

Journal of

Public Health and Epidemiology

Volume 4 Number 2 February 2012

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@acadjournals.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*

Dr. Simon Francis Thomsen

*Department of Respiratory Medicine
Copenhagen University Hospital
Bispebjerg Bakke 23
DK-2400 Copenhagen NV
Denmark*

Dr Manish Kumar Goel

*Dept. Of Community Medicine, PGIMS, Rohtak,
Haryana,
India*

Dr Zubair Kabir

*Visiting Scientist- Harvard School of Public Health,
Boston, MA- 02215, Senior Epidemiologist-
TobaccoFree Research Institute, Dublin
Ireland*

Dr. Liancai Mu

*Department of Research
Hackensack University Medical Center
30 Prospect Avenue
Hackensack, NJ 07601
USA*

Dr. Maria E. Dávila

*Universidad Centroccidental Lisandro Alvarado.
School of Health Sciences. Epidemiology and
Bioestatistic Branch. Department of Preventive
Medicine.
Venezuela*

Dr. Xiaofeng Ren

*Institution/address Northeast Agricultural University,
59 Mucai Street, Harbin 150030, China
China*

Prof. Guangwen Cao

*Second Military Medical University/ 800 Xiangyin Rd.,
Shanghai 200433
China*

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: © 2012, 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

- A descriptive study of behavioural patterns associated with gastrointestinal illness in the general Swedish population** 30
Jonas Toljander and Nina Karnehed
- Prevalence and transmission of *Trichomonas vaginalis* infection among women in Khartoum State, Sudan** 34
Dahab M. M., Koko W. S., Osman E. E. and Hilali A. H. M.
- Enteric pathogens and diarrhea disease potentials of water sources in Ahiazu Mbaise, Eastern Nigeria** 39
Esomonu Onyenonachi Charity, Abanobi Okwouma C. And Ihejirika Chinedu Emeka
- Prevalence and factors associated with healing outcomes of hospital-acquired pressure ulcers among patients with spinal cord injury** 44
Ezema Charles Ikechukwu, Idowu Opeyemi Ayodiipo, Anekwe David Emeka, Adelugba Julius Kayode, Nwoba Izuchukwu Michael and Ogunbameru Temitope Deborah
- Assessment of awareness on food borne zoonoses and its relation with veterinary public health services in and around Addis Ababa, Ethiopia** 48
Sisay Girma, Girma Zewde, Ketema Tafess, and Tariku Jibat

Full Length Research Paper

A descriptive study of behavioural patterns associated with gastrointestinal illness in the general Swedish population

Jonas Toljander* and Nina Karnehed

Risk Benefit Assessment Department, National Food Agency, Uppsala, Sweden.

Accepted 27 January, 2012

A nation-wide survey was conducted in 2009 to collect information about behavioural patterns possibly associated with gastrointestinal illness (GI) in the general Swedish population. One-third of the respondents used various internet and/or telephone resources to find information about GI. Nearly eighty percent said that they buy and consume certain food products or beverages, and one-third of the respondents claimed that they buy over-the-counter pharmaceutical products for treatment of GI. In the present study, information retrieval behaviour on the internet and telephone calls to health care advice services appear to be the most relevant indicators of GI in Sweden.

Key words: Beverages, consumption patterns, foods, drugs, incidence of foodborne and waterborne gastrointestinal illness, health indicators, information retrieval, outbreak detection, over-the-counter drugs (OTC drugs), surveillance.

INTRODUCTION

Research on behavioural patterns during gastrointestinal illness (GI) is sparse. However, knowledge in this area could have great public health implications. An earlier detection of food- or waterborne outbreaks increases the chances of identifying the source of infection. As a complement to traditional surveillance, syndrome surveillance based on various signals and health indicators in the community may be used for earlier detection of outbreaks (Hogan et al., 2003; Edge et al., 2006). Such signals may include behavioural patterns among those who are ill, for example, information retrieval, seeking of healthcare advice, and purchasing of drugs.

This study presents a nation-wide, population based survey of behavioural patterns of GI in Sweden. The primary aim was to obtain knowledge about behavioural patterns in Sweden that may serve as indicators for detecting outbreaks of GI in the general population. A secondary aim was to estimate the incidence of food- and waterborne illnesses in the population.

METHODOLOGY

Respondents, 16 to 85 years of age, were selected from Statens personadressregister (SPAR, 2009), which includes all individuals who are registered as resident in Sweden. Background information was collected about each respondent, including sex, age, place of residence, education, occupation, household size, number and age of children living in the household. Respondents were also asked whether they had experienced GI (vomiting and/or diarrhoea, chronic illness excepted) in the last five years, whether they had experienced GI in the last 12 months allegedly due to intake of food or drinking water, and whether the alleged food or drink had been consumed whilst being in Sweden or abroad. Respondents were also asked to provide information on information- and treatment seeking behaviour about GI on the internet and via the telephone, consumption of specific food products and pharmaceuticals for self-treatment of GI, and willingness to report foodborne illness. Behavioural data were analysed using logistic regression in Minitab version 15 (Minitab Inc.).

RESULTS AND DISCUSSION

Table 1 presents the main results of 1,000 completed computer assisted telephone interviews performed by professional interviewers in November 2009. The response rate of the survey was 55%. The estimated

*Corresponding author. E-mail: jonas.toljander@slv.se. Tel: +46-(0)18-17 55 00.

Table 1. Frequency of gastrointestinal illness (GI) and information retrieval and consumption behaviour associated with GI in the general Swedish population.

Question	Response	No. respondents (%)
Gastrointestinal illness (GI)		
Had GI in the past 5 years	Yes	476 (48)
	No	507 (51)
	Unsure	17 (2)
Had GI in the past 12 months due to intake of food or water	Yes	92 (9)
	No	364 (37)
	Unsure	20 (2)
Had GI in the past 12 months due to intake of food or water in Sweden	Yes	68 (7)
	No	23 (2)
	Unsure	1 (0)
Information retrieval		
Seeks information on the internet	Yes	278 (28)
	No	680 (68)
	Unsure	42 (4)
Most commonly used websites	www.google.com	149 (15)
	www.varguiden.se (a regional healthcare advice service, mainly Stockholm area)	73 (7)
	www.1177.se (a national healthcare advice service)	70 (7)
Seeks information via the telephone	Yes	386 (39)
	No	586 (59)
	Unsure	28 (3)
Most commonly used telephone health advice service	1177 Sjukvårdsrådgivningen (a national healthcare advice service)	227 (23)
	Outpatients' clinic	140 (14)
Consumption		
Buys certain foods or beverages	Yes	775 (78)
	No	204 (20)
	Unsure	20 (2)
Most commonly purchased food products	Blueberry soup	247 (25)
	Cola-type sodas	189 (19)
	Probiotics	62 (6)
	Rusks	59 (6)
	Soured milk	59 (6)
	Rose-hip soup	43 (4)
Buys pharmaceuticals (prescription or over-the-counter)	Yes	342 (34)
	No	589 (59)
	Unsure	68 (7)
Most commonly purchased pharmaceuticals	Electrolyte replacements	61 (6)

Table 1. Contd.

	Anti-diarrhoeal loperamide-based products	57 (6)
	Activated charcoal	23 (2)
Buys natural remedies	Yes	127 (13)
	No	819 (82)
	Unsure/no response	53 (5)

incidence of GI (all causes, 5-year recall) corresponded to 0.095 illnesses per person and year. The estimated incidence of food- and waterborne GI (12-month recall) was 0.092 illnesses per person and year and the corresponding incidence for GI believed to have been contracted in Sweden was 0.068 (Table 1). The estimated number of food- and waterborne illnesses contracted in Sweden was 506,739; 95% CI 390,535 to 622,942. A z-test was carried out and the proportion of food- and waterborne illnesses in 2009 was not significantly different from 1994 ($p > 0.05$) (Norling, 1994).

Gastrointestinal illness was significantly more common among younger respondents ($p < 0.05$), and respondents aged 20 to 39 were over-represented among those who had experienced GI. This is consistent with the reported foodborne illnesses in Sweden (Lindblad et al., 2009). A previous survey showed that young adults living in the cities twice as often contract foodborne GI compared with the average population and that the risk significantly increases for those who dine out rather than at home (Norling, 1994). Gastrointestinal illness was also more common among respondents in families with small children under the age of five, compared with respondents in families with older children or no children. The present estimates of GI incidence are likely to be underestimations since it was not possible for respondents to state the total number of illnesses (if applicable) experienced during the time period in question. In addition, recall bias may also lead to an underestimation of the incidence. This explains why the 5-year recall of total GI resulted in an estimated incidence that was very close to the 12-month recall of foodborne GI in the present study.

Many Swedes use the telephone or the internet to obtain information or advice about GI. One-third of the respondents used either the internet or the telephone to obtain information about GI when they, or a member of their family, fall ill from GI (Table 1). The most commonly used channels for this type of information were the telephone-based national healthcare advice service (<http://www.1177.se>) and the internet-based Google search engine. Using the internet for information retrieval about GI was significantly associated with respondents younger than the median age (52 years), with university education, living with another adult, and who had experienced GI due to food or drinking water in the past

12 months. Using the telephone for seeking information was significantly related to whether the respondent lived in a household with at least one child under the age of five years. The use of specific search terms in search engines or health care websites may provide information useful for syndrome surveillance. For example, Google Flu Trends (<http://www.google.org/flutrends>) use search terms as indicators of seasonal influenza (Ginsberg et al., 2009), and the Swedish Institute for Communicable Disease Control successfully use web queries as an additional surveillance system for monitoring seasonal norovirus infections (Hulth et al., 2010). It is however important to keep in mind that web queries are not direct measures of illness activity. Web queries rather reflect the current interest among internet users for the topic in question, which may be influenced by a range of factors.

Sales statistics on certain food products or drugs may possibly be used as public health indicators. Seventy-eight percent bought specific food products when they or a member of their family fell ill from GI (Table 1). Buying food products was significantly associated with respondents who were female, had children living at home, and had experienced GI in the past five years. The most frequently bought products were blueberry soup, cola-type sodas and probiotics. To the best of our knowledge, sales frequencies of food products have not been used for monitoring infectious disease in the general population. However, this may not be surprising since any association of such data to disease incidence is inherently difficult to analyse. This is due to high baseline consumption in the community and because factors other than GI more strongly correlate with consumption patterns of these food products.

One-third of the respondents bought pharmaceutical products or natural remedies (Table 1). Buying pharmaceuticals was significantly related to respondents younger than the median age, who lived in households consisting of at least two adults, and who had experienced GI due to food or drinking water in the past 12 months. The use of over-the-counter (OTC) drug sale statistics as indicators of illness has been evaluated in other studies. Edge et al. (2006) found that OTC sales of drugs against diarrhoea and nausea were good predictors of norovirus infections in the community. Hogan et al. (2003) concluded that increased sales of electrolyte products usually preceded hospital diagnoses

of respiratory and diarrheal diseases in children, and may therefore facilitate an earlier detection of outbreaks.

Forty-eight percent of the respondents claimed that they would report to their municipal health and environment department if they believed themselves, or a member of their family, to have become ill due to food poisoning. Most respondents prefer the internet as a means of reporting food poisonings. Seventy-six percent of the respondents said that they would like to be able to report to the National Food Agency (NFA) directly, preferably by using the internet. Willingness to report to NFA was significantly associated with respondents younger than the median age of the survey. There was no significant relationship between willingness to report and having experienced food- or drinking water-related GI in the past 12 months.

This study adds novel findings on how Swedes behave when encountering a GI event. The knowledge might be used in developing an efficient surveillance of foodborne illnesses that is necessary for timely intervention during outbreaks and for preventing new and/or severe cases of illness. Public health surveillance and early detection of food- and waterborne outbreaks in Sweden may be strengthened by: new options for the general public to report foodborne illnesses via the internet; a more efficient use of the currently available reporting system; and the use of information retrieval behaviour on the internet and via telephone calls to health care advice services; and, possibly, consumption patterns of certain foods and pharmaceuticals.

ACKNOWLEDGEMENT

This work was supported by grants from the Swedish Civil Contingencies Agency (MSB).

REFERENCES

- Edge VL, Pollari F, King L, Michel P, McEwen SA, Wilson JB, Jerrett M, Sockett PN, Martin SW (2006). Syndromic surveillance of norovirus using over-the-counter sales of medications related to gastrointestinal illness. *Can. J. Infect. Dis. Med. Microbiol.*, 17: 235-241.
- Ginsberg J, Mohebbi MH, Patel RS, Brammer L, Smolinski MS, Brilliant L (2009). Detecting influenza epidemics using search engine query data. *Nature*, 457: 1012-1014.
- Hogan WR, Tsui FC, Ivanov O, Gesteland PH, Grannis S, Overhage JM, Robinson JM, Wagner MM (2003). Detection of pediatric respiratory and diarrheal outbreaks from sales of over-the-counter electrolyte products. *J. Am. Med. Inf. Assoc.*, 10: 555-562.
- Hulth A, Andersson Y, Hedlund K-O, Andersson M (2010). Eye-opening approach to norovirus surveillance. *Emerg. Infect. Dis.*, 16: 1319-1321.
- Lindblad M, Westöö A, Lindqvist R, Hjertqvist M, Andersson Y (2009). *Matförgiftningar i Sverige - analys av rapporterade matförgiftningar 2003-2007* (Foodborne disease in Sweden - analysis of reported incidents in 2003-2007). Uppsala: National Food Administration.
- Norling B (1994). *Matförgiftningar i Sverige - resultat av en intervjuundersökning* (Foodborne disease in Sweden - results from an interview survey). Uppsala: National Food Administration.
- SPAR (2009). *Statens personadressregister (SPAR)*, Swedish National Tax Board.

Full Length Research Paper

Prevalence and transmission of *Trichomonas vaginalis* infection among women in Khartoum State, Sudan

Dahab M. M.¹, Koko W. S.¹, Osman E. E.² and Hilali A. H. M.³

¹Microbiology Department, Pure and Applied Sciences, International University of Africa, Khartoum, Sudan.

²Medicinal and Aromatic Plants Research Institute, National Centre for Research, Khartoum, Sudan.

³Biology Department, University College, Umm Elqura University, Makka Elmukaramma, Kingdom of Saudi Arabia.

Accepted 4 November, 2010

This study was carried out from January 2008 to December 2009 to determine the prevalence of trichomoniasis among women in Khartoum State, Sudan. Two different hospitals were selected. The two hospitals were Ibrahim Malik hospital which is serving an urban area and Ombada hospital which is serving a rural area and migrant people coming from other parts of Sudan particularly Western Sudan. Monthly data was collected including demographic, social and other factors related to infection with trichomoniasis using a questionnaire. Urine samples were collected weekly every month and examined using wet mount preparation method. 297 women were found infected with *Trichomonas vaginalis* of a total of 2473 examined making an overall prevalence rate of 12%. Prevalence of infection was slightly higher among women in Ombada hospital than those in Ibrahim Malik hospital but the difference is not statistically significant. However, difference in infection is statistically significant regarding areas of residence ($P < 0.05$). The highest (15.6%) and the lowest (4.8%) prevalence rates were recorded in Alsalam locality (Ombada hospital) and Khartoum locality (Ibrahim Malik hospital) respectively suggesting a difference in awareness between rural and urban areas. Significant differences related to age were recorded. The highest prevalence rates were among women in the age groups 15 to 19 and 20 to 24 years. High infection rates were recorded during the hot and rainy season from July to October. Social, traditional and behavioral factors proved to be important factors in relation to infection of *T. vaginalis* among women in Khartoum State. Results indicate the importance of the problem and the need for more research and efforts to control it.

Key words: *Trichomonas vaginalis*, prevalence, traditions, social, behavioral factors.

INTRODUCTION

Trichomonas vaginalis infection is one of the major health problems in the world, and one of the most common transmitted infections in many regions including the developed countries such as United State (Parbara, 2005). Prevalence estimates vary between populations studied falling in the range from 0.4 to 27.4% in women and 0.0 to 5.6% in men (Swygard et al., 2004). The annual worldwide incidence of trichomoniasis is more than 250 million cases (Seema and Arti, 2008).

In Sudan, trichomoniasis was reported among women by Omer (1978) and more recently by Salih (2005). But the actual burden of the disease in Sudan remains

unknown and no information on risk factors for *T. vaginalis* infection in women is available. Thus, the present study was undertaken among women in two hospitals in Khartoum State to give more information on prevalence and seasonal changes in transmission of the disease and to identify its associated risk factors. Findings of this study will lead to a better understanding of the disease and activate efforts for its control. Results will also stimulate further research in this area.

MATERIALS AND METHODS

Study area

This study was carried out among women patients of two hospitals in two localities in Khartoum State, Ombadda and Khartoum locality.

*Corresponding author: mahmoubio@hotmail.com.

Ombada locality lies at the western area of Omdurman town at about 7 km away from Khartoum. Ombada consists of three administrative units namely Albogaa, Alameer and Alsalam. Ombada is considered a migratory area as most of its population came from all parts of Sudan especially from Western Sudan with different culture and traditions. In this locality, there is a high degree of unawareness about the disease itself and health hazards as a whole. Khartoum locality lies between Blue and White Niles. Khartoum consists of seven administration units namely Alshohada, EL-geraif and Soba East, Alshagara, Middle, West and Khartoum unit. In this locality, there is generally better education and awareness about health hazards.

Collection of urine samples

T. vaginalis was detected in women who are admitted to Ombada and Ibrahim Malik Hospitals with pelvic inflammatory disease (PID) or vaginal discharge complaints. Urine samples were obtained in a sterile container. All samples were examined by wet mount preparations method as described by Ackers and Lumesdn (1978).

Wet mount preparations

A vaginal discharge samples were taken for diagnosis using wet smear as follows: Each subject was given a wide opening, leak-proof universal specimen container and was instructed on how to collect urine samples. About 20 ml of urine sample was obtained from each subject. No personal identifications (names, ID number, address etc) were used on the urine samples. Instead bar-coded numbers were used to ensure obscurity of subjects, to facilitate laboratory procedures and minimize the chances of errors during the handling of urine samples. Urine samples were placed into a tube and centrifuged (Ackers and Lumesdn, 1978). A drop of deposit was put on a slide, covered with a slip and examined under high power magnification 40x of light microscope and examined for motile flagellates. All positive cases were treated with metrinidazole (flagyl).

Study of transmission pattern

Samples from Ombada and Ibrahim Malik Hospitals were examined for presence or absence of *T. vaginalis*. The sampling conducted weekly from indoor patients at Ombada and Ibrahim Malik Teaching Hospitals for successive twelve month period. The Medical Ethical committee of the hospitals approved the study and consent was provided for all participants. Clinical examination was conducted by a physician in each hospital for all patients including reason for presentation to the clinic, complaints, pregnancy, previous abortions and examination of the cervix and vagina. Our inclusion criteria for the study were: women aged 15 to 45 years who were sexually active and had referred to gynecology units or general clinics for either to be symptomatic (vaginal discharge, genital ulcer and low abdominal pain) or asymptomatic (routine examination).

A questionnaire was also used to collect data on socio-demographic status including age and area of residence; behavioral variables including marital status of women, type of water used in shower, types of plant fume or any herbs used as traditional medicine and partner infection; lack of information about sexually transmitted diseases and pelvic inflammatory diseases (STD and PID, respectively).

Statistical analysis

Prevalence of infection was compared between different variables

by Chi-squared test. Significance was attributed to probability values $P \leq 0.05$. Computer SPSS and Microsoft excel programs were used for determination of probability values.

RESULTS

Of the total population of 2473 examined in the two hospitals, 297 (12%) were found infected with *T. vaginalis*. Prevalence of infection was higher in Ombada hospital (12.4%) compared to Ibrahim Malik hospital (11.7%) but the difference was not statistically significant ($P > 0.05$). However, difference due to area of residence was statistically significant as it is presented between localities in Table 1. Prevalence rates ranged between 11.9 and 15.6% in Ombada localities and between 4.8 and 12.8% in Ibrahim Malik localities (Table 1).

Prevalence of trichomoniasis infection in relation to age is shown in Table 2. The highest prevalence rates were 15.4 and 14.2%, and they were recorded in the age groups of 15 to 19 and 20 to 24 years, respectively. Prevalence rates tend to decrease in elderly women but the difference was not significant ($P > 0.05$).

Prevalence of trichomoniasis among married, single and divorced women is presented in Table 3. The highest infection rate was among married women (13.3%). Difference in relation to marital status is statistically significant. Similar difference was also in relation to pregnancy status but the highest prevalence was among aborted women (Table 3).

The relationship of infection to type of tap water temperature used in houses is illustrated in Table 4. Significant difference in the prevalence of infection with respect to degree of water temperature was observed ($P < 0.05$). The lowest prevalence rate was among women using hot water (10.8%); whereas, the highest rate was among those using cold water.

The relation between plant fume and trichomoniasis infection shows high effect from different types of plants (stems and branches of trees) which are traditionally used by women in all parts of Sudan. Women that used hot water had lower infection rates with increased water temperature compared to women that do not.

Patients infected with trichomoniasis showed various symptoms and signs of vaginitis. The frequency of vaginitis symptoms and signs is shown in Table 5. Vaginal discharge was the most common symptom in women (15.1%); the other high frequent symptoms or signs were priritus (12.3%) and abdominal pain 37 (12.5%). Vaginal discharge was significantly associated with *T. vaginalis*.

Figure 1 shows the monthly distribution of prevalence of *T. vaginalis* infection among women in Ombada and Ibrahim Malik hospitals. The highest number of infections was observed in October 17.8% while the lowest number of prevalence infections showed in February, March, April and May. Statistical analysis by Chi-square showed significant difference in the prevalence of infection by month.

Table 1. Prevalence of *T. vaginalis* among women in Ombada Hospital and Ibrahim Malik Hospital in Khartoum State.

Places	No. of infected	Total number	Prevalence (%)
Ombada Hospital*	145	1172	12.4
Ibrahim Malik Hospital*	152	1301	11.7
Alsalam	67	429	15.6
Alameer	46	387	11.9
Albogaa	24	201	11.9
Alshohada	40	421	9.5
Geraif+East soba	75	584	12.8
Alshagara	28	298	9.4
Middle Khartoum	16	132	12.1
Khartoum	1	21	4.8
Total	297	2473	12

* P value > 0.05; P value < 0.05.

Table 2. Prevalence of *T. vaginalis* according to the age of women in Ombada Hospital and Ibrahim Malik Hospital in Khartoum State.

Age range	No. of infected	Total number	Prevalence (%)
15-19	55	357	15.4
20-24	92	650	14.2
25-29	57	518	11
30-34	43	357	12
35-39	34	405	8.4
40-45	16	186	8.6
Total	297	2473	12

P value > 0.05.

Table 3. Prevalence of *T. vaginalis* according to marital and pregnancy status among infected women in Ombada Hospital and Ibrahim Malik Hospital in Khartoum State.

Women status	No. of infected	Total number	Prevalence (%)
Married	237	1783	13.3
Single	48	477	10.1
Divorced	12	213	5.6
Pregnant	71	703	10.1
Not pregnant	217	1637	13.3
Aborted	9	133	6.8

P value < 0.05.

DISCUSSION

The overall prevalence of the disease recorded among women in this study was 12% exceeding figures reported previously by Omer (1978) and Salih (2005). This refers to the importance of the disease among women. Moreover, it is clear from the findings of this study that the prevalence of infection was much higher in rural areas

compared to urban areas. This is logical since awareness about the disease and its associated risks and also access to health care centers in rural areas is by far less than urban areas.

The prevalence of infection was high among women of age groups 15 to 19 and 20 to 24 years compared to elder women (40 to 45 years). Similar pattern of infection in relation to age was reported in Sudan (Salih, 2005) and

Table 4. Prevalence of *T. vaginalis* in relation to type of plant fume and type of water temperature used by infected women in Ombada Hospital and Khartoum Hospital in Khartoum State.

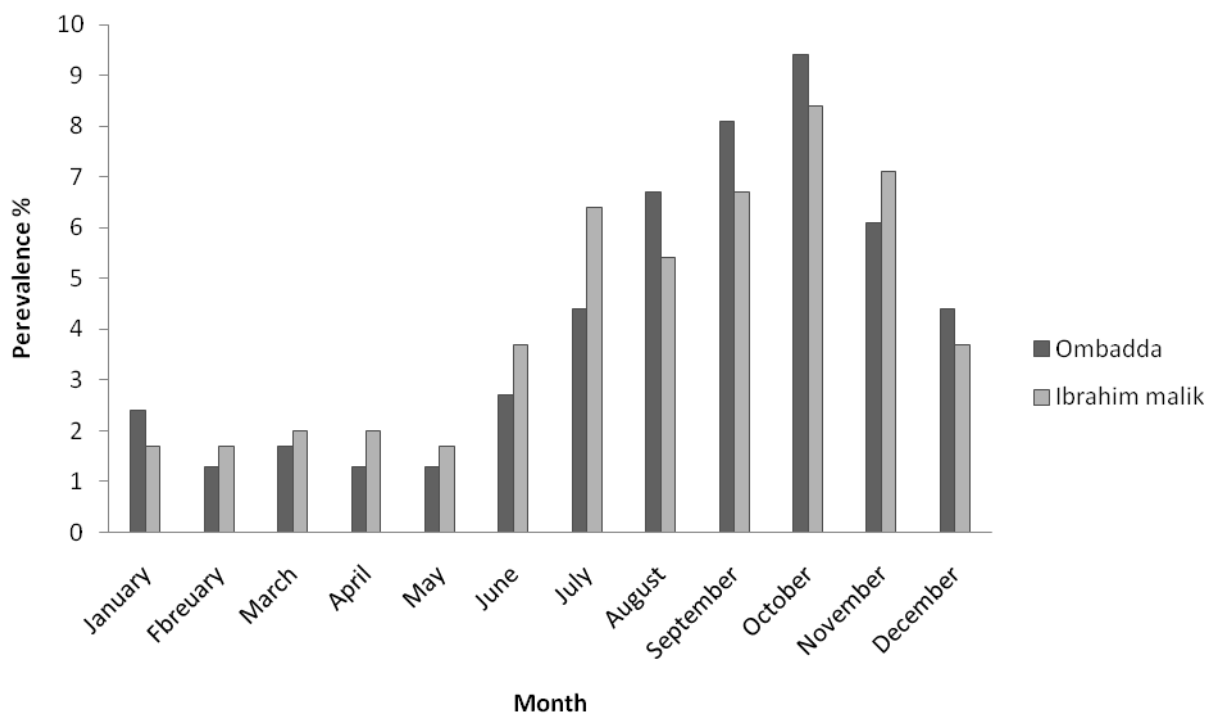
Type of plant fume	No. of infected	Total number	Prevalence (%)
Talih	152	1399	10.9
Shaf	47	464	10.1
Habeel	4	16	25
Fume not used	94	594	15.8
Cold water	60	480	12.5
Normal water	210	1743	12.1
Hot water	27	250	10.8

P value < 0.05

Table 5. Frequency of Trichomoniasis symptoms and signs among infected women in Ombada Hospital and Ibrahim Malik Hospital in Khartoum State.

Symptoms	No. of infected	Total number	Prevalence (%)
Vaginal discharge	144	957	15.1
Pruritus	42	340	12.3
Abdominal pain	37	297	12.5
Dysuria	23	256	9.1
Burning	19	222	8.6
Erythema	15	156	9.6
Pelvic pain	12	156	7.7
Dyspareunia	5	79	6.3
Total	297	2473	12

P value < 0.05

**Figure 1.** Monthly changes of prevalence of *T. vaginalis* infection among women in Ombada Hospital and Ibrahim Malik Hospital in Khartoum State.

in Nigeria (Chigozie et al., 2006; Adeoye and Akande, 2007). This is also in agreement with our observations in this study as the highest infections were among married women and all or most women in the age of 15 to 24 years are married. The low infection rates among women in the age of 40 to 45 years may probably be related to the development of acquired immunity to infection with increase of age.

As for infection of trichomoniasis in relation to pregnancy status, prevalence rates were less among aborted and pregnant women than among not pregnant women. This gives more evidence for the importance of regular clinical investigations for early diagnosis and treatment of such urino-genital infections in women as pregnant women are regularly visiting health units for routine check-up of pregnancy. However, in other studies in Nigeria for example pregnancy status did not affect the prevalence of trichomoniasis (Adeoye and Akande, 2007).

Prevalence of trichomoniasis tends to decrease with the increase of water temperature of path shower used by women in this study. The lowest records were among women using hot water. These observations agree with *in vivo* results described in Korea by Jae-Sook and Duk-Young (2006).

Traditional use of plants fume (Talih and Shaf trees) had lead to a lower infection rate of trichomoniasis among women using it. As these plants are usually heated on fire when used, high temperature may be the reason leading to high mortality of flagellates causing infection. Other reasons related to chemical composition of these plants should also be considered and studied in future.

Vaginal discharge was found to be high among infected women (15.1%) and seemed to be the prominent symptom of trichomoniasis infection in women. Other symptoms such as pruritis, abdominal pain and erythema were also reported among infected women in this study. Several studies have associated *T. vaginalis* with these symptoms particularly vaginal discharge and erythema and vulva irritation (Al-hindi and Lubbad, 2006 and Adeoye and Akande, 2007).

Significant seasonal changes have also been recorded in this study with a noticeable increase in prevalence of infection during the hot rainy season from July to October. This may be attributed to the less hygienic environment during this season in Sudan or to other reasons need to be investigated. However, Alhindi and Lubbad (2006) found no clear trend in prevalence of *T. vaginalis* infection in a study among Palestinian women over a period of 6 years.

Conclusion

In conclusion, this study contributed in giving further information on prevalence of infection with *T. vaginalis*

among women in two different localities in Sudan. The study also identified some important factors related to disease infection and transmission and referred to the need for further research in this problem.

ACKNOWLEDGEMENTS

The authors are grateful to the ministry of health in Sudan for providing facilities which make this study possible. Thanks are also due to Medicinal and Aromatic Plants Research Institute for their technical support. We are grateful to Mr. Eltayeb Fadul and Mrs. Aya Taha for their assistance in laboratory work.

REFERENCES

- Ackers J, Lumsden D (1978). Immunology of genitourinary trichomoniasis. Proceedings of International Symposium on Urinogenital trichomoniasis. Paris, pp. 109-113.
- Adeoye G, Akande A (2007). Epidemiology of *Trichomonas vaginalis* among women in Lagos Metropolis, Nigeria. Pak. J. Biol. Sci., 10(13): 2198-2201.
- Al-hindi AI, Lubbad AH (2006). *Trichomonas vaginalis* infection among Palestinian Women: Prevalence and Trends during 2000-2006. Turk. J. Med. Sci., 36 (6): 371-375.
- Chigozie J, Cletus DC, Ugwuoru E, Ali MA (2006). Trichomonas vaginalis among pregnant women in South-Eastern Nigeria: The public health significance. Internet J. Gynecol. Obstet., 6:1.
- Jae-Sook RYU, Duk-Young MIN (2006). *Trichomonas vaginalis* and trichomoniasis in the Republic of Korea. Korean J. Parasitol., 44(2): 101-116.
- Omer EE (1978). Trichomoniasis in Sudanese women presenting with vaginal discharge. Sudan Med. J., 16: 1-5.
- Parbara Van Der P (2005). Prevalence, incidence, natural history and response to treatment of *Trichomonas vaginalis* infection among adolescent women. J. Infect. Dis., 192: 2039-2043.
- Salih AM (2005). Detection of *Trichomonas vaginalis* individuals at Bashair Hospital. M. Sc. Thesis, Faculty of Veterinary Sciences, University of Khartoum, Sudan.
- Seema S, Arti K (2008). An update on Trichomonas vaginalis. Indian J. Sex. Transm. Dis. Rev., 29(1): 7-14.
- Swygard H, Sena AC, Hobbs MM, Cohn MS (2004). Trichomoniasis: Clinical Manifestations, Diagnosis, and Management. Sex. Transm. Infect., 80: 91-95.

Full Length Research Paper

Enteric pathogens and diarrhea disease potentials of water sources in Ahiazu Mbaise, Eastern Nigeria

Esomonu Onyenonachi Charity^{1*}, Abanobi Okwouma C.¹ and Ihejirika Chinedu Emeka²

¹Department of Public Health, Federal University of Technology, Owerri, Imo State, Nigeria.

²Department of Environmental Technology, Federal University of Technology, Owerri, Imo State, Nigeria.

Accepted 27 January, 2012

This research was targeted at determining the load of enteric pathogens and possible diarrheal disease potentials of the water sources to prevent possible disease outbreak through improved portable water supply for the inhabitants. Water samples were collected from boreholes, underground tanks, and streams and subjected to standard microbiological analysis. The result of total heterotrophic bacterial count (THBC) and total coliform bacterial count (TCBC) (cfu/ml) ranged between 2.0×10^5 to 1.2×10^2 and 4.8×10^3 to 2.0×10^1 cfu/ml respectively. The isolates occurred thus: *Escherichia coli* (50.0%), *Salmonella* spp. (100%), *Shigella* spp. (100%), *Streptococcus* spp. (50.0%), *Vibrio* spp. (20.0%), *Proteus* spp. (30.0%), *Klebsiella* spp. (80.0%), and *Enterobacter* spp. (50.0%). This showed that *Salmonella* and *Shigella* spp. occurred highest (100%) in water samples followed by *Klebsiella* (80.0%); while the lowest occurrence was recorded by *Vibrio* spp. (20.0%). The occurrence of total isolates in water samples showed thus: samples A (50.0%), B (37.5%), C (37.5%), D (50.0%), E (25.0%), F (75.0%), G (50.0%), H (87.5%), I (100%), and J (87.5%). These results show that stream water sources had more enteric pathogens followed by underground tank sources and borehole water sources being the least contaminated. Water sources in Ahiazu Mbaise are not free from enteric pathogens and might expose users to diarrhea.

Key words: Enteric pathogens, water sources, Ahiazu Mbaise, diarrhea, morbidity, mortality.

INTRODUCTION

A study in 1990 estimated that more than one billion people in developing countries lacked access to safe drinking water (WHO, 2000). A clean and treated water supply to each house may be the norm in Europe and North America, but in developing countries, access to both clean water and sanitation are not the rule, and waterborne infections are common. The lack of water supply and sanitation, that is, water that is easily accessible, adequate in quantity, free from contamination, safe and readily available throughout the year, is the primary reason why diarrheal diseases are so common in developing countries (Aderigbe et al., 2008; Park, 2002). Two and a half billion people have no access to improved sanitation, and more than 1.5 million children die each year from diarrhea diseases (Fenwick, 2006). Diarrhea

accounts for 10% disease burden in developing countries (Park, 2002). According to the WHO, the mortality of water associated diseases exceeds 5 million people per year. From these, more than 50% are microbial intestinal infections (Cabral, 2010). Coliform bacteria are used as microbiologic indicators for water quality. Freedom from contamination with fecal matter is the most important parameter of water quality because human fecal matter is generally considered to be a greater risk to human health as it is more likely to contain human enteric pathogens that are agents of diarrhea (Scott et al., 2008). Ahiazu Mbaise, Imo State, Nigeria, is made up of about 500,000 people and the major sources of water supply include underground water tanks, streams, and boreholes, which, if contaminated, might serve as a major source of enteric pathogens responsible for diarrhea disease. Therefore, this research was targeted at determining the load of enteric pathogens and possible diarrheal disease potentials of the water sources to prevent possible disease outbreak through improved portable water supply

*Corresponding author. E-mail: nachihejirika@yahoo.com. Tel: +234-8033917824.

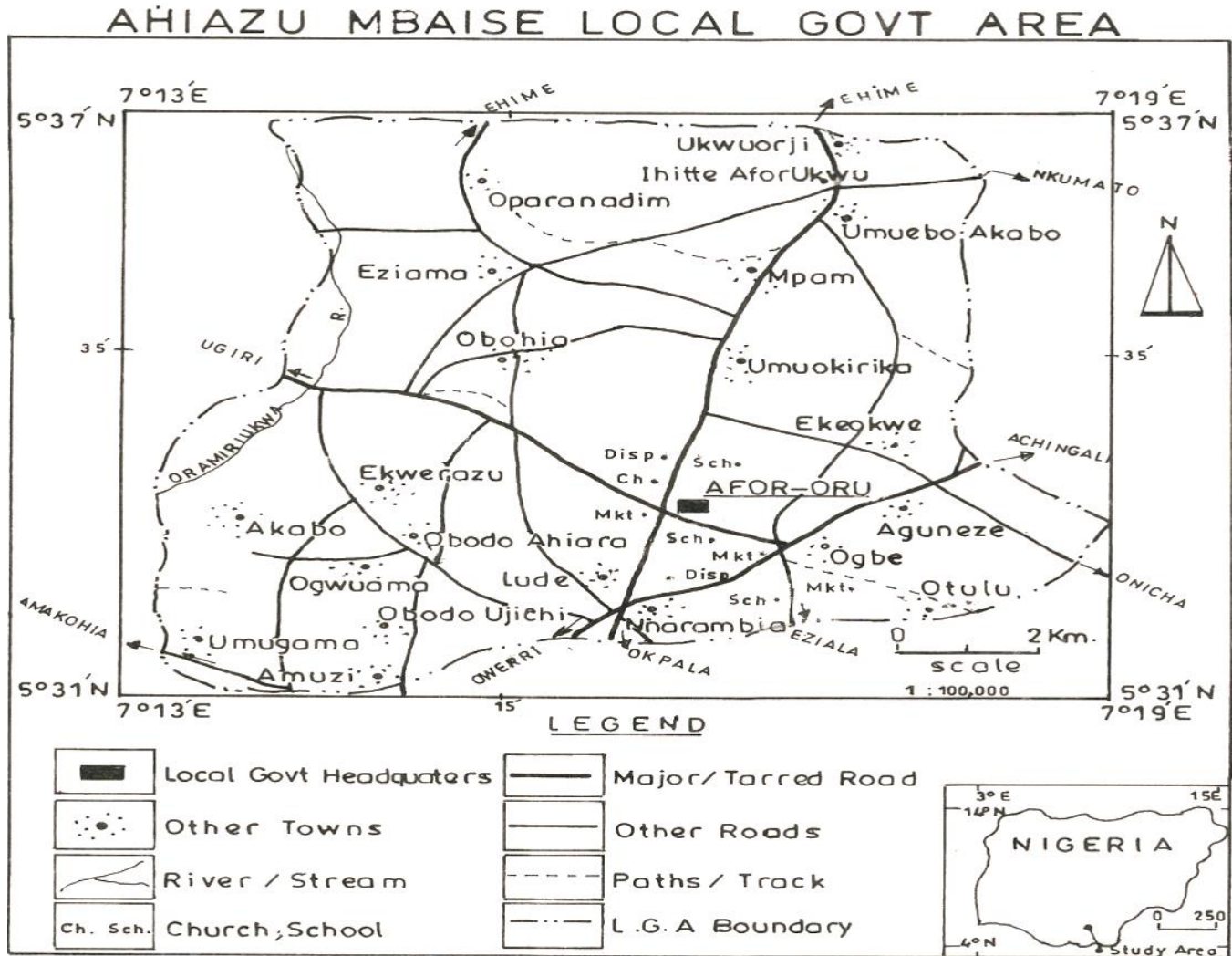


Figure 1. Map of the study area.

for the inhabitants.

MATERIALS AND METHODS

Study area

The study area is as shown in Figure 1. Ahiazu Mbaise is a local Government in Imo State of Nigeria and is made up of sixteen (16) communities which include Amuzi, Eziamma, Isiala Oparanadim, Mpam, Nnarambia, Obodo Ahiara Ihenweorie, Obohia/Ekwerazu, Ogbe, Ogbennishi, Ogbor, Okirika Nweke I, Okirika Nweke II, Okirika Nwenkwo, Oru/Lude, Otulu/Aguneze, and Umuno/Umuchieze. The population is estimated to be made up of about five hundred thousand people. Sources of water in Ahiazu Mbaise include rain water capture (underground tanks, containers), boreholes, and pipe borne water from reservoirs, rivers, and surface ponds. These rivers are Iyi Obohia, Iyi Ekwerazu, and Iyi Okponkume. These rivers are seen around its boundaries with Mbaitoli/Ikeduru, Etiti and Mbanu Local Government areas, but they also serve as source of water to neighboring communities in Ahiazu.

Sample collection

Water samples for bacteriological examination were collected with clean sterile water sampling bottles and analyzed within 3 h of collection. The borehole water samples were collected by first scrubbing the tap nozzle with 10% ethanol and flaming with flamer gun to burn off the ethanol. This was to sterilize the nozzle from external contamination. Thereafter, the borehole tap was opened to run for about 5 min before samples were aseptically collected. River water samples were collected from the surface by grab sampling method, while underground tank water samples were collected with clean sterile bottles.

Microbiological analysis

Sterilization of media was carried out by moist heat sterilization method using autoclave at 121°C, 15 psi for 15 min. Heat stable materials were sterilized using hot air oven at 160°C for 1 h as described by Cruickshank et al. (1982). Heat labile materials were aseptically rinsed with alcohol and distilled water. The water samples were aseptically subjected to 10 fold serial dilutions to

Table 1. Bacterial counts (cfu/ml) of water samples.

Sample	THBC	TCBC
Borehole water		
A	1.2×10^2	3.0×10^1
B	2.0×10^2	5.0×10^1
C	3.4×10^2	2.0×10^1
D	1.5×10^2	4.0×10^1
E	3.0×10^2	2.0×10^1
Underground water		
F	3.4×10^3	2.2×10^2
G	4.7×10^3	2.6×10^2
H	2.4×10^4	2.9×10^2
River		
I	1.8×10^4	4.8×10^3
J	2.0×10^5	1.9×10^4

THBC- total heterotrophic bacterial count; TCBC- total coliform bacterial count.

dilute the population of microorganism sufficiently in sterile blanks of 9 ml peptone water and then plated to produce discrete colonies for easy enumeration. The media used include nutrient agar, MacConkey agar, Eosin Methylene Blue agar, TCBS, and *Salmonella - Shigella* agar. All media were prepared as directed by the manufacturer. The method was adopted for the inoculation of media. Spread plates of appropriately diluted samples were incubated at 37°C for 24 h for heterotrophic bacterial count (THBC) while total coliform bacterial count (TCBC) were determined after incubation at 45°C for 24 h in MacConkey agar. Identification of isolates was based on the scheme described by Cheesbrough (1984) while serological test confirmed the pathogenicity of isolates based on the methods described by Vandepitte et al. (2003).

RESULTS

The result of total heterotrophic bacterial count (THBC) and total coliform bacterial count (TCBC) (cfu/ml) is as shown in Table 1. Bore hole water examples includes samples A, B, C, D and E, and the THBC counts ranged between 3.4×10^2 and 1.2×10^2 while the TCBC count ranged between 5.0×10^1 and 2.0×10^1 cfu/ml. Underground tank water samples includes samples F, G, H and the THBC count ranged between 2.4×10^4 and 3.4×10^3 cfu/ml while the TCBC count ranged between 2.9×10^2 and 2.2×10^2 cfu/ml. River water samples include samples I and J, and the THBC count ranged between 2.0×10^5 and 1.8×10^4 cfu/ml while the TCBC count ranged between 1.9×10^4 and 4.8×10^3 cfu/ml.

Table 2 shows the occurrence of bacterial isolates in water samples in percentage (%). The isolates occurred thus: *Escherichia coli* (50.0%), *Salmonella* spp. (100%), *Shigella* spp. 100% *Streptococcus* spp. (50.0%), *Vibrio* spp. (20.0%), *Proteus* spp. (30.0%), *Klebsiella* spp. (80.0%), and *Enterobacter* spp. (50.0%). This showed

that *Salmonella* and *Shigella* spp. occurred highest (100%) in water samples followed by *Klebsiella* (80.0%), while the lowest occurrence was recorded by *Vibrio* spp. (20.0%).

The occurrence of total isolates in samples showed thus: sample A (50.0%), B (37.5%), C (37.5), D (50.0%), E (25.0), F (75.0%), G (50.0%), H (87.5%), I (100%), and J (87.5). Result showed that the sample with the highest population of isolates was samples I (100%) followed by samples H and J (87.5) which were river underground water samples.

DISCUSSION

The total heterotrophic bacteria count (THBC) test also called "total count" "plate count" is assured to provide an estimate of the total number of bacteria in a water sample that will develop into colonies during a period of incubation in a nutrient. This test detects a wide array of bacteria including pathogens, and opportunistic pathogens, but could not report all the bacteria in the works of Ihejirika et al. (2011). High THBC may be an indicator of poor general biological quality of drinking water (USEPA, 2003). A recommended maximum contaminant level (MCL) for human drinking water has not yet been proposed. The upper limit for portable water is usually 500 cfu/ml (Ihejirika et al., 2011). According to Dezuan (1990), water with counts under 100 cfu/ml should be considered "portable" and values 100 to 500 cfu/ml "questionable". Therefore, all the water sources from Ahiazu Mbaise have questionable water quality.

The coliform test is a liable indicator of the possible presence of fecal contamination and is consequently

Table 2. Occurrence of bacterial isolates in water samples.

Water samples	<i>Escherichia coli</i>	<i>Salmonella</i>	<i>Shigella</i>	<i>Streptococcus</i>	<i>Vibro</i>	<i>Proteus</i>	<i>Klebsiella</i>	<i>Enterobacter</i>	Occurrence (%)
Borehole									
A	-	+	+	+	-	-	+	-	50.0
B	-	+	+	-	-	-	+	-	37.5
C	-	+	+	-	-	-	-	+	37.5
D	-	+	+	-	-	-	+	+	50.0
E	-	+	+	-	-	-	-	-	25.0
Underground tank									
F	+	+	+	+	-	-	+	+	75.0
G	+	+	+	-	-	-	+	-	50.0
H	+	+	+	+	+	+	+	-	87.5
Stream									
I	+	+	+	+	+	+	+	+	100
J	-	+	+	+	-	+	+	+	87.5
% Occurrence ^b	50.0	100.0	100.0	50.0	20.0	30.0	80.0	50.0	

correlated with pathogens. The USEPA MCL is less than one coliform per 100 ml. Many human facilities periodically test drinking water for coliform and use this limit (Dreeszen, 1996). The result of coliform test from all the water sources in Ahiazu Mbaise is above the USEPA MCL of less than one coliform per 100 ml. Borehole water samples were between 2.0×10^2 and 5.0×10^2 coliform per 100 ml, and underground tank water samples between 2.2×10^3 and 2.9×10^4 coliform per 100 ml, while stream water samples were between 4.8×10^5 and 1.9×10^6 coliform per 100 ml. This result shows that stream water sources had more enteric pathogens followed by underground tank sources and borehole water sources being the least contaminated.

All the isolates from the different water sources are members of the family *Enterobacteriaceae* excepting *Streptococcus* spp. and *Vibro* spp. (Prescott et al., 2005). As *E. coli* (50%) was isolated from underground tank water and stream water samples only, it indicated recent fecal contamination of the different sources. This result is supported by the works of Health Canada (2006), Cabral (2010) and Ihejirika et al. (2011). While most strains of *E. coli* are non-pathogenic, some can cause serious diarrheal infections in human (Health Canada, 2006).

Salmonella spp. (100%) was isolated from all the water sources samples. This might be due to contamination from domestic sewage, agricultural pollution and storm water runoffs. This argument is supported by the reports of WHO (2008) and Arvanitidon et al. (2005). *Salmonella* spp. are responsible for two types of salmonellosis: 1) typhoid and paratyphoid fever; and 2) gastroenteritis (Le Minor, 2003). This implies that controlled sewage water systems and personal hygiene will reduce the incidence of gastroenteritis and typhoid fever (Popoff et al., 2005)

that might result from the use of all the water sources in Ahiazu Mbaise.

The presence of *Shigella* spp. (100%) in all the samples might be due to unsanitary condition of the environment and secondary fecal contamination from an intermediary sources (Ihejirika et al., 2011). The implication of this is the risk of possible outbreak of shigellosis. This was in agreement with the report of Emch et al. (2008).

Streptococcus spp. (50%) isolated in some of the water sources might be due to fecal contamination of the water sources. This was supported by the report of Pruss (1998). Fecal *Streptococcus* spp. is responsible for gastrointestinal illness among humans (Donovan et al., 2008).

Vibro spp. (20.0%) was isolated from one underground tank water and one river water sample. Its presence in these samples might be due to contamination from birds, frogs, toads, and fishes present in aquatic environments. This argument is supported by the report of Ali et al. (2001). *Vibro* spp. especially *Vibro cholera* is responsible for the disease cholera in humans (Cabral, 2010).

Proteus spp. (30.0%) is an enteric pathogen associated with the feces of animals including humans (Ihejirika et al., 2011). Its low percent occurrence might be due to the fact that it exists in minority of contaminating human feces. This is supported by the report of Wilson (2005).

Klebsiella spp. (80.0%) are ubiquitous in the environment (Cabral, 2010). They have been associated with contaminants like wastewaters, plant products, fresh vegetables, food with a high content of sugars and acids, frozen orange juice concentrate, sugarcane waste and living trees. *Klebsiella* spp. can cause human disease, ranging from asymptomatic colonization of the intestinal,

urinary, or respiratory tract to fatal septicemia (Grimont et al., 2003).

Enterobacter spp. (50.0%) might be an implication of fecal contamination of the water sources. This was supported by the works of Grimont and Grimont (2005). Apart from fecal contamination, *Enterobacter* spp. might have been introduced from other sources like soil, polluted water, and plants (Ihejirika et al., 2011). The presence of *Enterobacter* spp. in 8 out of 10 water sources implied possible risk of nosocomial and health care-associated infection. This argument is supported by the reports of Hirdon et al. (2008) and Ihejirika et al. (2011).

Conclusion

This research work has confirmed that water sources in Ahiazu Mbaise is not free from enteric pathogens and might expose users to enteric diseases like diarrhea. Borehole waters are possibly not treated before usage while underground tanks might serve as source of water, but care should be taken as it is also a reservoir of water-borne pathogenic organisms. That streams are contaminated is not news, but provision of adequate portable water for the teeming population of the communities should be of utmost priority to prevent the morbidity and mortality caused by diarrhea.

REFERENCES

- Aderigbe SA, Awoyemi AO, Osagbami GK (2008). Availability, Adequacy and Quality of Water supply in Ilorin Metropolis Nigeria. *Eur. J. Sci. Res.*, 23(4): 528-536.
- Ali M, Emch M, Yunus M, Sack RB (2001). Are the environmental Niches off *Vibrio cholerae* 0139 different from *Vibrio cholerae* 01E1 Tor? *Int. J. Infect.*, 5: 214-219.
- Arvanitidou M, Kanellou K, Vagiona DC (2005). Diversity of *Salmonella* spp. and Fungi in Northern Greek Rivers and their Correlation to fecal indicators. *Environ. Res.*, 99: 278-284.
- Cabral JP (2010). *Water Microbiology. Bacteria Pathogens and Water*. *Int. J. Environ. Res. Pub. Health*, 7: 3657-3703.
- Cheesbrough M (1984). *Medical Laboratory Manual for Tropical Countries*. Butterworth Co. Ltd.
- Cruickshank R, Duguid JP, Marmoin BP, Swain RHA (1982). "Medical Microbiology". *The practice of Medical Microbiology* 13th ed. Churchill Livingstone, Edinburgh, 2: 273-284.
- DeZuane J (1990). *Handbook of Drinking Water Quality Standard and Controls*, Van Nostrand Reinhold, New York.
- Dreeszen PH (1996). *Microbiological Survey of Watering Systems*, Edstrom Industries, Inc. Document #D209.
- Emch M, Ali M, Yunus M (2008). Risk areas and Neighborhood- Level Risk Factors for *Shigella dysenteriae* 1and *Shigella flexneri*. *Health Place*, 14: 96-104.
- Fenwick A (2006). Waterborne - Could they be consigned to History? *Science*, 313: 1077-1081.
- Grimont F, Grimont PAD, Richard C (2003). The genus *Klebsiella*. In *the Prokaryotes: An Evolving Electronic Resource for the Microbiological Community*, electronic release 3.14, 3rd ed.; Dworkin, M., Falkow, S., Rosenberg, E., Eds.; Springer- Verlag: New York, NY, USA.
- Grimont PAD, Grimont F (2005). Genus *Enterobacter*. In *Bergey's Manual of Systematic Bacteriology*, 2nd ed. Brenner, D.J., Krieg, N.R., Staley, J.T., Eds Springer: New York, NY, USA, 2(B): 661-669.
- Health Canada (2006). *Bacterial Waterborne Pathogens-Current and Emerging organisms of Concern. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document*, Ottawa, Ontario.
- Hirdon AI, Edwards JR, Patel J, Horan TC, Sievert DM, Pollock DA (2008). Antimicrobial resistance pathogens associated with Healthcare-associated infections: Annual summary of data reported to the National Safety Network at the Centers for disease control and prevention, 2006-2007. *Infect. Control Hosp. Epidemiol.*, 29: 996-1011.
- Ihejirika CE, Ogbulie JN, Nwabueze RN, Orji JC, Ihejirika OC, Adieze IE, Azuwoke OC, Ibe IJ (2011). Seasonal Influences on the Distribution of Bacterial Pathogens and Waterborne Diseases Transmission Potentials of Imo River, Nigeria. *J. Res. Biol.*, 3: 163-172.
- Le Minor LE (2003). In *the prokaryotes: An Evolving Electronic Resource for the Microbiological Community*, electronic release 3.14, 3rd ed.; Dworkin, M., Falkow, S., Rosenberg, E., Eds.; Springer-Verlag: New York, NY, USA.
- Park K (2002). *Environment and Health in: Park Textbook of preventive and social medicine*, p. 17.
- Popoff MY, Le Minor LE (2005). Genus *Salmonella*. In: *Bergey's Manual of Systematic Bacteriology*, 2nd ed; Brenner, D.J., Krieg, N.R., Staley, J.T., Eds. Springer: New York, NY, USA., 2(B): 764-799.
- Prescott LM, Harley JP, Klein DA (2005). *Microbiology*. 6th edition. McGraw Hill.
- Pruss A (1998). Review of epidemiology study of health effects from exposure of recreational water. *Int. J. Epidemiol.*, 27: 1-9.
- Scott TM, Salina P, Rosen KM, Tamplin JB, Farran ML, Koo SR, Sood A, Singh KD, Pandey P, Shama S (2008). Assessment of bacterial indicators and physicochemical parameters to investigate pollution status of Gangetic river system of Uttarakhand (India). *Ecol. Indicators*, 8: 709-717.
- USEPA (United States Environmental Protection Agency) (2003). *Drinking Water Quality Standards*. Edstrom Industries, Waterford, Wisconsin.
- Vandepitte J, Verhaegen J, Engbaek K, Rohner P, Piot P, Heuck CC (2003). Bacteriological procedures in clinical bacteriology (2nd ed). World Health Organization, Geneva., pp. 122-137.
- WHO (World Health Organization) (2008). *Guideline for drinking – water quality. Incorporating 1st and 2nd Addenda, Volume 1, Recommendations*, 3rd ed; WHO, Geneva, Switzerland.
- WHO/UNICEF (2000). *Global Supply and Sanitation Assessment 2000 Report*. Geneva/New York.
- Wilson M (2005). *Microbial Inhabitants of Humans. Their Ecology and Role in Health and Disease*: Cambridge University Press: Cambridge, UK.

Full Length Research Paper

Prevalence and factors associated with healing outcomes of hospital-acquired pressure ulcers among patients with spinal cord injury

Ezema Charles Ikechukwu¹, Idowu Opeyemi Ayodiipo^{2*}, Anekwe David Emeka³, Adelugba Julius Kayode², Nwoba Izuchukwu Michael² and Ogunbameru Temitope Deborah²

¹Department of Medical Rehabilitation, College of Medicine, University of Nigeria, Enugu, Enugu State, Nigeria.

²Department of Physiotherapy, Federal Medical Centre, Ido-Ekiti, Ekiti State, Nigeria.

³School of Physical and Occupational Therapy, McGill University Montreal, Canada.

Accepted 11 January, 2012

Pressure ulcers remain a perennial challenge in the management of patients with spinal cord injury in developing countries due to lack of preventive facilities and trained personnel. This study assessed the prevalence and factors associated with healing outcomes of hospital-acquired pressure ulcers among patients with spinal cord injury in a Nigerian tertiary hospital. A retrospective case chart review of patients with spinal cord injury between January, 1997 and December, 2006 was carried out. Data were gleaned on gender, age, marital status, presence and number pressure ulcers per patient, worst hit body site by pressure ulcer, cause of spinal cord injury, spinal cord injury level, American spinal injury association impairment score (AIS), diabetes status, stage of worst hit body site and outcomes of healing. Data was analyzed using both descriptive and inferential statistics at α 0.05. The prevalence of pressure ulcers in the study was 51.58%. The sacrum and coccyx (56.20%) were the worst hit body sites by pressure ulcers. Gender ($p = 0.00$), aetiology of spinal cord injury ($p = 0.01$) and stage of worst hit body site by PU ($p = 0.00$) were associated with healing outcomes. The prevalence of pressure ulceration was high with a high majority of the ulcers not healing.

Key words: Pressure ulcers, retrospective, spinal cord injury.

INTRODUCTION

The National Pressure Ulcer Advisory Panel (NPUAP) and the European pressure ulcer advisory panel (EPUAP) described pressure ulcers (PU) as localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear” (European pressure ulcer advisory panel and National pressure ulcer advisory panel, 2009). PUs is usually accompanied by a slow rate of healing, discomfort, pain and cost implications (Yoshikawa et al., 2002). PUs is precipitated and perpetuated by both the patient intrinsic factors such as immobility, nutritional status, and incontinence and extrinsic factors such as

extrinsic factors such as pressure, friction, shear stress, and moisture (Yoshikawa et al., 2002; Nixon et al., 2001). Other risk factors documented in literature include race and socioeconomic status (Saunders et al., 2010).

PU remains a perennial challenge among recumbent and senescent individuals in the developing countries due to lack of preventive facilities and trained personnel (Adejumo and Ingwu, 2010). Therefore, PUs cannot be ignored in the healthcare delivery system, not only because of their deleterious effect on the patient and economy but their occurrence is often used as a marker for the quality of health care delivered to hospitalized patients (Perneger et al., 1998). Among individuals with spinal cord injury (SCI) in the developing nations, PU poses a serious lifelong threat (Garba and Rintala, 2003) because of sensation impairment (Bates et al., 2009) and the inability of these individuals to relieve pressure on

*Corresponding author. E-mail: Opelove4us@yahoo.com. Tel: +2347036873835.

bony prominences.

Praiseworthy advances at preventing PUs has been documented in the developed nations with the advent of sophisticated equipments such as alternating pressure mattresses/overlays, air fluid beds, low-air-loss beds and devices such as water-filled mattresses, air filled mattresses and gel-filled mattresses/overlays among others (Adejumo and Ingwu, 2010). Despite these innovative concepts and technology, PUs still remains recalcitrant and prevalent among hospitalized and high dependent patients (Chacon et al., 2010; Gunningberg and Stotts, 2008; Grey et al., 2006). A developing nation like Nigeria seems disadvantaged in combating the challenge of PUs due to lack of facilities and trained personnel (Adejumo and Ingwu, 2010). Episodes of PUs are common phenomenon in the Nigerian clinic setting; there is a dearth of empirical data on their prevalence and factors associated with their healing outcomes. This study assessed the prevalence and factors associated with healing outcomes of hospital-acquired pressure ulcers (PUs) among patients with spinal cord injury in a Nigerian tertiary hospital.

METHODS

A retrospective case chart review of patients with SCI between January, 1997 and December, 2006 was carried out at the records department of the National Orthopaedic hospital, Enugu, Nigeria. Data were gleaned on gender, age, marital status, worst hit body site by PU, SCI aetiology, SCI level, American spinal injury association impairment score (AIS), whether patient had diabetes or not, number of ulcers, stage of PU on worst hit body site (the stage of the most problematic pressure found on patient's body), its location and outcomes of healing (healed, not healed or referred for surgery). Ethical approval (NOHE/G.163/XI/) was sought and obtained from the institutional review committee of the National Orthopaedic Hospital, Enugu, Nigeria. Data was analyzed using descriptive and inferential statistics at 0.05 alpha on Statistical Package for Social Sciences version 16.

RESULTS

A total of 568 charts of patients with SCI were retrieved. 293 (51.6%) of these patients presented PUs. 28 of the charts of the PUs population were excluded due to incomplete documentation. 265 case charts were found to be valid and used for analysis. The ages of patients ranged from 15 to 87 years with a mean age of 37.41 ± 12.18 .

Two hundred and thirty six (89.10%) of the patients whose charts were reviewed were males, 83.40% had paraplegia and more than half had complete injuries (AIS A). One hundred and eighty-six patients of the total study sample were married and non-diabetic. The worst hit body sites by PUs in this study were the sacrum and coccyx (56.2%), followed by the feet and ankles (28.7%). This is shown in Table 1.

Outcomes were defined as whether ulcers healed, did not heal or was surgically repaired. 202 (80%) of the

ulcers did not heal, 14.00% (37) were surgically repaired while only 6.00% (16) healed (Table 1). Of all the cases reviewed in this study, only 13 (4.90%) were treated by physiotherapists on account of PUs. Some factors that could be associated with the outcomes of healing were identified. This included gender, worst hit body site by PU (categorized as ischium and trochanter versus sacrum and coccyx versus foot and ankle), SCI aetiology (divided into two groups: motor vehicle accidents versus all other aetiologies), SCI level, whether patient had diabetes or not, and stage of PU on worst hit body site (divided into two groups: stages II or III versus stage IV). Chi square test was used to test for association between these factors and healing outcomes.

From this study, result of healing outcomes showed that PUs in males were likely to heal than in females ($X^2 = 9.26$, $p = 0.01$). Ulcers located at the sacrum and coccyx was more likely to heal than in the ischium and trochanter or foot and ankle ($X^2 = 30.59$, $p = 0.00$). PUs of patients who sustained SCI as a result of road traffic accidents were more likely to heal than those of other aetiologies ($X^2 = 8.73$, $p = 0.01$). Stage IV ulcer were less likely to heal and more likely to be repaired by surgery than all other stages ($X^2 = 1.07$, $p = 0.00$) (Table 1).

DISCUSSION

The prevalence rate of hospital acquired ulcers in National Orthopaedic Hospital, Enugu, Nigeria study was 51.6%. This prevalence rate is higher than that of previous studies: Perneger et al. (1998) [10.3%]; Gunningberg and Stotts (2008) [22.9%]; Rathore et al (2008) [2.5%]. PUs is not totally a developing world problem, it is still adamant in developed nations too, defying the adequate attention that has been given to its prevention (Gunningberg and Stotts, 2008).

This may become a more serious problem in a developing country like Nigeria where most hospitals are unable to afford hi-tech preventive measures such as mattresses/overlays, air fluid beds, low-air-loss beds and devices such as water-filled mattresses, air-filled mattresses and gel-filled mattresses/overlays by most hospitals in Nigeria (Adejumo and Ingwu, 2010; Onche et al., 2004) and most health personnel involved in patient care lacks the essential knowledge of early identification and prevention of PUs (Rathore, 2007).

The worst hit body sites reported in this study were the sacrum and coccyx, followed by the feet and ankles. This finding is consistent with literature. The most common site for the development of PU has been documented to be the sacrum, followed by the heel (Petrie and Hummel, 2000; Perneger et al., 1998). This may be due to the fact that the more fat and muscle are around a muscle/ bone interface; the more susceptible it is to PUs (Yoshikawa et al., 2002). The very high percentage of PUs that did not heal (80.0%) in this study is similar to the findings of Garba and Rintala (2003) who reported that out of 57 SCI

Table 1. Characteristic of patients with hospital acquired pressure ulcers.

Characteristic	Number	%
Gender		
Male	236.00	89.10
Female	29.00	10.90
Marital status		
Single	61.00	23.00
Married	186.00	70.20
Divorced	10.00	3.80
Widowed	8.00	3.00
SCI level		
Tetraplegia	44.00	16.60
Paraplegia	221.00	83.40
AIS		
A	168.00	63.40
B	56.00	21.10
C	31.00	11.70
D	10.00	3.80
SCI aetiology		
MVA	194.00	73.20
Falls	9.00	3.40
GSW	57.00	21.50
Others	5.00	1.90
Stage of PU on worst hit body site		
II	41.00	15.50
III	210.00	79.20
IV	14.00	5.30
Worst hit body site by PU		
Sacrum/coccyx	149.00	56.20
R/L ischia	18.00	6.80
R/L trochanters	22.00	8.30
R/L feet/ankle	76.00	28.70
Diabetes		
Yes	11.00	4.20
No	254.00	95.80
Outcome		
Healed	16.00	6.00
Not healed	212.00	80.00
Repaired by surgery	37.00	14.00

Abbreviations: MVA, motor vehicle accidents, GSW, gunshot wounds, R/L, right/ left.

veterans who were admitted for PU treatment, 65% of the PU developed did not heal. Since the prevalence of PU

can be used as a litmus test for the quality of health care provided (Petrie and Hummel, 2000), this may imply that the quality of healthcare obtained in this part of the world still needs an overhauling. Despite the fact that the importance of electro-physical agents in wound care is well documented (Onigbinde et al., 2010; Guihan et al., 2009; Gupta et al., 2009; Rathore et al., 2008; Hanes, 2004; Adegoke and Badmos, 2001) the low involvement of physiotherapists (4.9%) in the management of PUs in the study may be an indication that most patients with PUs are not even referred for physiotherapy. Most hospitals in Nigeria are under-equipped with necessary therapeutic equipment that can be used in the treatment of PUs. This may also be a limiting factor to the role played by physiotherapists in the treatment of PUs and also PUs in female patients were less likely to heal and more likely to be referred for surgery than males. This may be associated with the fact that most females have more body adipose tissues than males. This may reduce the rate of healing of PUs developed.

This study revealed that stage IV ulcers were less likely to heal than all other stages. This may be due to the fact that the whole tissue surrounding such areas have been lost, which may eventually lead to a compromise of the vascular supply further delaying healing (European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel, 2009).

Conclusion

The prevalence of hospital acquired pressure ulcers is higher than what is obtained in the developed world, with the sacrum/coccyx being the worst hit body sites. Gender, worst hit body site, aetiology of SCI and stage of worst hit body site by PUs were associated with healing outcomes.

ACKNOWLEDGEMENTS

The authors would like to thank Mr J. K. Adelugba, Dr. Fatai Adeniyi, Mr. Akinsiku Oladapo, Mr. Aladeyelu, Mr. Olagunju for their advice and constructive criticism of this work. The authors would also thank Miss Temitope Sanusi for her appraisal of the final draft of the work.

REFERENCES

- Adegoke BO, Badmos KA (2009). Acceleration of pressure ulcer healing in spinal cord injured patients using interrupted direct current. *Afr. J. Med. Med. Sci.*, 3: 195-197.
- Adejumo PO, Ingwu JA (2010). Nurses' use of water-filled gloves in preventing heel pressure ulcer in the University College Hospital, Ibadan, Nigeria. *Int. Wound J.*, 7: 472-479.
- Bates-Jensen BM, Guiha M, Garber SL, Chin AS, Burns SP (2009). Characteristics of recurrent pressure ulcers in veterans with spinal cord injury. *J. Spinal. Cord Med.*, 1: 34-42.
- Chacon JMF, Blanes L, Hochman B, Ferreira LM (2010). Prevalence of pressure ulcers among the elderly living in long-stay institutions in Sao Paulo. *Sao Paulo Med. J.*, 4.

- European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel (2009). Treatment of pressure ulcers: Quick Reference Guide. Washington DC: National Pressure Ulcer Advisory Panel. Viewed on the 18th of July, 2011
- Garber SL, Rintala DH (2003). Pressure ulcers in veterans with spinal cord injury: A retrospective study. *J. Rehab. Res. Dev.*, 5: 433–442.
- Grey JE, Enoch S, Harding KG (2006). ABC of wound healing: Pressure ulcers. *BMJ*. 25: 472–475.
- Guihan M, Hastings J, Garber SL (2009). Therapists' Roles in Pressure Ulcer Management in Persons with Spinal Cord Injury. *J. Spinal Cord Med.*, 5: 560–567.
- Gunningberg L, Stotts NA (2008). Tracking quality over time: what do pressure ulcer data show? *Int. J. Qual. Healthc.*, 4: 246-253.
- Gupta A, Taly AB, Srivastava A, Kumar S, Thyloth M (2009). Efficacy of pulsed electromagnetic field therapy in healing of pressure ulcers: A randomized control trial. *Neurol. Ind.*, 57: 622-626.
- Haynes SJ (2004). Pressure ulcer risk assessment and prevention. *Br. J. Commun. Nurs.*, 9: 540–544.
- Nixon J, Brown J, McElvenny D, Mason S, Bond S (2001). Prognostic factors associated with pressure sore development in the immediate post-operative period. *Int. J. Nurs. Stud.*, 37: 279–289.
- Onche II, Yiltok SJ, SK Obiano SK (2004). Pressure ulcers in spinal cord injury patients in Gombe, Nigeria. *Nig. J. Orthop. Trauma.*, 1: 57-60.
- Onigbinde AT, Olafimihan KF, Ojoawo A, Adedoyin RA, Omiyale O, Mothabeng J (2010). The effect of ultraviolet radiation (Type B) on decubitus ulcers. *Int. J. Allied H. Sci. Pract.*, 1.
- Perneger TV, He'liot C, Rae A, Borst F, Gaspoz J (1998). Hospital-Acquired-Pressure Ulcers: Risk Factors and Use of Preventive Devices. *Arch. Int. Med.*, 158: 1940-1945.
- Petrie I, Hummel J (2000). Incidence of pressure ulcer. In Monaghan J. Heel pressure ulcers: the extent of the problem. *J. Tissue. Viability*, 96: 9–11.
- Rathore MFA, Hanif S, Farooq F, Ahmad N, Mansoor SN (2008). Traumatic Spinal Cord Injuries at a Tertiary Care Rehabilitation Institute in Pakistan. *J. Pak. Med. Assoc.*, 2: 53-57.
- Rathore MF, Rashid P, Butt AW, Malik AA, Gill ZA, Haig AJ (2007). Epidemiology of spinal cord injuries in the 2005 Pakistan earthquake. *Spinal Cord*, 45: 658-663.
- Saunders LL, Krause JS, Peters BA, Reed KS (2010). The Relationship of Pressure Ulcers, Race, and Socioeconomic Conditions after Spinal Cord Injury. *J. Spinal Cord Med.*, 4: 387–395.
- Yoshikawa TT, Livesley NJ, Chow AW (2002). Infected Pressure Ulcers in Elderly Individuals. *Clin. Infect. Dis.*, 1390-1396.

Full Length Research Paper

Assessment of awareness on food borne zoonoses and its relation with veterinary public health services in and around Addis Ababa, Ethiopia

Sisay Girma¹, Girma Zewde², Ketema Tafess³, and Tariku Jibat^{2*}

¹College of Veterinary Medicine, Haramaya University, P. O. Box 138, Dire Dawa, Ethiopia.

²School of Veterinary Medicine, Addis Ababa University, P. O. Box 34, Debre Zeit, Ethiopia.

³College of Medical Sciences, University of Gondar, P. O. Box 196, Gondar, Ethiopia.

Accepted 29 January, 2012

A qualitative survey was conducted to assess the awareness on food borne zoonoses and its relation with veterinary public health services in Addis Ababa and its surrounding districts. Structured questionnaire was used in the study. Factors like educational level, information source, and profession, were considered for possible explanation of the results. The most frequently known zoonotic diseases were rabies (100%), followed by anthrax (94.27%), teniasis (89.06%), tuberculosis (88.54%), brucellosis (49.48%), and mentioned others (31.25%). The importance of veterinary public health in the overall public health institutions was assessed by looking at the responses to questions and it is shown that the public health institutions do not yet see the need of having veterinarians in the public health. In conclusion, this study demonstrated that the awareness and use of inspected and packed animal products is relatively low, which exposes the people to risk of food borne pathogens. The authors would like to recommend to the government and concerned bodies to raise the awareness of the public, using the appropriate communication media, and to strengthen the contribution of public health veterinarians in the public health services for better community health.

Key words: Awareness, veterinarian, food borne zoonoses.

INTRODUCTION

Foods of animal origin are among the favourite and commonly consumed nutrients by most human communities in the world. However, if they are not prepared and handled properly, they lead to the cause of many food borne diseases (Avery, 2004). The most prevalent diseases transmissible from animals to man include, tapeworm, anthrax and bovine tuberculosis (FDRE - MoH, 2004). Veterinary medical practice is unique among the health professions, in that, its objectives are to enhance the health, care, productivity and well being of animals as well as to guarantee the safety of animal products used by people (Hendrix et al., 2005). The ultimate objective of veterinary medicine is to promote the well being and the quality of human life.

Moreover, veterinary public health is a discipline which deals with the contribution and responsibility of veterinary medicine for the public health (Cosivi and Meslin, 1999). Approximately four- fifth of all described agents of infections of human being are shared in nature with other vertebrate animals (Daszak et al., 2000). Many animal related problems, which negatively affect human health and economy, exist in all countries of the world including zoonoses, food borne diseases and pollution of the environment from animal sources. Most of the agents associated with the current world-wide increase in cases of food borne diseases such as salmonellosis, *Escherichia coli*, campylobacteriosis and listeriosis, are concerns especially in the developing world.

In addition, zoonoses like rabies, brucellosis, bovine tuberculosis, cysticercosis, hydatidosis, taeniasis, and toxoplasmosis are yet uncontrolled diseases (WHO, 2002; Ganguly et al., 2012) which need the attention of

*Corresponding author. E-mail: jibattariku@gmail.com.

Table 1. Use of inspected/treated animal products by education level and profession in Addis Ababa and its surroundings.

Category	Animal products		
	Meat (%)	Milk (%)	Honey (%)
Educational level*			
Elementary and high school (n=192)	174 (90.62)	185 (96.35)	59 (30.72)
Graduates (n=192)	184 (95.83)	190 (98.95)	67 (34.89)
Profession**			
Health professionals (n=96)	96 (100)	90 (93.75)	82 (85.42)
Non-health professionals (n=96)	69 (71.88)	88 (91.67)	77 (80.21)

* P>0.05; ** P<0.05.

veterinary public health services. Generally, in most cases, these cannot be controlled without a full, multidisciplinary approach which includes public education and involvement as well. Hence, veterinary public health has become a much more active field of inquiry and is involved with human health than it was before. Furthermore, veterinary public health activities involve a diverse range of functions within the public, which reflect the broad community interest between veterinary and human medicine (Christensen, 1996; King and Khabbaz, 2010). So far, there is no documented evidence of the awareness and use of veterinary public health services and how far public health institutes are aware of the importance of veterinary public health service in maintaining the health of the community. The purposes of this study were therefore to assess the awareness on food borne zoonoses and its relation with veterinary public health services.

MATERIALS AND METHODS

Study area and population

This study was conducted in Addis Ababa and its surrounding districts (namely Holleta, Sebeta and Debre Zeit) from November 2008 to April 2009. The study population comprised of students of different educational level (elementary and high schools and graduates), human and animal health professionals, and non-health professionals and institutes. Addis Ababa and its surroundings have approximately 6 million people, 16 hospitals and more than 500,000 students at different level of education (personal communication). The participants were allowed to answer at the spot in order to have a 100% response rate.

Study design and sample size

The survey was conducted to assess the awareness and use of veterinary public health services in and around Addis Ababa. Evaluation methods including a well designed interview and questionnaire were done. Stratified random sampling was considered based on educational level and profession. Accordingly, semi structured questionnaires supplemented with interview were administered to 576 people of whom 192 elementary and high school students, 192 graduates, and 96 health and 96 non-health

professionals were asked about their custom of consuming inspected, packed and or treated animal products, source of information about veterinary public health and knowledge of zoonotic diseases they knew. In addition, directors of 7 health institutions were interviewed regarding public health veterinarians in public health institutions.

Data collection and analysis

Data was collected using questionnaires and interviews to evaluate the degree of awareness and use of veterinary public health services. The data generated were entered to a MS-Excel-2007 program and were analysed by SPSS 18 version (2010) using descriptive statistics including chi square for possible explanation of associations. P-value of less than 0.05 was considered to be significant at 95% confidence interval.

RESULTS

The use of inspected meat, pasteurized or boiled milk, and packed honey across educational level and health related profession is shown in Table 1. The use of inspected animal products is found statistically different (P<0.05) among health and non-health professionals while no difference is seen between students and graduates.

Students, graduates, health and non-health professionals get information about zoonotic diseases and veterinary public health services from different sources (Table 2). Hence, majority (85.42%) of the students get the information from other information sources like their families in the form of advice, and 67.71% of health professionals get theirs from schools they attended during their medical education.

The most frequently mentioned zoonotic diseases were rabies (384, 100%), followed by anthrax (362, 94.27%), teniasis (342, 89.06%), tuberculosis (340, 88.54%), brucellosis (190, 49.48%), and 120 (31.25%) mentioned other infectious diseases of zoonotic importance. Different questions were raised through interviewers to directors of the seven public health institutions about the contribution of public health veterinarian to promote the health of the public; the study found no public health

Table 2. Sources of information about zoonotic diseases to study participants by education level and profession in Addis Ababa and its surroundings.

Information source	Educational status of respondents			
	Elementary and high school students (%)	Graduates (%)	Non-health Professionals (%)	Health Professionals (%)
Mass media*	24 (12.50)	56 (30.73)	50 (52.08)	10 (10.42)
Electronic media**	0 (0)	17 (8.85)	17 (17.71)	21 (21.88)
School***	4 (2.08)	47 (24.45)	2 (2.08)	65 (67.71)
Others****	164 (85.42)	72 (37.50)	27(28.13)	0 (0.00)

*P>0.05, **P<0.05, *** P < 0.05, ****P<0.05.

Table 3. Results of response by directors of public health institutes to questions on the importance of veterinary public health services in Addis Ababa and its surroundings.

Key condition (questions)	Response (%)	
	Yes	No
Presence of inter-professional cooperation between veterinarians and veterinary public health services providing centers.	1 (14.28)	6 (85.72)
Presence of services to inspect food of animal origin.	5 (71.42)	2 (28.58)
Presence of health extension department on zoonotic diseases.	3 (42.85)	4 (57.15)
Presence of public health veterinarian in the institute	0 (0)	7 (100)

veterinarian in health centres and hospitals contributing to public health (Table 3).

DISCUSSION

The current study has disclosed that the use of inspected animal products is found statistically different ($P < 0.05$) among health and non-health professionals while no difference is seen between students and graduates. The habit of eating uninspected backyard slaughtered meat was also seen to be very high as reported in a previous study (Tamiru et al., 2008; Avery, 2004). This could be due to the low level of awareness of the public on the importance of using inspected meat because of cultural beliefs that raw meat is better than cooked one and the deeply established traditional habit of eating raw meat in the country. The use of either pasteurized or boiled milk is relatively higher in all segments of the study participants because of better awareness. However, the use of packed honey was significantly low in the study population. This could be because of the marketing and unavailability of packed and processed honey packing companies in the country and also low level of awareness of availability of packed products in supermarkets.

The majority elementary and high school students get the information about zoonotic diseases from their families in the form of advice while most health professionals get their information from medical schools they attended which justifies that health professionals

have better awareness about zoonotic diseases. It is shown that health professionals have better know-how compared to non-health professionals and students' responses are used to access information about the families of school aged children. However, it does not tell their preference as they rarely prefer what to eat. Even though most of these people have awareness on zoonotic disease and the hazard that could emerge from consumption of uninspected and untreated animal products, it seems that they could not clearly understand the routes of transmission of these zoonotic diseases.

One interesting thing to consider here is that the degree of using inspected or treated animal products gets better as educational level and accessibility to media and health related education advances (Table 2). This study indicated that public health service providing centres have low level of awareness on the importance of veterinary public services, which is consistent with the report by Ketema (2010). Veterinarians, because of their knowledge of animal diseases and food production, as well as their training in ecological, economic and human cultural issues, have become leaders in developing and implementing new methods of promoting sustainable public health which consider the ecosystem that are culturally feasible and economically realistic. Veterinary input and major disease control programmes have resulted in the successful eradication of many zoonotic diseases, for example, bovine tuberculosis, brucellosis, rabies, trichinellosis and echinococcosis in developing countries (King and Khabbaz, 2010). The most poignant

example is Hong Kong, with the control of avian influenza envied in the region that has been a direct result of veterinary advice and policy implementation (King, 2006; Waltner-Toews, 2009). The placement of public health veterinarians in public health giving centres is negligible and even the public health personnel have low level of awareness on the importance of public health veterinarians in maintaining public health. Furthermore, there is no structural organization of veterinary public health units in Ethiopia. According to the WHO and FAO joint report, there is a recommendation about importance of placing veterinarians in the public health sector for zoonotic diseases control prevention, inspection of food of animal origin hygiene, consumer protection and environment protection (King and Khabbaz, 2010). Therefore, based on this study, the authors would like to recommend to the government and concerned institutions to campaign to raise the awareness of the public using the appropriate communication media, and to strengthen the contribution of public health veterinarians in the public health for better community health.

The interview with the directors of public health institutions was an important indicator of lack of participation of veterinarians in public health departments. Graduate and high school information sources is a means which probably differentiates the power to apply what is transmitted on mass media as it is believed that elementary and high school students are under their family's quality choice of food item. In addition, information from medical school for health professionals were considered important in their selection of inspected meat and knowledge of zoonotic disease; the significance of these needs to be reiterated. So therefore, it is important that this be considered when educating health professionals and the directors of the public health schools increase the involvement of veterinarians in public health improvement. Further studies are recommended for the importance of veterinary public health services from one health point of view.

ACKNOWLEDGEMENT

The authors would like to thank Addis Ababa University for the research grant.

REFERENCES

- Avery A (2004). Red meat and poultry production and consumption in Ethiopia and distribution in Addis Ababa. *Borlaug Ruan World Food Prize*. International Livestock Research Institute Addis Ababa, Ethiopia.
- Christensen SG (1996). Veterinary medicine- Impacts on human health and nutrition in Africa: Inproceeding of an international conference held at ILRI, Addis Ababa, Ethiopia. August 27-31, 1995.
- Cosivi O, Meslin FX (1999). Future trends in veterinary public health. *World Vet. Assoc. Bull.*, 16: 2-9.
- Daszak P, Cunningham AA, Hyatt AD (2000). Emerging Infectious Diseases of Wildlife-Threats to Biodiversity and Human Health. *Science*, 287: 443.
- FDRE- MoH (Federal democratic republic of Ethiopia- Ministry of Health) (2004). Food Hygiene and Safety Measures Extension Package.
- Ganguly S, Mukhopadhyay SK, Biswas S (2012). Potential threat to human beings from food borne illness having serious implications on public health- A Review. *Int. J. Chem. Biochem. Sci.*, 1: 65-68.
- Hendrix CM, McClelland CL, Thompson I, Maccabl AT, Hendrix CR (2005). An inter194 professional role of veterinary medicine in human health promotion and disease prevention in; *J. Inter-Professional Care*, p. 19.
- Ketema T (2010). Assessments of the awareness the community about zoonotic diseases, habit of consuming raw animal products and the importance of veterinary public health in the health institutes. Research work submitted to Gondar university research and publication office, Gondar, Ethiopia.
- King JL (2006). Veterinary Medicine and Public Health at CDC. Office of the Director, National Centre for Zoonotic, Vector-Borne, and Enteric Diseases. Atlanta.
- King L, Khabbaz R (2003). Converging Issues in Veterinary and Public Health. *Emerging Infect. Dis.*, 9: 4.
- Tamiru N, Getachew T, Medhin G (2008). Seroprevalence of *Toxoplasma gondii* in Nazareth town, Ethiopia. *East Afr. J. Public Health*, 5: 3.
- Waltner-Toews D (2009). Eco-Health: A primer for veterinarians. *Can. Vet. J.*, 50: 519-521.
- WHO (2002). Future trends in Veterinary public health Technical report series. 907, Report of a WHO Study Group, Geneva, pp. 1-7.

UPCOMING CONFERENCES

2nd International Congress on Neurology and Epidemiology, Nice, France, 8-10 November 2012



The 2nd IASTED African Conference on Health Informatics

~AfricaHI 2012~



Conferences and Advert

May 2012

8th Annual World Health Care Congress, Amsterdam, Netherlands, 23 May 2012

July 2012

1st Asia Pacific Clinical Epidemiology and Evidence Based Medicine Conference (APCEEEM), Kuala Lumpur, Malaysia, 6 Jul 2012

September 2012

2nd African Conference on Health Informatics, Gaborone, Botswana, 5 Sep 2012

November 2012

2nd Congress on Neurology and Epidemiology, Nice, France, 8 Nov 2012

1st National Sexual and Reproductive Health Conference (NSRHC) Melbourne, Australia, 20 Nov 2012



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