

Journal of Public Health and Epidemiology

Volume 7 Number 8 August, 2015

ISSN 2141-2316



*Academic
Journals*

ABOUT JPHE

The **Journal of Public Health and Epidemiology (JPHE)** is published monthly (one volume per year) by Academic Journals.

Journal of Public Health and Epidemiology (JPHE) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as health observatory, biostatistics, occupational health, behavioral medicine etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JPHE are peer-reviewed.

Submission of Manuscript

Submit manuscripts as e-mail attachment to the Editorial Office at: jphe@academicjournals.org. A manuscript number will be mailed to the corresponding author shortly after submission.

The Journal of Public Health and Epidemiology will only accept manuscripts submitted as e-mail attachments.

Please read the **Instructions for Authors** before submitting your manuscript. The manuscript files should be given the last name of the first author.

Editors

Professor Mostafa A. Abolfotouh

*Professor of Family & Community Medicine
Head of Medical Team - Biobanking Section.
King Abdullah International Medical Research
Center, King Saud Bin-Abdulaziz University for
Health Sciences, National Guard Health Affairs,
Saudi Arabia*

Editorial Board

Dr. Guolian Kang

*The University of Alabama at Birmingham/1665
University Blvd, Ryals 443
Guolian
USA*

Dr. Mohammed Danlami Salihu

*Public Health Department
Faculty of Veterinary Medicine
Usmanu Danfodiyo University, Sokoto.
Nigeria.*

Prof. Jahanfar Jahanban

*Oral Pathology Dept. Dental faculty of Tehran Islamic
Azad University/
Address: B 107 Pezeshkan-Farabi Build No 67 Javanshir
St. Hosseinabad Pasdaran St. Tehran
Iran*

Okonko, Iheanyi Omezuruike

*University of Ibadan, Ibadan, Nigeria
Nigeria*

Dr. Afroditi K Boutou

*Respiratory Failure Unit, Aristotle University of
Thessaloniki, "G. Papanikolaou", Hospital, 57010,
Exohi.
Greece*

Dr. Anil K. Philip

*Rajiv Academy for Pharmacy/ delhi-Mathura Highway,
NH#2, Mathura-281001, Uttar Pradesh, India
India*

Dr. Bijan Mohammad hosseini

*Ayatollah Kashani Social Security Hospital
P.O Box: 14515 - 799 Tehran - Iran
Iran*

Dr. Brajadulal Chattopadhyay

*Department of Physics, Jadavpur University, Kolkata-
700032, India
India*

Dr. Carlos H Orces

*Laredo Medical Center, 1700 East Saunders, Laredo
Texas 78041
USA*

Mrs Iscah A. Moth

*Ministry of Public Health and Sanitation
P.O. Box 1210-40100 Kisumu
Kenya*

Prof. Tariq Javed

*Department of Pathology, Faculty of Veterinary Science,
University of Agriculture, Faisalabad-38040.
Pakistan.*

Dr. María Elena Dávila L

*Universidad Centroccidental "Lisandro Alvarado".
School of Medicine/ School of Health Science . Av.
Andrés Bello C/ Av. Libertador. Barquisimeto, Lara,
Venezuela, SA*

Dr. Lay Ching Chai

*Centre of Excellence for Food Safety Research, Faculty of
Food Science and Technology, Universiti Putra Malaysia,
43400 UPM Serdang, Selangor,
Malaysia*

Dr. Liting Song

*Appointment pending, Public Health Agency of
Canada/Health Canada
809-50 Riddington Drive,
Toronto, ON M2K 2J8
Canada*

Dr. Joaquim Xavier Sousa Jr

*Laboratory Immunodermatology of Clinics Hospital -
Av Dr Eneas Carvalho Aguiar, 255 3th floor Room 3016
05403-000 Sao Paulo, Brazil
Brazil*

Dr. K.K.I.U. Arunakumara

*Institution/address - Dept. of Crop Science, Faculty of
Agriculture, University of Ruhuna, Mapalana,
Kamburupitiya, Sri Lanka
Sri Lanka*

Dr. Keya Chaudhuri

*Indian Institute of Chemical Biology
Raja S C Mullick Road, Kolkata-700032, India
India*

Belchiolina Beatriz Fonseca

*Universidade Federal de Uberlândia, Rua Ceará s/n,
bloco 2D. saça 43, Campus Umuarama, Uberlândia MG,
Brazil. Brazil*

Dr. Charles R. Doarn

*Associate Professor of Public Health and Biomedical
Engineering
Director, Telemedicine Program
Department of Public Health Sciences
University of Cincinnati
USA*

Instructions for Author

Electronic submission of manuscripts is strongly encouraged, provided that the text, tables, and figures are included in a single Microsoft Word file (preferably in Arial font).

The **cover letter** should include the corresponding author's full address and telephone/fax numbers and should be in an e-mail message sent to the Editor, with the file, whose name should begin with the first author's surname, as an attachment.

Article Types

Three types of manuscripts may be submitted:

Regular articles: These should describe new and carefully confirmed findings, and experimental procedures should be given in sufficient detail for others to verify the work. The length of a full paper should be the minimum required to describe and interpret the work clearly.

Short Communications: A Short Communication is suitable for recording the results of complete small investigations or giving details of new models or hypotheses, innovative methods, techniques or apparatus. The style of main sections need not conform to that of full-length papers. Short communications are 2 to 4 printed pages (about 6 to 12 manuscript pages) in length.

Reviews: Submissions of reviews and perspectives covering topics of current interest are welcome and encouraged. Reviews should be concise and no longer than 4-6 printed pages (about 12 to 18 manuscript pages). Reviews are also peer-reviewed.

Review Process

All manuscripts are reviewed by an editor and members of the Editorial Board or qualified outside reviewers. Authors cannot nominate reviewers. Only reviewers randomly selected from our database with specialization in the subject area will be contacted to evaluate the manuscripts. The process will be blind review.

Decisions will be made as rapidly as possible, and the journal strives to return reviewers' comments to authors as fast as possible. The editorial board will re-review manuscripts that are accepted pending revision. It is the goal of the JPHE to publish manuscripts within weeks after submission.

Regular articles

All portions of the manuscript must be typed double-spaced and all pages numbered starting from the title page.

The Title should be a brief phrase describing the contents of the paper. The Title Page should include the authors' full names and affiliations, the name of the corresponding author along with phone, fax and E-mail information. Present addresses of authors should appear as a footnote.

The Abstract should be informative and completely self-explanatory, briefly present the topic, state the scope of the experiments, indicate significant data, and point out major findings and conclusions. The Abstract should be 100 to 200 words in length.. Complete sentences, active verbs, and the third person should be used, and the abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited.

Following the abstract, about 3 to 10 key words that will provide indexing references should be listed.

A list of non-standard **Abbreviations** should be added. In general, non-standard abbreviations should be used only when the full term is very long and used often. Each abbreviation should be spelled out and introduced in parentheses the first time it is used in the text. Only recommended SI units should be used. Authors should use the solidus presentation (mg/ml). Standard abbreviations (such as ATP and DNA) need not be defined.

The Introduction should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of scientific disciplines.

Materials and methods should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail.

Results should be presented with clarity and precision.

The results should be written in the past tense when describing findings in the authors' experiments. Previously published findings should be written in the present tense. Results should be explained, but largely without referring to the literature. Discussion, speculation and detailed interpretation of data should not be included in the Results but should be put into the Discussion section.

The Discussion should interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. The Results and Discussion sections can include subheadings, and when appropriate, both sections can be combined.

The Acknowledgments of people, grants, funds, etc should be brief.

Tables should be kept to a minimum and be designed to be as simple as possible. Tables are to be typed double-spaced throughout, including headings and footnotes. Each table should be on a separate page, numbered consecutively in Arabic numerals and supplied with a heading and a legend. Tables should be self-explanatory without reference to the text. The details of the methods used in the experiments should preferably be described in the legend instead of in the text. The same data should not be presented in both table and graph form or repeated in the text.

Figure legends should be typed in numerical order on a separate sheet. Graphics should be prepared using applications capable of generating high resolution GIF, TIFF, JPEG or Powerpoint before pasting in the Microsoft Word manuscript file. Tables should be prepared in Microsoft Word. Use Arabic numerals to designate figures and upper case letters for their parts (Figure 1). Begin each legend with a title and include sufficient description so that the figure is understandable without reading the text of the manuscript. Information given in legends should not be repeated in the text.

References: In the text, a reference identified by means of an author's name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author's name should be mentioned, followed by 'et al'. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like 'a' and 'b' after the date to distinguish the works.

Examples:

Abayomi (2000), Agindotan et al. (2003), (Kelebeni,

1987a,b; Tijani, 1993,1995), (Kumasi et al., 2001)

References should be listed at the end of the paper in alphabetical order. Articles in preparation or articles submitted for publication, unpublished observations, personal communications, etc. should not be included in the reference list but should only be mentioned in the article text (e.g., A. Kingori, University of Nairobi, Kenya, personal communication). Journal names are abbreviated according to Chemical Abstracts. Authors are fully responsible for the accuracy of the references.

Examples:

Chikere CB, Omoni VT and Chikere BO (2008). Distribution of potential nosocomial pathogens in a hospital environment. *Afr. J. Biotechnol.* 7: 3535-3539.

Moran GJ, Amii RN, Abrahamian FM, Talan DA (2005). Methicillinresistant *Staphylococcus aureus* in community-acquired skin infections. *Emerg. Infect. Dis.* 11: 928-930.

Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing *Escherichia coli* in the Calgary Health Region: emergence of CTX-M-15-producing isolates. *Antimicrob. Agents Chemother.* 51: 1281-1286.

Pelczar JR, Harley JP, Klein DA (1993). *Microbiology: Concepts and Applications*. McGraw-Hill Inc., New York, pp. 591-603.

Short Communications

Short Communications are limited to a maximum of two figures and one table. They should present a complete study that is more limited in scope than is found in full-length papers. The items of manuscript preparation listed above apply to Short Communications with the following differences: (1) Abstracts are limited to 100 words; (2) instead of a separate Materials and Methods section, experimental procedures may be incorporated into Figure Legends and Table footnotes; (3) Results and Discussion should be combined into a single section. Proofs and Reprints: Electronic proofs will be sent (e-mail attachment) to the corresponding author as a PDF file. Page proofs are considered to be the final version of the manuscript. With the exception of typographical or minor clerical errors, no changes will be made in the manuscript at the proof stage.

Fees and Charges: Authors are required to pay a \$650 handling fee. Publication of an article in the Journal of Public Health and Epidemiology is not contingent upon the author's ability to pay the charges. Neither is acceptance to pay the handling fee a guarantee that the paper will be accepted for publication. Authors may still request (in advance) that the editorial office waive some of the handling fee under special circumstances.

Copyright: © 2015, Academic Journals.

All rights Reserved. In accessing this journal, you agree that you will access the contents for your own personal use but not for any commercial use. Any use and or copies of this Journal in whole or in part must include the customary bibliographic citation, including author attribution, date and article title.

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, or thesis) that it is not under consideration for publication elsewhere; that if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher.

Disclaimer of Warranties

In no event shall Academic Journals be liable for any special, incidental, indirect, or consequential damages of any kind arising out of or in connection with the use of the articles or other material derived from the JPHE, whether or not advised of the possibility of damage, and on any theory of liability.

This publication is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications does not imply endorsement of that product or publication. While every effort is made by Academic Journals to see that no inaccurate or misleading data, opinion or statements appear in this publication, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the responsibility of the contributor or advertiser concerned. Academic Journals makes no warranty of any kind, either express or implied, regarding the quality, accuracy, availability, or validity of the data or information in this publication or of any other publication to which it may be linked.

ARTICLES

Research Articles

Seroprevalence of brucellosis among livestock workers at Maiduguri cattle market, Borno State, North Eastern, Nigeria **253**

Nuhu Bala Adamu, Solomon Olushola Adeniyi, Shuaibu Gidado Adamu, James Olaniyi Olabode Bale, Anthony Ekle Joseph Okoh, Gali Abaka Umaru and Yahaya Abdullahi Umar

Is mobile health (mHealth) the magic bullet? A short review of the impact of mHealth on adolescent sexual health **258**

Chukwuemeka Austin Ihesie

Audit of use of antimicrobial agents at a tertiary health centre in Lagos, Nigeria **263**

Sunday O. Ogundele, Olayinka O. Ogunleye, Bamidele Mutiu and Samuel O. Akodu

Full Length Research Paper

Seroprevalence of brucellosis among livestock workers at Maiduguri cattle market, Borno State, North Eastern, Nigeria

Nuhu Bala Adamu¹, Solomon Olushola Adeniyi¹, Shuaibu Gidado Adamu^{1*}, James Olaniyi Olabode Bale², Anthony Ekle Joseph Okoh³, Gali Abaka Umaru⁴ and Yahaya Abdullahi Umar⁵

¹ Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Nigeria.

² National Animal Production Research Institute, Animal Reproduction Research Programme, Ahmadu Bello University Zaria, Nigeria.

³ Department of Veterinary Public Health and Preventive Medicine, University of Agriculture, Makurdi, Nigeria.

⁴ Department of Animal Health, College of Agriculture, Jalingo, Taraba State, Nigeria.

⁵ Department of Biological Sciences, Nigerian Defence Academy, Kaduna, Nigeria.

Received 2 May, 2015; Accepted 5 June, 2015

A serological survey was conducted to determine the seroprevalence of brucellosis in livestock workers at Maiduguri cattle market, Borno State, Nigeria. A total of 100 serum samples comprising 40 from animal handlers, 25 from livestock keepers, 20 from butchers and 15 from middlemen were tested using Rose Bengal Plate Test (RBPT) antigen for both *Brucella abortus* and *Brucella melitensis*. Seroprevalence rate of 11% was detected for *B. abortus* and 0% for *B. melitensis* antibodies out of the total sampled. The seroprevalence in animal handlers, livestock keepers, butchers and middlemen were found to be 12.5, 16, 10 and 0%, respectively. All persons screened were males. There was no significant difference ($p > 0.05$) between different categories of workers. It was concluded that brucellosis is prevalent in livestock workers at Maiduguri cattle market in Borno State. There should be education of this category of risk group of people especially as it relates to the use of personal protective equipments (PPEs) ante mortem and post mortem outfit and the consumption of unpasteurized milk and milk products. Government should control the disease with appropriate existing laws or new regulations, public health enlightenment, mass vaccination of animals and the establishments of equipped laboratories for regular screening of humans and animals by well trained personnel.

Key words: Brucellosis, livestock workers, Maiduguri, Nigeria, seroprevalence.

INTRODUCTION

Brucellosis is a contagious bacterial infection of livestock and continues to be of great health concern and

economic importance worldwide, especially in Mediterranean countries (Munir et al., 2010). The orga-

nism is intracellular, coccobacilli, Gram-negative bacteria of the genus *Brucella* which consists of ten species ranked according to their host preferences namely, *B. abortus* (cattle), *B. melitensis* (small ruminants and camels), *B. suis* (swine), *B. canis* (dog) which also affect man, *B. ovis* (sheep), *B. neotomae* (desert woodrat), *B. ceti* (cetaceans), *B. pinnipedialis* (pinnipeds) are species isolated from marine mammals and occasionally cause infection in man, *Brucella inopinata* (human breast) (Scholz et al., 2009; Martín-Martín et al., 2011 and Falenski et al., 2011). Human brucellosis is a zoonotic disease with a major impact on public health, even though successful eradication and control programmes for domestic animals have been established in many developed countries around the world (Al Dahouk et al., 2013). More than 500,000 human cases are reported worldwide each year particularly from developing countries (Seleem et al., 2010). Brucellosis is endemic in Nigeria and causes severe economic losses to livestock farmers, which estimated to account for about 46 million Naira (Chukwu, 1987). It is a serious risk to human health and has been documented in different parts of the country especially in ranches, livestock breeding centre and dairy farms in Nigeria (Mohammed et al., 2011; Mai et al., 2012). In Borno State, some evidence of brucellosis in sheep, goats, cattle, camels, and humans has been documented (Brisibe et al., 1993; Adamu et al., 2007; Tijjani et al., 2012; Sadiq et al., 2013 and Adamu et al., 2014). However, the exact status of the disease in workers at cattle market in Maiduguri, Borno State has never been determined despite the fact that this group of people are among the high risk group of contracting the disease (Alballa, 1995; Cadmus et al., 2006). Studies within abattoirs have documented the risk of aerosol transmission. Consumption of unpasteurized dairy products, close contact with infected animals and with contaminated environmental sources could be major risk factors for the spread of *Brucella* infections among humans (Boukary et al., 2010). The present study was therefore conducted to determine the seroprevalence of the disease in this high risk group of workers in Maiduguri, Northeastern Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in Borno State which is located on an elevation of about 35 meters above sea level and along Latitude 11°N and Longitude 13°E. The state has land mass area of 75,540

square kilometers and is located in the north-eastern part of Nigeria. The boundaries of the state are the Republic of Niger to the north, Cameroon Republic to the east and to the north-east by Chad Republic. Within the country, its neighboring states are Adamawa to the south, Yobe to the west and Gombe to the southwest. The population of people in the state which is sparsely distributed was put at a total of 4,151,193 people (FGN, 2007) consisting mostly of farmers, animal rearers, fishermen, traders and civil servants. Agriculture and livestock farming are the main stay of the economy employing about 70% of the population (Oguntunde, 1998). The vegetation of the state consists of Sahel Savannah in the north and Sudan Savannah in the south. However, most part of the state generally consists of semi-arid Savannah or sub-desert. The arid zone has rather austere climate conditions with hot dry season from late January to late June, during which average daily peak temperature especially in April and May are 34.4°C to 37.8°C. The rainy season with an average annual rainfall of 46.3 centimeters last from late June to mid-September but can vary. The main relative humidity at room temperature fluctuates between 5% (December to January) and 45% (June to August). The cold north easterly trade wind blowing across the Sahara desert in October to January brings with it, cold and desiccant effect on the environment. The dry season is characterized by complete absence of green pasture. However, towards the Lake Chad area, there is abundance of pasture because of a large water body of the Lake Chad in the area. This brings a lot of nomadic pastoralists both within and outside the country to graze their animals in the area. The soil in the north-central part of the state is largely sands, formed by wind-drift from the desert.

Sample collection

Blood samples were aseptically collected from livestock workers comprising animal handlers, livestock keepers, butchers and middlemen at the Maiduguri cattle market, Borno State. Before the sample collection, "a pilot study was conducted" with individuals and also consultation with their respective leaders were held during which they were informed of the purpose, the significance of the study and were invited to participate. Ethical clearance was also obtained from Borno State Ministry of Health ethical clearance committee. Verbal and written permission was obtained from chairmen of livestock workers, livestock keepers, butchers and abattoir worker. Verbal and informed consent was gotten from all the respondents before the study. Demographic features of each volunteer was also obtained at the time of sample collection. The blood collection was done by qualified health workers from the University of Maiduguri Clinic. For this, five milliliters sterile syringe and needles were used to aseptically collect blood samples from the cephalic veins of volunteers into properly labeled sterile bottles. The samples were kept in an ice-packed cooler before being transported to the laboratory. At the laboratory, the samples collected were centrifuged at 3000 rpm for 10 min and the sera decanted into vials and stored at - 20°C in the freezer until tested.

Sample analysis

The samples were analyzed for evidence of *Brucella* antibodies

*Corresponding author. E-mail: gsadamu@yahoo.com.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Table 1. Seroprevalence of brucellosis in different livestock workers at Maiduguri cattle market, Borno State, Nigeria.

Occupational groups	Number examined	Serological tests			
		RBPT with <i>B. abortus</i>		RBPT with <i>B. melitensis</i>	
		No. +ve (%)	No. -ve (%)	No. +ve (%)	No. -ve (%)
Animal handlers	40	5(12.5)	35(87.5)	00(00)	40(100)
Livestock keepers	25	4(16.0)	21(84.1)	00(00)	25(100)
Butchers	20	2(10.0)	18(90)	00(00)	20(100)
Middle men	15	00(0.0)	15(100)	00(00)	15(100)
Total	100	11(11)	89(89)	00(00)	100(100)

*The figure in parenthesis is percentages (%) of the amber positive or negative, No. +ve = Positive, No. -ve = negative, % +ve = percentage positive, % -ve = percentage positive, RBPT = Rose Bengal Plate Test.

using two different types of Rose Bengals Plate Test (RBPT) antigens. The antigens were the standard acidified Rose Bengal stained *B. abortus* and *B. melitensis* antigens prepared, standardized and supplied by the Veterinary Laboratory Agency (VLA) Survey, United Kingdom. The samples and RBPT antigens were removed from the refrigeration condition and left on the table at room temperature for an hour before the test was carried out. The rationale behind thawing of antigens before the test proper for one hour is to aloud the antigen attain room temperature so that it will not affect the test. A drop of the test serum was taken using a clean Pasteur pipette and placed onto test plate beside an equal drop of RBPT antigen using another clean pipette. These were then mixed well using a sterile applicator stick. The mixture was then hand rocked manually for 4 min. The presence of distinct granular agglutinin was recorded as positive result while samples that appeared clear without agglutination granules were recorded negative results. This procedure carried out was as described by Alton et al. (1975).

Data analysis

Prevalence rates of brucellosis in different categories of livestock workers and sex were subjected to Chi-square analysis using GraphPad InStat® to compare the prevalence among the different categories of animal handlers at 0.05 level of significance, where appropriate a computer software Statistical Package for Social Sciences (SPSS) version 20.0 was used (Dhand et al., 2005).

RESULTS

Out of 100 serum samples screened by Rose Bengal Plate Test (RBPT) antigen for both *B. abortus* and *B. melitensis*, 11 (11.0%) were seropositive to *Brucella* infection using *B. abortus* and 0% using *B. melitensis*. This comprised of 5 (12.5%) animal handlers, 4 (16.0%) livestock keepers, 2 (10.0%) butchers and 0% for the middle men, respectively (Table 1). There was no significant statistical difference ($P > 0.05$) between the various categories of livestock workers screened. The seroprevalence rate of 11.0% was detected in males only

as no female was screened for brucellosis and this could be as a result of mostly animal’s handlers in the state are male. Out of 100 serum samples tested using Rose Bengal Plate Test (RBPT) antigens for both *B. abortus* and *B. melitensis*, a seroprevalence rate of 11% was detected for *B. abortus* and 0% for *B. melitensis*. Eleven percent seroprevalence rate was detected in males only as no female was screened since the livestock work is still predominantly a male affair in the state.

The seroprevalence in animal handlers, livestock keepers, butchers and middlemen were found to be 12.5, 16, 10 and 0%, respectively (Table 1). Statistically, there was no significant difference ($P > 0.05$) between different categories of workers when the data were subjected to Chi-square analysis.

DISCUSSION

Sample collection from livestock workers was not easy as most of the workers assumed that their blood might be used for ritual purposes. Others refused to give their blood because they felt that they do not have sufficient blood to give out.

To minimize the problems of sample collection from this category of people, the livestock workers needed to be diplomatically approached ahead of time using their languages (Kanuri, Shuwa, Gwaza or Hausa) and also to go through their respective leaders. In most times, incentives had to go along with sample collection from this group of people. These reasons account for the only 100 samples obtained from volunteers. There was also the need to educate and enlighten the workers ahead of sample collection and the education continued even during the sample collection. It was equally very important to return to them the results of the findings on their sera, so as to know their test results and seek treatment from the medical hospital. The 11% (11/100)

prevalence rate of livestock workers against brucellosis at Maiduguri cattle Market is higher than the finding of 0% of livestock workers tested at the Akinyele cattle market, Ibadan, Nigeria (Cadmus et al., 2006). The difference is probably due to sample size as only 21 samples were collected from butchers, herdsman and abattoir workers in the Ibadan study as compared to 100 blood samples collected from animal handlers, livestock keepers, butchers and middlemen at the Maiduguri cattle market in our study. The 11% prevalence rate highlights the occupational hazard posed to this category of workers who handle most time infected animals (Falade, 2002). Most of the livestock workers during screening complained of frequent treatments for malaria without much improvement while some complained of joint pain and general body weakness signs suggestive of brucellosis (CDC, 2005; Muchaal, 2005). The fundamental reasons for the high infection rate recorded among the workers may not be unconnected with the poor and unhealthy practices by the workers. Generally, the livestock workers in this cattle market do not wear any protective clothing, leaving them exposed to infected materials such as blood, urine, vaginal discharges, aborted fetuses and placentas from infected animals. These workers are constantly exposed on a daily basis to aerosol and because of possible cuts on their bodies (especially hand and faces), they are at great risk of exposure to the diseases. As a result of little or no access to detailed medical care, those who develop symptoms of fever, joint aches and weakness always associate them with malaria which is an endemic disease in Africa (Cadmus et al., 2006). The seroprevalence was higher in livestock keepers (16%), followed by animal handlers (12.5%) then butchers (10%) and the least were middlemen (0%). The differences in the seroprevalence rates in these different categories of workers might not be unconnected with the differences in duration and constant exposure to infected materials from infected animals. From the study, the workers were infected mainly by *B. abortus* and not *B. melitensis*. The likelihood of the source of infection may be cattle since *B. abortus* infects cattle more than *B. melitensis* which predominantly infects sheep and goats (Radostits et al., 1997).

CONCLUSION AND RECOMMENDATION

Our serological investigation of livestock workers for evidence of brucellosis demonstrates the existence of the disease in people of the area studied and suggests the need to control the disease among this group of workers. The control measures should include among others, public health enlightenment of this group of workers on the danger and the mode of transmission of this disease.

They should be educated on the importance of strictly adhering to hygienic measures and should always wear gloves and protective clothing when handling sick or dead animals and especially at meat inspection. They should be educated on the avoidance of raw dairy foods especially unpasteurized milk, cheese and ice-cream. Attempts should be made by government and private hospitals to encourage routine screening of humans especially those at risk of exposure and those with pyrexia of unknown etiology and for brucellosis free treatment for those found positive.

Conflicts of interest

The authors declare that they have no conflict of interest.

ACKNOWLEDGEMENTS

The authors acknowledge the group leaders and the local chiefs who facilitated sample collection. The technical assistance given by Akintola of Veterinary Public Health and Preventive Medicine Department and Mallam Isa Adamu Gulani of Veterinary Medicine Department Research Laboratory are greatly acknowledged. We also greatly acknowledged the technical assistance rendered by Mr. Peter Akeredolu of Immunology Department, University of Maiduguri Teaching Hospital, Maiduguri and Almu A. M. Abdulkadir of University of Maiduguri Health Service.

REFERENCES

- Adamu NB, Okoh AE J, Azunka UJ (2007). Prevalence of brucellosis in nomadic herds of dromedaries in Borno State, Nigeria. *J. Camel Pract. Res.* 14(2):135-135
- Adamu SG, Tijjani AO, Adamu NB, Atsanda NN, Ali S, Gashua MM, Jajere MS, Hambali IU, Mustapha FB, Simon C (2014). Seroprevalence of Brucellosis in One-Humped Camel (*Camelus dromedarius*) Herds in Yobe State, Nigeria. *Int. J. Livest. Res.* 4(4):36-42.
- Alballa SR (1995). Epidemiology of human brucellosis in Southern Saudi Arabia. *J. Trop. Med. Hyg.* 98:185-189.
- Al Dahouk S, Sprague LD, Neubauer H (2013). New developments in the diagnostic procedures for zoonotic brucellosis in humans, *Rev. Sci. Tech. Off. Int. Epiz.* 32(1):177-188.
- Alton GG, Jones LM, Pietz DE (1975). *Laboratory Techniques in Brucellosis*, seconded. WHO Monograph Series No 55, WHO Geneva pp. 11-59.
- Boukary AR, Saegerman C, Rigouts L, Matthys F, Berkvens D (2010). Preliminary results of the study on zoonotic brucellosis and tuberculosis in Niamey. In: *Globalization of Tropical Animal Diseases and Public Health Concerns; proceedings of 13th AITVM 2010 International Conference*, 23–26 August 2010, Bangkok, Thailand. [Bangkok]: [Chulalongkorn University; Utrecht: Association of Institutions for Trop. Vet. Med. (AITVM)] pp. 22-24.
- Brisibe F, Nawathe DR, Bot CJ (1993). Serological prevalence of brucellosis in sheep, goats and human beings in Maiduguri

- Metropolis. Trop. Vet. 2:27-33.
- Cadmus SIB, Ijagbone IF, Oputa HE, Adesokan HK, Stack JA (2006). Serological survey of brucellosis in livestock animals and workers in Ibadan, Nigeria. Afr. J. Biomed. Res. 9:163-168.
- Center for Disease Control (CDC) (2005). *Brucellosis (Brucella melitensis, abortus suis and canis)*. Available at: www.cdc.gov/ncidod/dbmd/diseasesinfo/brucellosisg.htm.
- Chukwu CC (1987). Brucellosis in Africa part II. The importance. Bull. Anim. Health Prod. Afr. 35:92-98.
- Dhand NK, Gumber S, Sing BB, Ardhana, Bal MS, Kumar H, Shama DR, Singh J, Sandhu KS (2005). A study on the epidemiology of brucellosis in Punjab (India) using a survey tool box. Rev. Sci. Tech. Off. Int. Epiz. 24(3):879-885.
- Falade S (2002). A case of possible brucellosis relapse in a veterinarian. Trop. Vet. 20:226-230.
- Falenski A, Mayer-Scholl A, Filter M, Gollner C, Appel B, Nockler K (2011). Survival of *Brucella* spp. in mineral water, milk and yogurt. Int. J. Food Microbiol. 145:326-330.
- Mai HM, Irons P, Kabir J, Thompson PN (2012). A large seroprevalence survey of brucellosis in cattle herds under diverse production system in northern Nigeria. BMC Vet. Res. 8:144.
- Martín-Martín AI, Sancho P, Tejedor C, Fernández-Lago L, Vizcaino L (2011). Differences in the outer membrane-related properties of the six classical *Brucella* species. Vet. J. 189:103-105.
- Muchaal P (2005). Zoonoses of dairy cattle, with reference to Africa. www.ruaf.org/123/17-19.html.
- Mohammed FU, Ibrahim S, Ajogi I, Olaniyi BJ (2011). Prevalence of bovine brucellosis and risk factors assessment in cattle herds in Jigawa State. ISRN Vet. Sci. doi: 10.5402/2011/132897.
- Munir R, Afzal M, Hussain M, Naqvi SMS, Khanum A (2010). Outer membrane proteins of *B abortus* vaccinal and field strains and their immune response in buffaloes. Pak. Vet. J. 30:110-114.
- Oguntunde AO (1998). The appropriate technology for milk and dairy products in Nigeria. Paper Presented at the 12th Annual Conference of the Nigeria Institute of food, Science and Technology, Maiduguri. pp 3-5.
- Radostits OM, Blood DC, Gay C (1997). Disease caused by *Brucella* species. In: *Veterinary Medicine: A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses*. 8th edition. London. W.B. Saunders pp. 787-812
- Sadiq MA, Tijjani AN, Auwal MS, Mustapha AR, Tijjani AO, Gulani I, Mohammed A (2013). Prevalence of *Brucella* antibodies in donkeys (*Equus asinus*) in Borno and Yobe States, Nigeria. Sokoto J. Vet. Sci. 11(1):7-9.
- Seleem MN, Boyle SM, Sriranganathan N (2010). Brucellosis: A reemerging zoonosis. Vet. Microbiol. 140:392-398.
- Scholz HC, Nockler K, Gollner C, Bahn P, Vergnaud G, Tomaso H (2009). *Brucella inopinata* species Nov. isolated from a breast implant infection. Int. J. Syst. Evol. Microbiol. 60:650-654.
- Tijjani AO, Atsanda NN, Sule AG, Sadiq MA, Mohammed A, Hambali IU, Agbalaya M, Jankada AT (2012). Serological survey of *Brucella* antibodies in horses in Maiduguri Metropolis, Borno State, Nigeria. Afri. J. Anim. Biomed. Sci. 7(1):114-117.

Review

Is mobile health (mHealth) the magic bullet? A short review of the impact of mHealth on adolescent sexual health

Chukwuemeka Austin Ihesie

Department of Community Health, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria.

Received 3 April, 2015; Accepted 15 June, 2015

Adolescent sexual and reproductive health (ASRH) remains a major public health and developmental issue worldwide. The stage of adolescence is typically characterised by a desire for information, curiosity and experimentation. Adolescent social interactions, relationships and sexual behaviour are intimately linked to information available to them during this transition period and ASRH programmes deliver sexual and reproductive health (SRH) information through a varying number of intervention strategies. The proliferation of mobile phones ownership and use across all populations worldwide has created opportunities for new interventions in health. Its use in SRH especially for adolescents and young people has been researched in a number of studies. This article explores the potential and impact of the use of mobile health (mHealth) for ASRH promotion. This study is a literature review based on analysis of secondary data from published literature. An electronic database search was conducted on Global health, Web of science, Popline, PubMed and Google-scholar. Findings of the review show that most published studies on mHealth interventions were from developed countries. The mHealth based interventions recorded positive effects on improving knowledge and promoting some aspects of positive sexual behaviour like sexually transmitted infection (STI) testing and seeking SRH information. However, the effect on other aspects of sexual behaviour like condom use and sex-partner behaviour was inconsistent. It is concluded that mobile phones can be an effective tool for engaging with adolescents concerning their SRH however, further research with randomised controlled trials are encouraged with special focus on adolescents in developing countries.

Key words: Adolescent, reproductive health, mobile phones, mHealth.

INTRODUCTION

Mobile health (mHealth) is the use of mobile communications technology and portable electronic devices such as personal digital assistants (PDAs) and mobile phones to provide health services and information (Vital-wave, 2009). About 5 billion mobile phone subscriptions exist worldwide; around 60% of these users

are in developing countries. This high penetration has resulted in mobile phones being considered as a viable option for assisting the provision of healthcare services including sexual and reproductive health (SRH) (WHO, 2011).

Adolescent SRH has been an area of focused interest

* E-mail: austinihesie@yahoo.com. Tel: +2348033286352.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

in the health sector. Adolescents are a group of the population between the ages of 10-19 years characterised by experiences of series of rapid developmental changes which impact their SRH (WHO, 2010). Access to SRH education and services is essential for this group as they are exposed to significant risks of sexually transmitted infections (STIs) as a result of interrelated factors like low risk perception, low confidence, socio-cultural values and issues of trust, confidentiality, poor judgement and knowledge of sexual health. All these result in risky sexual behaviour like early sexual debut, poor condom use and multiple sex-partners (Malbon and Romo, 2013; WHO, 2010).

Mobile phone ownership and access among adolescents is increasing, bringing attention to how this application can aid in bridging the gaps in adolescent sexual health. Recent publications have reported that mHealth interventions like short message service (SMS) have been successful in promoting behaviour change for smoking, diet and physical activity in young people (Gold et al., 2011a). Mobile phones have also been used in health successfully in the area of data collection, monitoring, disease/epidemic outbreak-tracking, health-education and others (WHO, 2011).

This paper reviews literature on the subject-topic to ascertain if mHealth interventions have an effect on promoting positive sexual behaviour among adolescents.

METHODOLOGY

This is a study review based on analysis of secondary data from published literature. An electronic database search was conducted on Global health, Web of science, Popline, PubMed and Google-scholar. Keywords related to the research question (mHealth, mobile health, sexual health, adolescents, young people) were used for basic and advanced search of the databases. Keyword truncation was initially employed to broaden the search while keywords combination was done using Boolean characters “and” or “or” to limit the initial search. Citation snowballing from selected articles reference list was also done to identify related articles.

Criteria

Inclusion: Articles/publications on:

1. Mobile phone use in SRH.
2. On adolescents and young people.
3. Published between 2004 to 2014.

Exclusion: All non-English publications.

Justification

1. Focus on mHealth research has increased over the 10

10 years with several pilot studies ongoing.

2. Young people are included because their age range (15 to 24) overlaps with adolescents (12 to 19).
3. Limited language proficiency necessitates the exclusion of non-English publications.

Articles identified from the keyword search strategies were subjected to a selection process depicted by a Prisma flow diagram illustrated in Figure 1. Abstracts and contents of search results were comprehensively reviewed for relevance to the question and finally 8 articles were selected.

Limitations

The exclusion of non-English publications and 10-year restriction limits the number of available publications which may contain important findings.

LITERATURE REVIEW/ANALYSIS

Mobile health interventions have been shown to be effective in improving knowledge (WHO, 2011), yet translation of knowledge gained to sexual behaviour change varies. Results from studies measuring the effect of mobile phone interventions on sexual behaviour of adolescents do not show uniformly significant effects. The sexual behaviour of adolescents assessed in most studies reviewed include: risky sexual behaviour (condom use and multiple sex partners), STI testing, clinic attendance and seeking sexual health information. These form the themes for the review.

Risky sexual behaviour: Condom use, multiple sex-partners

The effect of mobile SMS on risky sexual behaviour of adolescents has been shown to have mixed outcomes. Gold et al. (2011a) in a randomised control trial (RCT) of 7,606 Australian young people (adolescents and young adults) evaluated the use of mobile phone advertising to promote positive sexual behaviour and sun safety. Participants were randomised to receiving text messages for sexual health and sun safety as intervention and control groups, respectively. An example of one of the messages sent to the intervention group reads “Roses are red, daisies are white, use a condom if you get lucky tonight. Happy Valentines Day!”. The study reported the intervention group as having fewer multiple sex-partners and more likely to use a condom with a new partner than the control group (Gold et al., 2011a). Although the small proportion of enrolled participants who actually completed the baseline and follow-up survey (<5%) threatened the validity of the study, the study design ensured the findings were nonetheless significant.

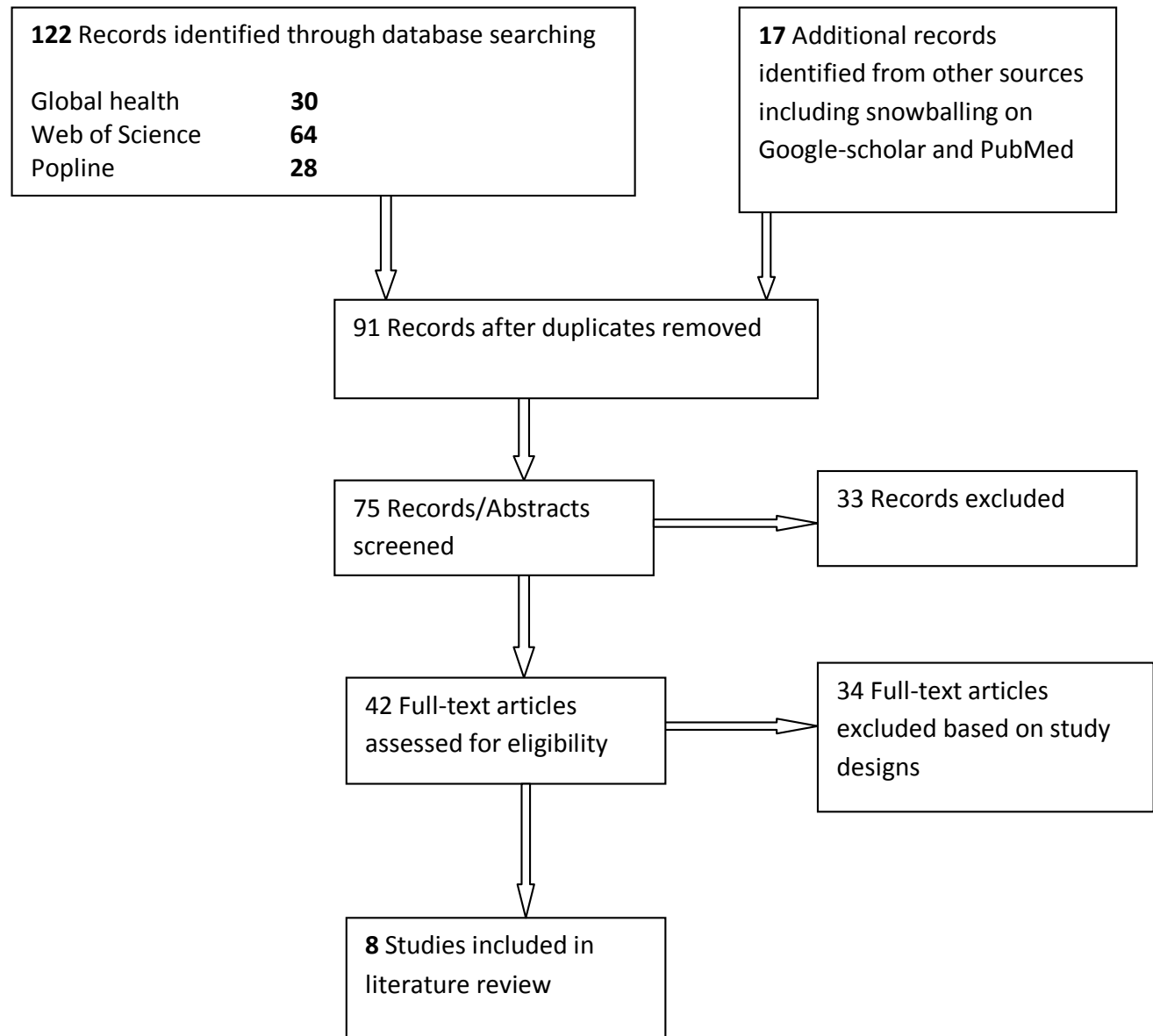


Figure 1. The search process in prisma flow diagram.

In another study in the United States of America, Cornelius et al. (2013) who focused on HIV prevention intervention for African-American adolescents delivered via mobile phones also recorded increased condom use along with increased knowledge of human immunodeficiency virus (HIV) (Cornelius et al., 2013). A similar effect on condom use was recorded among young people in Kenya and Tanzania in another prospective pilot study reported by Namirembe and Hoefman (Namirembe and Hoefman, 2012). However, mixed results were reported by Juzang et al. (2011) in their non-randomised controlled trial of mobile texts for HIV prevention in the United States. Although there was a significant reduction in participants engaging with multiple

sex-partners, there was no change in condom use. However, the small sample of 30 per group may have resulted in a low powered study, impacting the findings (Juzang et al., 2011). In contrast to the positive effect on risky sexual behaviour reported, an RCT on 994 Australian young people by Lim et al. (2012) reported no significant change in condom use in the intervention group after sending SMS for 12 months. This occurred despite the reported increase in awareness of sexual risk and favourable reception of messages by participants (Lim et al., 2012).

In the United States, another RCT assessing impact of mobile voice-calls for 12 months on contraceptive use by 805 adolescent female clinic patients reported no change

in condom use between the 2 groups (Kirby et al., 2010). Only 2.7 out of 9 voice-calls specified by study protocol were completed suggesting that using phone calls may be a less feasible mHealth delivery strategy for this purpose. The completion rates of 75% for the study, 39% by Lim et al. (2012) and the long duration of the studies (12-months) gave the results a better validity than the RCT by Gold et al. (2011a) (with <5% completion-rate).

STI testing and reproductive clinic attendance

The effect of SMS on promoting STI testing was reported by Levine et al while evaluating SEXINFO, a free sexual health mobile text messaging information and referral service for young people in the United States (Levine et al., 2008). They sampled 322 young patients on sexual behaviours and SEXINFO use at clinics where SEXINFO users were commonly referred for sexual health consultation/testing. Findings reported 11% of respondents had used the SEXINFO service and a significantly large number resided in campaign target areas, suggesting that SEXINFO had a positive effect on encouraging STI testing. They also found that those within the adolescent age group were both more likely to be aware and make use of the service. The survey method for assessment helped reduce bias associated with self-reporting for STI testing. The report was however ambiguous about the status of surveyed patients as it didn't clearly state if they were new or returning clients.

Gold et al. (2011a) in a large prospective study (1771 participants) on the impact of SMS on youth sexual promotion also reported a significant increase in STI testing in both sexes (Gold et al., 2011b) unlike results from the RCT by Lim et al. (2012) which reported increased STI testing only among females. The large sample size used by Gold et al. (2011a) strengthens the validity of the results however the study design employed without randomisation and controls implies confounders were not excluded. Randomization is important because it provides the strongest evidence for causal inference. It is therefore impossible to clearly say if the increased STI-treatment recorded was due to the SMS or other ongoing SRH-promotion programmes. Namirembe and Hoefman (2012) reported a significant increase in SRH-clinic attendance and uptake of family planning services by young people in Kenya and Tanzania following SMS intervention (Namirembe and Hoefman, 2012).

In contrast, the RCT by Gold et al. (2011a) on Australian youths reported no improvement in STI testing and clinic attendance after 4 months of intervention (Gold et al., 2011a).

Seeking sexual health information

Studies showed an improvement in sexual health

information-seeking behaviour after mHealth intervention. Lim et al. (2011) in their RCT reported a significant increase in seeking sexual-health information among females in the intervention group only, most females reported seeking and discussing sexual health issues with a clinician following the mobile SMS (Lim et al., 2012). The evaluation results of the SEXINFO program (Levine et al., 2008) also reported increased text inquiries for sexual health information. It recorded 4,500 inquiries in 6 months with more than half leading to referrals and more information. The program encourages young people to take up the responsibility of seeking SRH information for themselves through their mobile phones unlike previous studies above that sent out SRH information on a regular basis. This is similar to the "pull" component of the "pull-and-push" concept and mobile health interventions designed to combine this two modes of delivery may result in more promising results. However, this mode of delivery needs more research with robust study designs. Most of the literature reviewed used SMS as the delivery method for mobile phone interventions on sexual health probably because SMS are cheap and popular among adolescents and young people, meeting their needs for relevant, accurate information, privacy and confidentiality for sexual health promotion (Perry et al., 2012).

CONCLUSION

The findings of the review as summarised in Table 1 show that mHealth interventions improve knowledge and have some effect on promoting positive sexual behaviour albeit non-uniformly. Although STI testing and seeking SRH information showed improvements following interventions, the same cannot be said for condom use and sex-partner behaviour. Further research into this area is necessary to unravel underlying reasons and help plan more effective interventions. Future reports should also be disaggregated by gender to identify any differences for possible focus. The deployment of mHealth for adolescent sexual health promotion in developing countries also needs to be intimately researched with RCTs as they provide the strongest evidence for causal inference and none were retrieved during the search for this review. Although mobile phone ownership/access and willingness to access sexual-health information is high among adolescents in developing countries (Akinfaderin-Agarau et al., 2012; Mitchell et al., 2011), socio-economic and gender-cultural issues/barriers need to be considered in designing studies. Mobile phones can be an effective tool for engaging with adolescents who tend to be enthusiastic and adapt easily to new technology. Although mHealth is not a 'magic bullet', it has a strong potential to address barriers, improve access to required SRH information and promote positive sexual behaviour among adolescents and young people.

Table 1. Summary of findings.

Source	Population targeted	Country	Design/sample size	Mhealth strategy used	Effect of mHealth intervention on:		
					Risky sexual health behaviour: Condom use, multiple sexual partners	Seeking sexual health information	STI testing and clinic attendance
Gold et al. (2011a)	16 – 29 years	Australia	RCT (7606)	SMS	Increased condom use; reduced multiple sexual partners	NR	No improvement
Lim et al. (2012)	16 – 29 years	Australia	RCT (994)	SMS	No change	Improved in females only	Improved in females only
Kirby et al. (2010)	14-18 years	USA	RCT (805)	Voice-calls	No change	NR	NR
Levine et al. (2008)	12 -24 years	USA	Prospective (322)	SMS	NR	Increased	Increased
Gold et al. (2011b)	16 -29 years	Australia	Prospective (1171)	SMS	NR	NR	Increased
Namirembe and Hoefman (2012)	12 years and above	Kenya, Tanzania	Prospective	SMS	Increased condom use	Increased	Increased family planning uptake
Juzang et al. (2011)	16 – 20 years	USA	Non-randomised controlled (60)	SMS	Unchanged condom use; Reduced multiple sexual partners	NR	NR
Cornelius et al. (2013)	13 – 18 years	USA	Prospective (40)	SMS	Increased Condom use	NR	NR

NR: Not reported.

Conflict of interest

Author have none to declare.

REFERENCES

- Akinfaderin-Agarau F, Chirtau M, Ekponimo S, Power S (2012). Opportunities And Limitations For Using New Media And Mobile Phones To Expand Access To Sexual And Reproductive Health Information And Services For Adolescent Girls And Young Women In Six Nigerian States. (Special Issue: Promoting Youth Sexual And Reproductive Health In Africa: The Need For A Paradigm Shift.). *Afr. J. Reprod. Health* 16(2):219-230.
- Cornelius JB, Dmochowski J, Boyer C, St Lawrence J, Lightfoot M, Moore M (2013). Text-Messaging-Enhanced Hiv Intervention For African American Adolescents: A Feasibility Study. *J. Assoc. Nurses AIDS Care* 24(3):256-67.
- Gold J, Aitken CK, Dixon HG, Lim MS, Gouillou M, Spelman T, Wakefield M, Hellard ME (2011a). A Randomised Controlled Trial Using Mobile Advertising To Promote Safer Sex And Sun Safety To Young People. *Health Educ. Res.* 26(5):782-794
- Gold J, Lim MS, Hocking JS, Keogh LA, Spelman T, Hellard ME (2011b). Determining The Impact Of Text Messaging For Sexual Health Promotion To Young People. *Sex. Transm. Dis.* 38(4):247-252
- Juzang I, Fortune T, Black S, Wright E, Bull S (2011). A Pilot Programme Using Mobile Phones For Hiv Prevention. *J. Telemed. Telecare* 17(3):150-3
- Kirby D, Raine T, Thrush G, Yuen C, Sokoloff A, Potter SC (2010). Impact Of An Intervention To Improve Contraceptive Use Through Follow-Up Phone Calls To Female Adolescent Clinic Patients. *Perspect. Sex. Reprod. Health* 42(4):251-7
- Levine D, McCright J, Dobkin L, Woodruff AJ, Klausner JD (2008). Sexinfo: A Sexual Health Text Messaging Service For San Francisco Youth. *Am. J. Public Health* 98(3):393-5.
- Lim MSC, Hocking JS, Aitken CK, Fairley CK, Jordan L, Lewis JA, Hellard ME (2012). Impact Of Text And Email Messaging On The Sexual Health Of Young People: A Randomised Controlled Trial. *J. Epidemiol. Commun. Health* 66(1):69-74.
- Malbon K, Romo D (2013). Is It Ok 2 Txt? Reaching Out To Adolescents About Sexual And Reproductive Health. *Postgrad. Med. J.* 89(1055):534-9.
- Mitchell KJ, Bull S, Kiwanuka J, Ybarra ML (2011). Cell Phone Usage Among Adolescents In Uganda: Acceptability For Relaying Health Information. *Health Educ. Res.* 26(5):770-81
- Namirembe E, Hoefman B (2012). Promoting Youth Reproductive Health Through Text Messaging. *Sex. Health Exch.* 2:14-15
- Perry RC, Kayekjian KC, Braun RA, Cantu M, Sheoran B, Chung PJ (2012). Adolescents' Perspectives On The Use Of A Text Messaging Service For Preventive Sexual Health Promotion. *J. Adolesc. Health* 51(3):220-5
- Vital-Wave C (2009). Mhealth For Development: The Opportunity Of Mobile Technology For Healthcare In The Developing World. [Online]. Available at: <http://Unpan1.Un.Org/Intradoc/Groups/Public/Documents/Unpan/Unpan037268.Pdf>
- WHO (2010). The Sexual And Reproductive Health Of Young Adolescents In Developing Countries: Reviewing The Evidence, Identifying Research Gaps, And Moving The Agenda. Report Of A Who Technical Consultation. Geneva: Who
- WHO (2011). Mhealth: New Horizons For Health Through Mobile Technologies: Second Global Survey On Ehealth. Geneva: World Health Organisation.

Full Length Research Paper

Audit of use of antimicrobial agents at a tertiary health centre in Lagos, Nigeria

Sunday O. Ogundele^{1*}, Olayinka O. Ogunleye¹, Bamidele Mutiu² and Samuel O. Akodu³

¹Department of Pharmacology, Lagos State University College of Medicine Ikeja, Lagos, Nigeria.

²Department of Microbiology, Lagos State University College of Medicine Ikeja, Lagos, Nigeria.

³Department of Paediatrics, Lagos State University Teaching Hospital Ikeja, Lagos, Nigeria.

Received 27 October, 2014; Accepted 10 July, 2015

Antimicrobial agents are reported to be the commonest prescribed medication among physicians. Studies have shown that up to 50% of antimicrobial agents prescriptions are inappropriate. The study was a retrospective cross-sectional design. Records of all patients admitted to both the medical and paediatrics wards during the period of audit were reviewed after discharge from the hospital. The appropriateness of the prescribed antimicrobial agents given to them was determined by a microbiologist who was independent of the team that managed the patients. More than 50% of antimicrobial agents prescribed for our inpatients were inappropriate. The most common test done to investigate infections in these patients was complete blood count and the most common class of antimicrobial agents prescribed was cephalosporin. Based on the outcomes of this study we recommend constituting a drug and therapeutics committee to develop an antimicrobial stewardship policy and the guideline for implementing the policy for a more rational use of these agents.

Key words: Antimicrobial agents, physicians, prescriptions.

INTRODUCTION

Antimicrobial agents (AA) are reported to be the commonest prescribed medication among physicians (Odusanya and Oyediran, 2000; Arroll and Goodyear-Smith, 2000). Studies on drug use indicators showed that inappropriate use of AA is common, with the rate of inappropriate prescription of these agents exceeding 50% in many centres (Pulcini et al., 2007; Akinyede et al., 2000; Ohaju-Obodo et al., 2008; Hawkey, 2008). Consequences of inappropriate use of AA include increased morbidity, mortality, and cost of health care (Arroll and Goodyear-Smith, 2000; Lee et al., 2007; Norberto et al., 2007; Hsueh et al., 2005; Shira and Lisa

2011). Problems associated with inappropriate use of AA are caused by emergence of drug resistant microorganisms, increased rate of *Clostridium difficile* infection, AA toxicity, drug-drug interactions, catheter related infections and other hospital acquired infections (Pulcini et al., 2007; Albrich et al., 2004).

Therefore, this study sought to audit the prescription pattern of antimicrobial agents for patients admitted to our hospital wards. The study broad objective was to determine the rate of inappropriate use of AA at our centre and to use findings from this study as a basis for recommending appropriate steps to reduce this practise.

*Corresponding author. E-mail: soogundele@hotmail.com. Tel: +234 803 721 3422.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](http://creativecommons.org/licenses/by/4.0/)

The specific objectives were to determine the appropriateness of the use of the AA in our hospital settings, pattern of use of these agents and assessment of laboratory investigations for assessing possible infection in patients before prescribing AA. The study design was a retrospective cross-sectional review of case records of patients treated with AA during their hospital stay.

MATERIALS AND METHODS

Site

This study took place at Lagos State University Teaching Hospital, Ikeja, Lagos State, Nigeria in Departments of Medicine and Paediatrics. The review was conducted in April 2014.

Study design

The design was a retrospective cross-sectional review of case records of all patients given antimicrobial medicine during the period. All the available case records of adults and children admitted to the medical and paediatric wards during the study period were included for review.

Study procedure

From the available case notes, relevant information for the study were extracted and transferred onto a structured questionnaire which served as a guide for the information required. The audit took place over a four week period. Information extracted from the patients record include the following: gender, indications for antibiotic use, co-morbid conditions, investigations requested and completed, name(s) of antimicrobial agent(s) and other medications used during inpatient care, dosages of the antimicrobial agent, duration of use and outcome of patient care. The appropriateness of the prescribed antimicrobial agents was determined by a microbiologist who was independent of the team that managed the patients. Extractions of data from the patients' case record were done by the investigators and not the physicians in the team that managed the patients at admission.

Microbiologist review

The assessment of appropriateness was done using the algorithm developed by Gyssens et al. (1992). Important factors considered in the determination of appropriateness of these studies include the use of the agent indicated, spectrum of activity of the agent, dosage interval, route of administration, duration of therapy, effectiveness, toxicity, and cost. The diagnosis and the results of the laboratory work up were also considered in the assessment of the antimicrobial agents.

Ethics

Patients' information were treated with confidentiality and no form of personal identifiers was disclosed.

RESULTS

A total of 82 case notes of patients who received AA

during their admission into both the medical and paediatrics wards of our centre during the study period were assessed.

The profile of these patients showed that 44 (54%) of them were males, with 45 (55%) of them admitted to the medical wards (Table 1).

The most common class of antimicrobial agents prescribed during the study period was cephalosporin, 59 (72%) of the patients had a drug in this class; this was followed by co-amoxiclav, which was given to 14 (17%) of the patients (Figure 1).

The assessment of the antimicrobial agents prescription performed by a microbiologist independent of the team that managed the patients revealed that less than half, 46% of the antimicrobial agents prescribed during the study period was appropriate; there was no sufficient data available to assess the AA prescription for 13% of the patients (Table 2).

DISCUSSION

This study showed that inappropriate prescriptions of antimicrobial agents are still common among physicians in our centre. The finding that less than 50% of antimicrobial agents prescribed during the study period were appropriate in keeping what had been reported from previous studies (Odusanya and Oyediran 2000; Akinyede et al., 2000; Lee et al., 2007). The most common form of inappropriate use of antimicrobial agents in this study was the prescription of AA when there was no justification for their use. The lack of justification can either be that there was no need to use these agents for prophylaxis, no evidence of infection is present to indicate their use or the suspected infection is of viral origin. The finding from an Australia study showed that an average of 82% of prescriptions at eight different hospitals that participated in their review to assess the prevalence and appropriateness of antimicrobial use among children were appropriate showed that it is possible to achieve a higher rate of rational use of antimicrobial agents (Osowicki et al., 2014). The high rate of appropriate use of AA reported in the study was because those hospitals have antimicrobial stewardship policy in place (Osowicki et al., 2014). It has been reported that the problem of inappropriate use of AA is due to poor prescribers' knowledge of rational use antimicrobial as well as lack of standard treatment guidelines for their use (Shira and Lisa, 2011; Leung et al., 2011; Nadjm et al., 2010). Lack of sufficient supervision and training of prescribers, lack of access to rapid diagnostic tests to guide treatment decisions, considerations of financial gains from both prescribers and dispensers, and inappropriate marketing strategies of pharmaceuticals can also lead to improper prescribing (Leung et al., 2011; Nadjm et al., 2010).

Laboratory support is important in the overall management of infectious diseases. Laboratory tests

Table 1. Demographic profile of patients managed with antimicrobial agents on medical and paediatric ward of LASUTH Ikeja.

Variable	Count (%)
Gender	
Male	44 (54)
Female	38 (46)
Number of antimicrobial agents	
One	38 (46)
At least two	44 (54)
Cases per department	
Medicine	45 (55)
Paediatrics	37 (45)
Indication for use of antimicrobial agent	
Empirical	70 (85)
Prophylaxis	12 (15)
Investigation	
Complete blood count	60 (73)
Chest X-ray	20 (24)
Culture and sensitivity	23 (28)
Microscopy	21 (26)

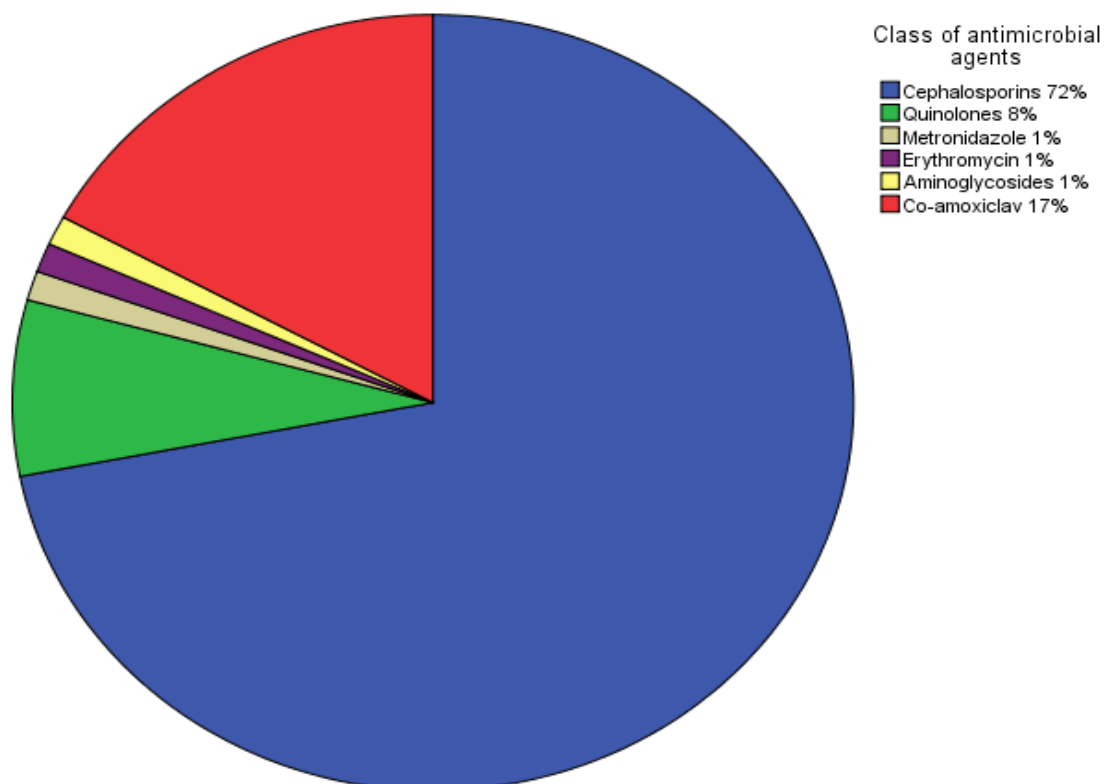
**Figure 1.** Class of antimicrobial agents.

Table 2. Classification of appropriateness of antimicrobial agents used on the medical and paediatric ward of LASUTH Ikeja.

Classification	Description	Count (%)
I	Appropriate	38 (46)
II	Inappropriate dosage interval	1 (1)
IIIa	Inappropriate due to excessive duration	7 (9)
IIIb	Inappropriate due to short duration	3 (4)
Iva	Inappropriate due to available a more effective alternative	7 (9)
IVb	Inappropriate due to available less toxic alternative	1 (1)
V	Use of antimicrobial agent not justified	14 (17)
VI	Insufficient data for classification	11 (13)
Total	-	82 (100)

help in detecting the presence of infections or in identifying organism causing them, and in assessing sensitivity of organisms to different AA The TDR Diagnostics Evaluation Expert Panel (2010). Pattern of investigations ordered and done in cases reviewed in this study revealed that the most common test done prior to starting antimicrobial agents was complete blood count (CBC). This test is useful in establishing the presence of infection but not for identifying the organism causing it. This test therefore does not help in deciding the choice of the antimicrobial agent to be prescribed. This may explain why most of the AA prescribed in this study were speculative and not directed at the organisms causing the infections.

The finding in this study that prescription of AA is rarely supported by culture and sensitivity results is in line with similar finding by Nadjm et al (2010) as reported in WHO guidelines for antimicrobial treatment in children admitted to hospitals in areas of intense *Plasmodium falciparum* transmission Nadjm et al. (2010). Inappropriate use of medicines affects the safety and quality of therapeutic care and lead to waste of resources.

The most commonly prescribed class of antimicrobial agents of choice in this study are the cephalosporins. Availability of equally effective and cheaper alternative agents make the use of cephalosporins inappropriate in some of the cases reviewed (Nadjm et al., 2010; The TDR Diagnostics Evaluation Expert Panel 2010; NICE, 2014).

The finding of high rate of inappropriate prescription of AA in this study makes the need to have an antimicrobial stewardship programme necessary. Antimicrobial stewardship is defined as 'the optimal selection, dosage, and duration of antimicrobial treatment that results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance' (Shira and Lisa, 2011). The aim of the stewardship team is to help each patient receive the most appropriate antimicrobial at the correct dose and duration; prevent antimicrobial agents overuse, misuse, and abuse; and to minimize the development of resistance by the currently available antimicrobial agents

Shira and Lisa (2011).

The National Institute for Health and Care Excellence (NICE) guideline for AA use recommends that antimicrobial agents should not be started without clinical evidence of bacterial infection, where evidence exists or suspected local guidelines should be used to commence prompt and effective antimicrobial treatment NICE (2014). Documentation of treatment should include the following clinical indication, duration of treatment or review date, route and dose of antimicrobial agents NICE (2014). Duration review of treatment decision is taken on when to stop, switching from intravenous to oral route, and changing the agent if indicated. The review should occur within 48 h of commencement of the AA NICE (2014).

To promote a more rational use of antimicrobial agents in our hospitals, it was recommended that an antimicrobial stewardship team be established. The main focus of the team should be to develop an antimicrobials policy or guidelines for the hospital. The team may be in the form of a drug and therapeutics committee that will provide a forum for all relevant professionals to work together to achieve a set goal Kathleen and Terry (2014). In many developed countries, a well-functioning Drug and Therapeutics Committees (DTC) has been shown to be effective in addressing drug use problems. DTCs do not exist in many developing countries and where they exist, they do not function optimally due to lack of local expertise or a lack of incentives. The establishment of an infectious disease unit for liaison services within the hospital was also recommended. The unit may be headed by an infectious disease physician or by a clinical microbiologist.

Conflict of interest

Authors have none to declare.

REFERENCES

Akinyede AA, Mabadeje AFB, Aliu A (2000). A comparative study of

- patterns of prescription of antibiotics in two health centres in Lagos. *J. Niger. Infect. Control Assoc.* 3:20-23.
- Albrich WC, Monnet DL, Harbarth S (2004). Antibiotic selection pressure and resistance in *Streptococcus pneumoniae* and *Streptococcus pyogenes*. *Emerg. Infect. Dis.* 10:514-517.
- Arroll B, Goodyear-Smith F (2000). General practitioner management of upper respiratory tract infections: when are antibiotics prescribed? *N Z Med. J.* 113(1122):493-496.
- Gyssens IC, Van danBroek PJ, Uliberg BK, Hekster YA, Van der Meer JWM (1992). Optimizing antimicrobial therapy. A method for antimicrobial drug use evaluation. *Antimicrob. Chemother.* 30: 724-727.
- Hawkey PM (2008). The growing burden of antimicrobial resistance. *J. Antimicrob. Chemother.* 62(suppl):1-9.
- Hsueh PR, Chen WH, Luh KT (2005). Relationships between antimicrobial use and antimicrobial resistance in Gram-negative bacteria causing nosocomial infections from 1991-2003 at a university hospital in Taiwan. *Int. J. Antimicrob. Agents* 26:463-472.
- Kathleen H, Terry G (2014). Drug and therapeutics committees: A practical guide. Available at: www.who.int/medicinedocs/pdf/s4882e/s4882e.pdf.
- Lee NY, Lee HC, Ko NY, Chang CM, Shih HI, Wu CJ, Ko WC (2007). Clinical and economic impact of multidrug resistance in nosocomial *Acinetobacter baumannii* bacteremia. *Infect. Control Hosp. Epidemiol.* 28:713-719.
- Leung E, Weil DE, Raviglione M, Nakatani H, on behalf of the World Health Organization (2011). World Health Day Antimicrobial Resistance Technical Working Group: The WHO policy package to combat antimicrobial resistance. *Bull. World Health Organ.* 89:390-392.
- Nadim B, Amos B, Mtove G, Ostermann J, Chonya S, Wangai H, Kimera J, Msuya W, Mtei F, Dekker D, Malahiyo R, Olomi R, Crump JA, Whitty CJ, Reyburn H (2010). WHO guidelines for antimicrobial treatment in children admitted to hospital in an area of intense *Plasmodium falciparum* transmission: prospective study. *BMJ* 340:c1350
- NICE (2014). Quality statement 1: Antimicrobial stewardship. NICE quality standards [QS61]. Available at: <http://www.nice.org.uk/guidance/qs61/chapter/quality-statement-1-antimicrobial-stewardship>
- Norberto K, Wissam A, Yaron B, Salim H (2007). Antibiotic prescription and cost pattern in a general intensive care unit. *Pharm. Pract.* 5(2):67-73.
- Odusanya OO, Oyediran MA (2000). Rational drug use at primary health care centres in Lagos, Nigeria. *Nig. Q J. Hosp. Med.* 10(1):4-7.
- Ohaju-Obodo JO, Isah AO, Mabadeje AFB (2008). Prescribing pattern of clinicians in private health institutions in Edo and Delta states of Nigeria. *Nig. Q J. Hosp. Med.* 8:91-94.
- Osowicki J, Gwee A, Noronha J, Palasanthiran P, McMullan B, Britton PN, Isaacs D, Lai T, Nourse C, Avent M, Moriarty P, Clark J, Francis JR, Blyth CC, Cooper CM, Bryant PA (2014). Australia-wide point prevalence survey of the use and appropriateness of antimicrobial prescribing for children in hospital. *Med. J. Aust.* 201(11):657-62.
- Pulcini C, Cua E, Lieutier F, Landraud L, Dellamonica P, Roger PM (2007). Antibiotic misuse: a prospective clinical audit in a French university hospital. *Eur J Clin. Microbiol. Infect. Dis.* 26 (4):277-280.
- Shira D, Lisa E (2011). Davidson. *Antimicrobial Stewardship*. *Mayo Clin. Proc.* 86(11):1113-1123
- The TDR Diagnostics Evaluation Expert Panel (2010). Evaluation of diagnostic tests for infectious diseases: general principles. Available at: <http://www.nature.com/reviews/micro>. Accessed June 16 2015.

The background of the journal cover features a dark brown, textured surface. In the center, there is a glowing globe with a sunburst effect emanating from it. The sunburst consists of numerous thin, white, needle-like rays radiating outwards. The globe itself is partially obscured by the text and other elements.

Journal of Public Health and Epidemiology

Related Journals Published by Academic Journals

Journal of Diabetes and Endocrinology

Journal of Medical Genetics and Genomics

Journal of Medical Laboratory and Diagnosis

Journal of Physiology and Pathophysiology

Medical Practice and Reviews

Research in Pharmaceutical Biotechnology

academicJournals