5 days.

Caretakers administered antibiotics, antimalarials, corticosteroids, herbal medicines, vitamin supplements, analgesics and decongestants to treat ARIs. Kallander et al. (2004) and Ukwaja and Olufemi, (2010). reported an overlap between symptoms of ARIs and malaria and this may be the reason for use of various combinations at households. However, the majority of the care takers were not confident in the appropriateness of the initial treatment. The findings are in agreement with a previous report in Uganda where widespread use of antibiotics was reported (Kengeya et al., 1994; Pariyo et al., 2005). Amoxicillin and cotrimoxazole were the most commonly used antibiotics in the management of ARIs at households. The most commonly used antimalarials were artemesinin combination therapies. Private medicine outlets including clinics, pharmacies and drug shops were the most commonly reported sources of medicines used

in the initial management of the ARIs. Care takers also reported the use of remnants of medicines in their custody for initial treatment of ARIs. The finding is similar to that of Mbonye, (2004) who found that medicines used at households were obtained from 'drug shops' (75%) compared to health units (9.2%) (Tupasi et al., 1989). Access to antibiotics at drug outlets is in conflict with the National drug policy that restricts access of these medicines from qualified health care professional (Mbonye 2004). A similar study in Nigeria reported that a significant proportion of these cases of children with pneumonia were mismanaged as malaria in the community.

The main driving factor for household initiated ARI treatment was access to medicines, prior effectiveness of the treatment, no guarantee of quick access to quality services or medicines at public health units compared to private drug outlets. The severity of the ARI, time of occurrence and availability of funds were the main determinants of treatment seeking behaviors. A study by Ukwaja and Olufemi, (2010) in Nigeria showed that "carers of infants and children with difficulty in breathing were more likely to seek care within 24 h of symptom recognition"– this finding reached statistical significance. UNICEF (2007), in its progress reports highlighted that many children do not receive timely and appropriate treatment at health facilities (Uganda Bureau of Statistics 2000; Ministry of health Uganda, 2010; Mbonye, 2004). This may explain why parents attempt to initiate treatment at home to account for the delays anticipated at the health facilities. Kallander et al. (2008), found that many children died at home prior to seeking services at health facilities in Uganda. Greer et al. (2004) identified the need to build the capacity of drug vendors to improve rational use of medicines at community level in Nigeria[21].

CONCLUSION AND RECOMMENDATIONS

The household prevalence of ARI among children under 5 years of age in Kampala is high relative to the findings in literature. Most care takers initiate treatment of ARI with antibiotics, antimalarials or analgesics based on their experience of prior effectiveness. There is inappropriate use of medicines particularly antibiotics, antimalarials and dexamethasone at households in the management of ARI.

The capacity of households to screen and refer children with danger signs of ARI should be strengthened: the need for integration of ARI related public health education programs with malaria and Human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) is urgent and may be more cost effective. Bring quality health services close to the communities. Strengthen the capacity of drug outlet professionals in the detection and management of ARIs common in their communities. Enforce policies that restrict access to medicines by community drug outlets, particularly in private drug outlets that have undertaken training in ARI management. Explore the role of herbal remedies in the management of ARI and provide appropriate information to the communities using these remedies.

Conflict of Interest

The authors have no conflict of interest to declare.

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REFERENCES

Campbell H (1995). Acute respiratory infection: a global challenge Arch Dis Child. 73(4): 281-283.

Greer G, Akinpelumi A, Madueke L, Plowman B, Fapohunda B, Tawfik Y (2004). Improving Management of Childhood Malaria in Nigeria and Uganda by Improving Practices of Patent Medicine Vendors. Arlington, Va.: BASICS II for the United States Agency for International Development.

Johnson AW, Osinusi K, Aderele WI (2008). Etiologic agents and outcome determinants of community acquired pneumonia in urban children: a hospital based study. J. Natl. Med. Assoc. 100:370-85.

Kallander K, Nsungwa-Sabiti J, Peterson S (2004). Symptom overlap of malaria and pneumonia - policy implications for home management strategies. Acta Tropical. 90:211-214.

Kallander K, Hildenwall H, Waiswa P, Galiwango E, Peterson S, Pariyo G (2008). Delayed care seeking for fatal pneumonia in children aged under-five years in Uganda: a case-series study. Bull. WHO 86:332-338.

Kallander K, Nsungwa-Sabiti J, Balyeku A, Pariyo G, Tomson G, Peterson S (2005). Home and community management of acute respiratory infections in children in eight Ugandan districts. Ann. Trop. Paediatr. 25:283-291

Kengeya JK, Seeley JA, Kajura-Beganja E, Kabunga E, Mubiru E, Sembaja F (1994). Recognition, treatment seeking behavior and perception of cause of malaria among rural women in Uganda. Acta Trop. 58:267-73.

Makerere university school of public health (2006). Community medicine distributors training manual on the integrated management of malaria and pneumonia

Mbonye AK (2004). Risk Factors for Diarrhoea and Upper Respiratory Tract Infections among Children in a Rural Area of Uganda. J. Health Population Nutrition 22(1):52-58

Ministry of Health Uganda (2002). Communication strategy for Home-Based Management of Fever/Malaria in children and control of malaria in pregnancy in Uganda 2001-2005. Kampala.

Ministry of health Uganda (2010). Statistical abstracts. Health.go.ug

Mulholland K, Hilton S, Adegbola R, Usen S, Oparaugo A, Omosigho C, Weber M (1997). Randomized Trial of *Haemophilus influenzae* Type-B Tetanus Protein Conjugate Vaccine. Lancet 349:1191-97.

Nantanda R, Ndeezi G, Tumwine JK, Ostergaard MS (2013). Asthma and pneumonia among under-fives at Mulago National Referral hospital Uganda: Is asthma under-diagnosed? 8th European Congress on Tropical Medicine and International Health.

Pariyo GW, Gouws E, Bryce J, Burnham G (2005) Uganda IMCI Impact Study Team. Improving facility-based care for sick children in Uganda: training is not enough. Health Policy Plan. 20:i58-68.

Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H (2008). Epidemiology and etiology of childhood pneumonia. Bull. World

Health Organization 86:408-416.
Sazawal S, Black RE (2003). Pneumonia Case Management Trials
Group Effect of Pneumonia Case Management on Mortality in Neonates, Infants, and Preschool Children: A Meta-Analysis of Community-Based Trials. Lancet Infect. Dis. 3:547-56.
Simoes AF, Cherian T, Chow J, Shahid-Salles S, Laxminarayan R, John TJ (2006). Acute Respiratory Infections in Children. In Disease Control Priorities in Developing Countries. Second edition. Washington: Oxford University Press.
Tupasi TE, Miguel CA, Tallo VL (1989). Child care practices of mothers: implications for intervention in acute respiratory infections. Ann. Trop. Paediatr. 9:82-8.
Uganda Demographic and House survey (2000).
Uganda Bureau of Statistics (2000).The population and housing census. Entebbe: Uganda Bureau of Statistics pp. 59-62.
Ukwaja K, Olufemi O (2010) Home management of acute respiratory infections in a Nigeria district. Afr. J. Respir. Med. 6:18-22.
UNICEF (2007). Progress for children: a world fit for children[Statistical Review. Number 6]. New York.
UDHS (2000). Uganda Demographic and Health Survey. Preliminary Report. Available at:http://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/Uganda%20DHS%202000-01%20Final%20Report.pdf
Williams BG (2002). Estimates of world-wide distribution of child deaths from acute respiratory tract infections. Lancet Infect. Dis. 2:25-32.
World Health Organization (1984). A programme for controlling acute respiratory infections in children: memorandum from a WHO meeting. Bulletin of the World Health Organization 62:47-58.
World Health Organization (WHO), (1991). Technical bases for the WHO recommendations on the management of pneumonia in children at first-level health facilities. Geneva: WHO.
WHO/UNICEF (2006). Integrated management of malaria and pneumonia.