



HEALTH SCIENCES & DISEASE

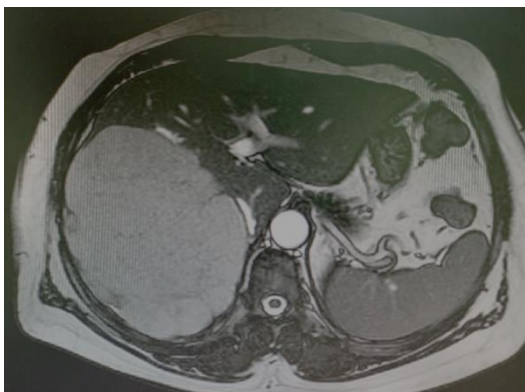
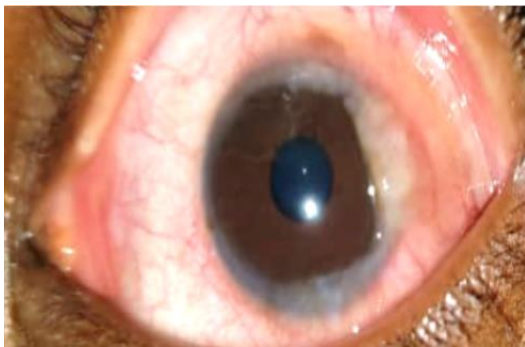
The Journal of Medicine and Biomedical Sciences

Health Sci. Dis: Vol 24 (1) January - 2023

ISSN (print journal) : 1684-2782

EISSN (online) : 2309-6535

Information and Education of Health Professionals for a Better World



FEATURED ARTICLES

RESEARCH ARTICLES

Risque de Transmission des Arbovirus à Travers le Don de Sang à Bamako
Amadou B Diarra, Mariam Ba, Moussa Cissé et al. Bamako - Mali

Nasal Eosinophilia for Diagnosing Allergic Rhinitis:
A Diagnostic Accuracy Study
Atanga LC, Meva'a Biouele RC, Choffor Nchinda E et al. Yaounde - Cameroon

Aspects Épidémiologiques et Thérapeutiques des Pathologies
Neurochirurgicales chez l'Enfant de Moins de 5 Ans à Libreville
Nkole Aboughe M, Kuissi Kamgaing E, Saphou Damon MA et al. Libreville - Gabon

Estimation du Coût Réel de la Prise en Charge des Cancers
du Col de l'Utérus en Radiothérapie au Cameroun
A Maison Mayeh AM, Esson Mapoko BS, Mekah Mapenya R et al. Douala - Cameroun

PHARMACY AND PHARMACEUTICAL SCIENCES

Profil Pharmacologique de deux Plantes Médicinales
Utilisées en Médecine Traditionnelle contre le Diabète
Nyangono Ndongo M, Soppo Lobe CV, Mbole Mvondo JM et al. Yaounde - Cameroun

MEDICINE AND SURGERY IN THE TROPICS

Profil Évolutif de la Limbo-Conjonctivite Endémique des Tropiques à Yaoundé
Nomo AF, Ohandja C, Akono Zoua ME et al. Yaounde - Cameroun

Aspects Épidémiologiques des Enfants Diabétiques Perdus de Vue à Abidjan
Massi Idrissa A-W, Yao A, M Sanogo et al. Abidjan - Côte d'Ivoire

Les Cancers Gynécologiques en Pratique Oncologique à Lomé
Ablavi Adani-Ifè, Ayi Amavi, Damigou Sambiani et al. Lomé - Togo

PUBLIC HEALTH

Aspects Cliniques et Audiométriques de l'Exposition au
Bruit dans une Usine de Métallurgie du Burkina Faso
Traore I, Ouilly S, Ouedraogo WLR et al. Ouagadougou - Burkina Faso

CLINICAL CASES

Pentalogy of Cantrell: A Case Report
M Chaibou Yacouba, H Soumana Diaouga, et al. Bamako - Mali

Hémangiome Hépatique Géant : À Propos d'un Cas
Hissene Mahamat T, Tra Bi Zamble OD, Bako Daouda I et al. Abidjan - Côte d'Ivoire

Published Monthly and Available Free at www.hsd-fmsb.org

Copyright © 2022 HSD. This is an Open Access Issue under the CC BY-NC-ND 4.0 license.



Portal Regional da BVS

Informação e Conhecimento para a Saúde

português | espanhol | english | français

Localizar descritor de assunto

Busca Avançada

EVID@Easy

Título, resumo, assunto



QUEREMOS SUA OPINIÃO

[Home](#) / [Pesquisa](#) / [Knowledge and practices toward COVID-19 preventive measures and symptoms: A case-control](#)

Knowledge and practices toward COVID-19 preventive measures and symptoms: A case-control study in Benin

Nonvignon Kêdoté, Marius; Aymeric Darboux, Joaquin; Sonagnon Assogba, Claude-Gervais; Houngnihin, Roch; Dossou, Ange; Essé, Agossou; Salako Djogbénoù, Luc; Bintou Sarr, Fatou; Mavoungou, Jacques François.

Health sci. dis ; 24(1): 61-70, 2023. tables

Artigo em Inglês | AIM (África) | ID: biblio-1411147

Biblioteca responsável: [CG1.1](#)

 Texto completo

 Adicionar na Minha BVS

 Imprimir

 XML

 Buscar no Google

Texto completo: Disponível

Conteúdo em Inglês | Arquivo de Saúde



About Health Sciences and Disease

ISSN (print): 1684-2782 / EISSN (online) : 2309-6535

JOURNAL SCOPE

Health Sciences and Disease, is an open source, peer reviewed medical journal that covers all aspects of medicine, pharmacy, biomedical and health sciences, including public health and societal issues. It is an “online first” publication, which means that all the publications articles appear on the website before being included in the print journal. The papers are published in full on the website, with open access. Our vision is to be the leader medical journal in our region. Our mission is to inform and educate all the health professionals and to promote constructive debate on health issues that matter in the management not only of diseases but of health as a whole. Health Sciences and Disease is the official publication of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I. Its team is based in Yaounde (Cameroon).

Acceptance of manuscripts is based on the originality, the quality of the work and validity of the evidence, the clarity of presentation, and the relevance to our readership. Publications are expected to be concise, well organized and clearly written. Authors submit a manuscript with the understanding that the manuscript (or its essential substance) has not been published other than as an abstract in any language or format and is not currently submitted elsewhere for print or electronic publication.

JOURNAL FACTS

Publisher

Faculty of Medicine and Biomedical Sciences, The University of Yaounde I.

Board of trustees

- The Minister of Higher Education, Republic of Cameroon
- The Rector of the University of Yaounde I, Yaounde.

Managing editor

Ze Minkande Jacqueline, MD

Editor in chief

Samuel Nko’o Amvene, MD

Deputy editors

- Alfred Kongnyu Njamnshi, MD
- Oudou Njoya, MD
- Essi Marie-José, Ph.D
- Bediang Georges, Ph.D

Section editors

- 1) **Internal medicine and subspecialties** : Sobngwi Eugene, Singwe Madeleine, Ashutantang Gloria, Menanga Alain, Bissek ZoungKanyi Anne Cécile, Azabджи Marcel, Ankouane Andoulo, Alfred Kongnyu Njamnshi
- 2) **Surgery and surgical specialties** : Angwafo III Fru, Essomba Arthur, Ze Minkande Jacqueline, Ngowe Ngowe Marcellin, Djientcheu Vincent de Paul, Bahebeck Jean
- 3) **ENT and ophthalmology**: Ndjolo Alexis, Ebana Mvogo Côme, Épée Emilienne, Njock Louis Richard.
- 4) **Pediatrics** : Koki Paul, Mah Evelyn, Mbassi Awa Hubert
- 5) **Obstetrics and gynecology**: Kasia Jean Marie, Mboudou Emile, Mbu Rbinson, Foumane Pascal, Dohbit Julius, Mve Koh Valere
- 6) **Radiology, medical imaging and biophysics** : Zeh Odile Fernande, Ongolo Zogo Pierre, Moifo Boniface, Guegang Goujou Emilienne, Nko’o Amvene Samuel, Gonsu Fotsin Joseph
- 7) **Microbiology, parasitology and biomedical sciences**: Mbacham Wilfred, Mbopi-Keou François Xavier, Torimiro Ndongo, Kamgno Joseph, Gonsu Hortense
- 8) **Pathology**: Essame Oyono Jean Louis, Sando Zacharie, Mendimi Nkodo Joseph
- 9) **Odontostomatology** : Bengondo Charles
- 10) **Pharmaceutical Sciences** : Mpondo Mpondo, Fokunang Estella, Guedje Nicole, Nnanga Nga
- 11) **Public health / research methodology**: Kamgno Joseph, Koki Paul.
- 12) **Medical informatics / Biostatistics** : Nguefack Tsague, Bediang Georges

Technical Secretariat

Bediang Georges, Mbede Maguy, Moulion Tapouh Jean Roger, Nko’o Amvene Michael Robert, Belobo Eyebe Grace, Akono Ondo Laryssa, Seme Ambroise, Awana Armel, Nko’o Ebale Franklin Albert, Amenele Jeanne Marie Priscille, Abdouraman Sali, Angono Dorotheé Célanie, Bite’e Bengono Nathalie, Nguidai Angelle, Nko’o Mints Samuel Princy

Advisory Committee

Sosso Maurice Aurélien (Yaoundé), Rabiou Cissé (Ouagadougou), Siaka Sidibe (Bamako), Ondo Ndong François (Libreville), Mbacham Wilfred (Yaoundé), Wonkam Ambroise (Cape Town), Zo'o Martin Roger (Le Mans), Mbopi-Keou François Xavier (Yaounde), Gresenguet Gérard (Bangui), Ibara JR (Brazzaville), Leke Rose (Yaounde), Mbanya Jean Claude (Yaounde), Kamgno Joseph (Yaounde).

INDEXING

HSD is indexed by Google Scholar, DOAJ, ROAD, JournalTOCs, African Index Medicus (WHO).

As an institutional publication of the Faculty of Medicine and Biomedical Sciences of the University of Yaounde I, *Health Sciences and Disease* is accredited by the Conseil Africain et Malgache pour l'Enseignement Supérieur (CAMES).

Health Sciences and Disease home page: <http://hsd-fmsb.org>

Contact information

hsdeditor3@gmail.com, / nkooamvenes@gmail.com

Health Sciences and Disease

Faculty of Medicine and Biomedical Sciences

PO Box 1364, Yaoundé Cameroon.

ISSN (print): 1684-2782 / EISSN (online) : 2309-6535

MANUSCRIPT SUBMISSIONS

The preferred way for submission is the online submission. Please, refer to the instructions to authors and to the *Health Sciences and Disease* home page: <http://hsd-fmsb.org>. Otherwise, manuscripts can be addressed to nkooamvenes@gmail.com.

EDITORIAL POLICIES

HSD's Publications Policy Committee follows the recommendations of the International Committee of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), and the Committee on Publication Ethics (COPE) for guidance on policies and procedures related to publication ethics. The policies for *HSD* have been adapted from those three advisory bodies and, where necessary, modified and tailored to meet the specific content, audiences, and aims of *HSD*.

Manuscripts are initially checked by the editor in chief or section editor for identification of gross deficiencies. At this stage, the proposal may be rejected. After this initial screening, articles are sent to two-reviewers. The review process may take days to weeks to reach a decision. The duration from submission to publication may take one to six months (average: 2 months).

ARTICLE PROCESSING CHARGES (APC)

Article submission is free of charges, but **if your paper is accepted for publication**, you will be asked to pay article processing charges to cover publications costs, depending on the type, complexity and length of the work, and on the **number of authors**

Inquiries about fast track, manuscript status and preparation, as well as letters to the editor, should be directed to:

Nko'o Amvene Samuel

Editor-in-Chief, Health Sciences and Disease

Email: nkooamvenes@gmail.com

COPYRIGHT NOTICE

Authors who publish with this journal agree to the following terms:

- Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under a Creative Commons Attribution License that allows others to share the work with an acknowledgement of the work's authorship and initial publication in this journal.
- Authors are able to enter into separate, additional contractual arrangements for the non-exclusive distribution of the journal's published version of the work (e.g., post it to an institutional repository or publish it in a book), with an acknowledgement of its initial publication in this journal.
- Authors are permitted and encouraged to post their work online (e.g., in institutional repositories or on their website) prior to and during the submission process, as it can lead to productive exchanges, as well as earlier and greater citation of published work





CONTENTS

#In this Issue	i
#About Health Sciences and Disease	iii
RESEARCH ARTICLES	
(1) Risque de Transmission de Certains Arbovirus à Travers le Don de Sang à Bamako <i>Amadou B Diarra, Mariam Ba, Moussa Cissé, Djakaridja Traoré, Gaoussou Togora, Adama Traoré et al. Bamako - Mali</i>	1
(2) Nasal Eosinophilia for Diagnosing Allergic Rhinitis: A Diagnostic Accuracy Study <i>Atanga LC, Meva'a Biouele RC, Choffor Nchinda E, Ndassa Sede Mbakop C, Njock R, Djomou F. Yaounde - Cameroon</i>	6
(3) Cow's Milk Protein Allergy: Prevalence of Sensitization Using the Prick Test Method Among Infants in a Sub-Saharan African Country <i>Eposse Ekoube C, Puepi Y, Epee P, Alima Yanda AN, Mandeng Ma Linwa E, Mbono Ritha et al. Yaounde - Cameroon</i>	12
(4) Aspects Épidémiologiques et Thérapeutiques des Pathologies Neurochirurgicales chez l'Enfant de Moins de 5 Ans à Libreville de 2019 à 2021 <i>Nkole Aboughe M, Kuissi Kamgaing E, Saphou Damon MA, Comlan E, Chassem Lapue C, Atebo SJ. Libreville - Gabon</i>	17
(5) Congenital Cardiac Anomalies in Children with Cleft Lips and/or Palates in Yaounde: A Cross-Sectional Retrospective Study <i>Jocelyn Tony Nengom, Leonel Atanga, Thibaut Meyebe, Suzanne Sap Ngo Um. Yaounde - Cameroon</i>	26
(6) Aspects Cliniques et Audiométriques de l'Exposition au Bruit dans une Usine de Métallurgie de Ouagadougou <i>Traore I, OUILY S, Ouedraogo WLR, Kabore NF, Kabore SG, Kabore M et al. Ouagadougou - Burkina Faso</i>	30
(7) Eye Diseases of Traditional Mining Hand Workers in the Gold Panning Sites of Niger <i>Abba Kaka HYI, Laminou L, Moussa M, Boubacar M, Roufai Lamyne. Niamey - Niger</i>	35
(8) Frequency and Pattern of Intra Uterine Hysterocopic Lesions among Women Coming for IVF in the City of Yaoundé <i>Serge Robert Nyada, Pascale Mpono E, Ngono A Vanina, Junie Annick Metogo Ntsama, Yves Kasia Onana et al. Yaounde - Cameroun</i>	39
(09) Aspects Épidémiologiques des Enfants Diabétiques Perdus de Vue à Abidjan <i>Massi Idrissa A-W, Yao A, M Sanogo, P Koffi-Dago, A Hue, J Danho, J Abodo. Abidjan - Côte d'Ivoire</i>	43
REVIEW ARTICLE	
(10) Major Cardiovascular Risk Factors and Serious Mental Disorders, a Double-Edged Sword : Literature Review <i>Kemmang Yemele H, Ndobu-Koe V, Njedock SN, Ananfack Nguefack EG, Tchouanlong AT, Nganou-Gnindjio N. Yaounde - Cameroon</i>	47
COVID-19 IN AFRICA	
(11) Attitudes and Practices of Travelers regarding Vaccine COVID-19, Adverse Reactions and Compliance with Barrier Measures <i>Kouame KB, Golly KJ, Diplo TFB, Yao SS, Kouakou DK, Anne BJCPA et al. Abidjan - Côte d'Ivoire</i>	51
(12) Association of Acute COVID-19 with 24 Hours-Pulse Wave Velocity in Cameroonian Workers <i>Sidick Aboubakar Mouliom, Marie Solange Ndom, Siddikatou Djibrilla, Ngando Pane Gervaise et al. Douala - Cameroun</i>	56
(13) Knowledge and Practices towards COVID-19 Preventive Measures and Symptoms : A Case-Control Study in Benin <i>Nonvignon Marius Kédoté, Aymeric Joaquin Darboux, Sonagnon Claude-Gervais Assogba, Roch Houngnihin et al. Cotonou - Benin</i>	61
MEDICINE AND SURGERY IN THE TROPICS	
(14) Profil Évolutif de la Limboconjunctivite Endémique des Tropiques à l'Hôpital Gynéco-Obstétrique et Pédiatrique de Yaoundé <i>Nomo AF, Ohandja C, Akono Zoua ME, Nanfack NC, Mvilongo TC, Malla EG. Yaoundé - Cameroun</i>	70
(15) Les Cancers Gynécologiques en Pratique Oncologique à Lomé <i>Ablavi Adani-Ifè, Ayi Amavi, Damigou Sambiani, Kwamé Doh, Koffi Améghor. Lomé - Togo</i>	77
(16) Prise en Charge des Hémopathies Malignes au Centre National d'Oncologie Médicale et de Radiothérapie Alassane Ouattara d'Abidjan <i>Condé Abdoulaye, Danho Nanho Clotaire, Diakité Mamady, Diallo Idrissa, Diallo Thierno Amadou et al. Abidjan - Côte d'Ivoire</i>	82
(17) L'Insuffisance Cardiaque Aigue Chez les Enfants à Bamako <i>Hamady Dado Sow, Bouréma Dembele, Boubacar Diarra, Noumou Sidibe, Mamadou Diakite, Aliou Sangare et al. Bamako - Mali</i>	88
(18) Quality of Life of a Group of Cameroonians Patients Aged over 65 in an Urban Setting: a Cross-Sectional Study <i>Ndobu-Koe Valérie, Biatu N, Kemmang Yemele H, Nganou-Gnindjio CN, Ba Hamadou, Menanga A, Kingué S. Yaounde - Cameroun</i>	92
(19) Aspects Cliniques de la Maladie Hémorroïdaire Interne à L'hôpital du District de la Commune IV de Bamako <i>Alassane Diarra, Youssef Fofana, Drissa Sangaré, Abdoul Razakou Dicko, Amadou Galo Dicko et al. Bamako - Mali</i>	97
(20) Sepsis et Choc Septique en Réanimation à Brazzaville (Congo) <i>Niengo Outsouta G, Mpooy EMY Monkessa CM, Elombila M, Leyono-Mawandza PDG, Ontsira Ngoyi EN et al. Brazzaville, Congo</i>	101



Contents

(21) Estimation du Coût Réel de la Prise en Charge des Cancers du Col de l'Utérus en Radiothérapie au Cameroun <i>Maison Mayeh AM, Esson Mapoko BS, Mekah Mapenya RR, Sango AJF, Dina Bell Mbassi E et al. Douala - Cameroun</i>	109
(22) Epidemiology, Clinical Presentation and Outcome of Acute Kidney Injury in the City of Bobo-Dioulasso (Burkina Faso) <i>Aoua Semde, PF Kissou, A Sawadogo, I Kere, J Dah, G Sanou et al. Bobo-Dioulasso - Burkina Faso</i>	114
CLINICAL CASES	
(23) Pentalogy of Cantrell: A Case Report <i>M Chaibou Yacouba, H Soumana Diaouga, H Moustapha, O Ali Ada, I Nafiou, M. Garba et al. Bamako - Mali</i>	119
(24) Diagnosis of Severe Rheumatic Mitral Stenosis in the Postpartum: A Case Report <i>Laurence Carole Ngo Yon, Charles Mve Mvondo, Hermann Nestor Tsague Kengni, Marcellin Ngowe Ngowe. Yaounde - Cameroun</i>	122
(25) Ventricule Droit à Double Chambre Chez une Femme Adulte Malienne : à Propos d'un Cas <i>Sidibé N, Diarra B, Dembele B, Ba H, Sangaré I, Camara Y et al. Bamako - Mali</i>	125
(26) Monocular Blindness and Plexiform Neurofibromas in Association to Neurofibromatosis Type 1: A Report of Two Pediatric Cases <i>Laouali Laminou, Hassane A Traoré, Abba Kaka Y, Amza Abdou. Niamey - Niger</i>	128
(27) Hémangiome Hépatique Géant : À Propos d'un Cas <i>Hissene Mahamat T, Tra Bi Zambie OD, Bako Daouda I, Essoté Alain B, Karimou Bondabou A et al. Abidjan - Côte d'Ivoire</i>	131
(28) Lumbosacral Plexopathy Associated Psoas Abscess <i>Saphou Damon MA, Nguete Ndjota B, Diouf Mbourou N, Nkole Aboughe M, Diatta Mayombo K et al. Libreville - Gabon</i>	134
PHARMACY AND PHARMACEUTICAL SCIENCES	
(29) Profil Pharmacologique de deux Plantes Médicinales Utilisées en Médecine Traditionnelle contre le Diabète : Caloncoba Echinata et Césaria Barteri <i>Nyangono Ndongo M, Soppo Lobe CV, Mbole Mvondo JM, Myniem Ngombi A, Benga Mekoulou CF et al. Yaounde - Cameroun</i>	137
MENTAL HEALTH	
(30) Hypnothérapie Brève de l'Encoprésie sur Mégacôlon en Institution Pédiopsychiatrique <i>Issack BIYONG, Irène Coretta Ngo Beguel, Jessica Carbel. Genève - Suisse</i>	143
INSTRUCTIONS TO AUTHORS	
# Instructions to Authors	v



HEALTH SCIENCES & DISEASE
The Journal of Medicine and Biomedical Sciences

Health Sci. Dis: Vol 23 (1) January - 2023
ISSN (print journal): 1684-2782
EISSN (online): 2309-6535
Information and Education of Health Professionals for a Better World



FEATURED ARTICLES

RESEARCH ARTICLES

- Risque de Transmission des Arbovirus à Travers le Don de Sang à Bamako
Amadou B Diarra, Mariani Sa, Moussa Cissé et al. Bamako - Mali
- Nasal Eosinophilia for Diagnosing Allergic Rhinitis: A Diagnostic Accuracy Study
Atanga LC, Meva'a Eoussie RC, Chaffor-Nianda E et al. Yaounde - Cameroun
- Aspects Épidémiologiques et Thérapeutiques des Pathologies Neurochirurgicales chez l'Enfant de Moins de 5 Ans à Libreville
Nkole Aboughe M, Kiassi Kamgang E, Saphou Damon M et al. Libreville - Gabon
- Estimation du Coût Réel de la Prise en Charge des Cancers du Col de l'Utérus en Radiothérapie au Cameroun
Maison Mayeh AM, Esson Mapoko BS, Mekah Mapenya R et al. Douala - Cameroun

PHARMACY AND PHARMACEUTICAL SCIENCES

- Profil Pharmacologique de deux Plantes Médicinales Utilisées dans le Dja et Lobo en Médecine Traditionnelle contre le Diabète.
Nyangono Ndongo M, Soppo Lobe CV, Mbole Mvondo JM, Myniem Ngombi A, Benga Mekoulou CF et al. Yaounde - Cameroun

MEDICINE AND SURGERY IN THE TROPICS

- Profil Évolutif de la Limbo-Conjonctivite Endémique des Tropiques à l'Hôpital Gynéco-Obstétrique et Pédiatrique de Yaoundé
Nomo AF, Ohandja C, Akono Zoua ME et al. Yaounde - Cameroun
- Aspects Épidémiologiques des Enfants Diabétiques Perdus de Vue à Abidjan
Massi Idrissa A-W, Yao A, M Sarogo et al. Abidjan - Côte d'Ivoire
- Les Cancers Gynécologiques en Pratique Oncologique à Lomé
Abiani Adani-Jé, Ayi Amari, Damigou Samiani et al. Lomé - Togo

PUBLIC HEALTH

- Aspects Cliniques et Audiométriques de l'Exposition au Bruit dans une Usine de Métallurgie de Ouagadougou
Traore I, Ouilly S, Ouedraogo WLR et al. Ouagadougou - Burkina Faso

CLINICAL CASES

- Pentalogy of Cantrell: A Case Report
M Chaibou Yacouba, H Soumana Diaouga, et al. Bamako - Mali
- Hémangiome Hépatique Géant : À Propos d'un Cas
Hissene Mahamat T, Tra Bi Zambie OD, Bako Daouda I et al. Abidjan - Côte d'Ivoire



AMs
Excellence & Dedication in Patient Care
AFRIMVOE MEDICAL SERVICES

Published Monthly and Available Free at www.hsd-fmsb.org





Original Article

Knowledge and Practices toward COVID-19 Preventive Measures and Symptoms: A Case-Control Study in Benin

Connaissances et pratiques concernant les mesures préventives et les symptômes de la COVID-19 : une étude cas-témoins au Bénin

Nonvignon Marius Kêdoté^{1,2,3*}, Aymeric Joaquin Darboux^{2,3}, Sonagnon Claude-Gervais Assogba^{3,4}, Roch Hounghinin^{3,5}, Ange Dossou^{3,6}, Essé Agossou^{3,7}, Luc Salako Djogbénu^{1,3}, Fatou Bintou Sarr^{3,8} and Jacques François Mavoungou^{3,9}

ABSTRACT

Introduction. Following communication and awareness actions related to COVID-19, we assessed the knowledge and practices about COVID-19 in Benin. **Methods.** A case-control survey was conducted from 14 September to 20 October 2020 in Benin. Questions relating to knowledge and practices on COVID-19 were collected through a questionnaire survey. A total of 312 respondents (104 cases and 208 controls) were included in the study. Logistic regression and Spearman correlation tests were used to examine the relation between participants knowledge and practice at a 5% significance level. **Results.** From the survey, 65.4% of cases and 68.3% of controls knew about COVID-19 transmission via air droplets. Most of the cases (67.31%) and control (79.81%) participants reported cough as a symptom of COVID-19. Handwashing with soap and water was the most protective measure known by 87.5% of cases and 90.87% of controls. Concerning practice, the cloth mask was the type mostly worn by cases (54.81%) and controls (58.65%). Wearing a face mask in public areas was significantly associated with the COVID-19 health status of respondents (OR = 2.98, CI95% [1.16-7.67]; p = 0.022). Furthermore, a significantly positive correlation exists between knowledge of the COVID-19 protective measures and hand hygiene practices when leaving a public place (r = 0.184, p=0.001). **Conclusion.** Through this study, we observed some discrepancies between the knowledge and practices related to COVID-19 among cases and controls surveyed. Therefore, efforts should be directed toward raising awareness about the disease to improve their knowledge and practices.

RÉSUMÉ

Introduction. Suite aux actions de communication et de sensibilisation liées à la COVID-19, nous avons évalué les connaissances et les pratiques sur la COVID-19 au Bénin. **Méthodes.** Une enquête cas-témoins a été menée du 14 septembre au 20 octobre 2020 au Bénin. Les questions relatives aux connaissances et aux pratiques sur la COVID-19 ont été recueillies par le biais d'une enquête par questionnaire. Un total de 312 répondants (104 cas et 208 témoins) ont été inclus dans l'étude. La régression logistique et le test de corrélation de Spearman ont été utilisés pour examiner la relation entre les connaissances et les pratiques des participants à un niveau de signification de 5%. **Résultats.** D'après l'enquête, 65,4% des cas et 68,3% des témoins connaissaient la transmission du COVID-19 par les gouttelettes d'air. La plupart des cas (67,31%) et des témoins (79,81%) ont déclaré que la toux était un symptôme de la COVID-19. Le lavage des mains à l'eau et au savon était la mesure de protection la plus connue par 87,5% des cas et 90,87% des témoins. Concernant les pratiques, le masque en tissu était le type le plus porté par les cas (54,81%) et les témoins (58,65%). Le port d'un masque facial dans les lieux publics était significativement associé à l'état de santé COVID-19 des répondants (OR = 2,98, IC95% [1,16-7,67] ; p = 0,022). De plus, une corrélation significativement positive existe entre la connaissance des mesures de protection contre la COVID-19 et les pratiques d'hygiène des mains à la sortie d'un lieu public (r = 0,184, p=0,001). **Conclusion.** A travers cette étude, nous avons observé certaines divergences entre les connaissances et les pratiques liées à la COVID-19 chez les cas et les témoins interrogés. Par conséquent, les efforts devraient être orientés vers la sensibilisation à la maladie afin d'améliorer leurs connaissances et leurs pratiques.

1. Department Health Environment, Comlan Alfred Quenum Regional Institute of Public Health (IRSP-CAQ), University of Abomey-Calavi, Benin
 2. Community of Practice Ecohealth for West and Central Africa, University of Abomey-Calavi, Benin
 3. Thematic Program of Health Research, African and Malagasy Council for Higher Education
 4. Laboratory of Research on Innovation for Agricultural Development, Faculty of Agronomy, University of Parakou, Benin
 5. Laboratory of Applied Medical Anthropology, University of Abomey-Calavi, Benin
 6. Ministry of Health, Benin
 7. Faculty of Science and Technology/Laboratory of Biomembranes and Cellular Signaling, University of Abomey-Calavi, Benin
 8. Laboratory of Physiology and Functional Explorations, UFR of Health Sciences, Iba Der Thiam University of Thies, Senegal
 9. International University of Libreville, Gabon

Corresponding author

Nonvignon Marius Kêdoté
 Email: kedmar@yahoo.fr
mkedote@irsp-ouidah.org
 Tel : +22997380303

Keywords: Benin; COVID-19, Case-Control, Knowledge, Practices.

Mots-clés : Bénin, COVID-19, Cas-Témoins, Connaissances, Pratiques.

HIGHLIGHTS**What is already known on this topic**

Knowledge, attitudes, and practices (KAPs) studies on COVID-19 are important in controlling its spread and play a vital role in determining people's readiness to accept behavioural change measures.

What question this study addressed

Knowledge and practices about COVID-19 in Benin following communication and awareness actions.

What this study adds to our knowledge

After intervention there is a better knowledge of the incubation period, protective measures and better practice about wearing masks in a public place.

How this is relevant to practice, policy or further research.

Efforts should be directed toward raising awareness about the disease to improve knowledge and practices.

INTRODUCTION

Knowledge, attitudes, and practices (KAPs) studies on COVID-19 are important in controlling its spread and play a vital role in determining people's readiness to accept behavioural change measures recommended by health authorities^{1,2}. To guarantee a successful COVID-19 control, people's adherence to preventive and control measures is essential. This adherence is highly dependent on the population's KAPs toward the disease³. Previous studies indicated that knowledge correlated with more optimistic attitudes toward COVID-19 preventive practices⁴. Another study reported a positive relationship between individuals knowledge and practices toward COVID-19⁵. Without effective treatment, the world is left with no option other than to adhere to public health preventive measures such as regular washing of hands using soap and water or alcohol-based solution, physical distancing (maintaining a distance of at least one meter), wearing of face masks, etc. These measures have been welcomed and promoted by the World Health Organization (WHO), governments, and health ministries of countries around the world⁶. The effectiveness of these mitigation measures is strongly dependent on the collaboration and compliance of everyone².

In Benin, on March 16, 2020, the Ministry of Health announced the first confirmed case of COVID-19. Since then, 101 deaths out of 8,025 confirmed cases were reported as of June 09, 2021⁷. After the confirmation of this first case, to mitigate the spread and to safeguard the population, the Benin's government declared a state of emergency. In addition to the several restrictions quoted above, one of the actions taken by the government was the stop of face-to-face education for students and the isolation of the first districts with confirmed cases. Moreover, the government, alongside the media, conducted several public sensitization programs on COVID-19 to raise the public's awareness. We, therefore, conducted a national study to assess the influence of contextual factors (environmental, socio-cultural, demographic, economic, and political) on the dynamics of COVID-19 spread in Benin. The current article, based on

a part of the data from this survey, assesses the knowledge and practices about COVID-19 among the Beninese. Another objective was to compare the knowledge and practices between case and control participants. Our insights are important to inform future efforts focusing on effective public health preventive measures to better control the spread of COVID-19 and future epidemics.

MATERIALS AND METHODS**Study area**

This study was conducted in Benin, a country located in West Africa. Benin is bordered to the west by Togo, in the north by Niger and Burkina-Faso, and in the east by Nigeria, which is one of the most affected countries in Africa by COVID-19. The survey was carried out in health facilities transformed into COVID-19 screening and treatment sites.

Study design

A case-control and cross-sectional survey was conducted from 14 September to 20 October 2020. We considered cases as individuals with a positive RT-PCR test for SARS-CoV-2 and who were undergoing treatment, while controls were those with a negative result and who had no symptoms of COVID-19 before enrolment in the study. Cases enrolled in the study were those who were healthy enough to be interviewed (not hospitalised for serious complications). The selection method was non-probabilistic. Cases and controls were selected for convenience in two stages. The first stage consisted of a purposive selection of nine (9) screening and treatment sites. These sites were identified by the health authorities and selected because they are located in different regions of Benin (North, Center, and South) and are the ones with the highest attendance in terms of tests performed and people being treated and followed up. In Benin, there was a total of 84 screening and treatment sites, distributed at a rate of one (1) per commune (77), with three (3) more in Cotonou, one more in Porto-Novo, one more in Sèmè-Kpodji, one more in Parakou and one more in Natitingou. Thus, in southern Benin, six sites were selected, one in the center and two in the north.

The second stage consisted of convenience recruitment of cases and controls screened at the sites. A total of 312 participants were surveyed (104 cases for 208 controls). For each case, two controls from the same site were surveyed.

Study variables

The study variables related to COVID-19 knowledge were about the mode of transmission, persons at risk, protective measures, the incubation period, and the existence of asymptomatic people. For practice, they were about the type of mask used, wearing mask habits, hand washing with soap and water habits, cleaning and disinfection of objects/surface habits, social distancing, risk behaviours (handshake, mask below the chin, touching the face with hands, eyes or mouth) and teleworking.

Statistical analysis

All statistics were performed using Stata software version 11.0. To identify statistically significant variables, logistic

regression analysis was conducted at 95% confidence interval (CI). Spearman correlation coefficient was used to examine the correlation between participants knowledge and practice. A significance level of 5% was defined and used.

Ethical consideration

An agreement for the selection of screening and treatment sites of COVID-19 was obtained from the National Direction of Benin Hospitals as well as an ethical approval (N°086/MS/DRFMT/CNERS/SA of August 04, 2020) from the National Ethics Committee for Health Research in Benin. The health area coordinators where the selected sites were located, were all informed about the study. The participants (cases and controls) gave their free and informed written consent and the interviews were conducted in strict respect of the privacy and confidentiality of participants.

RESULTS

Sociodemographic characteristics of the respondents

A total of 312 (50.96% male and 49.04% female) respondents were interviewed. The mean age of the participants was 34 ± 11.85 years (females: 34.27 ± 12.3 and males: 33.78 ± 11.44). Regarding their educational status, about 43.59% had attended university, 38.14% stopped at secondary school, 13.46% at primary school, and 4.81% had no formal education. Most participants are married (62.7%) and Christians (81.29%) in religion. Concerning their monthly income, about 33.22% earned between 75-185 USD (United States Dollars), less than 75 USD (28.27%), 185-560 USD (25.44%) and more than 560 USD (13.07%).

Knowledge and practices related to COVID-19

The results obtained showed that the respondents had moderate knowledge of COVID-19 infection. The modes of transmission of COVID-19 through direct contact with the virus were known by 53.9% of the cases and 48.6% of controls. Additionally, transmissions via air droplets when an infected person coughs were known by 65.4% of the cases and 68.3% controls. Handwashing with soap and water was the most reported protective measure by 87.5% of cases and 90.87% of controls. Most of the controls (61.54%) knew the incubation period of COVID-19 while fewer cases (35.38%) did. Only 2.88% of cases and 1.92% of controls recognised obese individuals as a risk group. Both cases (87.5%) and controls (90.87%) mentioned handwashing with soap and water as the most known protective measures against COVID-19. Regarding practice, cloth mask was the most worn as reported by 54.81% of cases and 58.65% of controls. The majority of participants often wear a mask in public places with people as reported by 89.32% of cases and 96.15% of controls. Hand washing after returning home was often executed by 75% of controls and 79.81% of cases. Few cases (7.69%) and controls (13.95%) often shook hands with other people. The social distancing of at least 1 meter was observed by 70.19% of cases and 83.65% of controls. We also noticed that at home, cleaning and disinfection of surfaces and objects were rarely conducted daily by 13.46% cases and 12.02% of controls. Respondents who

did not know the incubation period of COVID-19 were 2.89-times more in cases compared to controls (OR = 2.89, CI95% [1.77-4.72]; $p = 0.029$). Those who did not wear a face mask regularly (never or rarely) in public places were 2.98-times more in cases compared to controls (OR = 2.98, CI95% [1.16-7.67]; $p = 0.022$). Tables 1, 2, and 3 show details of knowledge and practices related to COVID-19 among case and control respondents.

Correlation between knowledge and practice toward COVID-19

Our statistical analysis through the Spearman correlation coefficient revealed that there exists some significant correlation between respondents' knowledge and their practices. The frequency of wearing face masks at home in the presence of other people was positively correlated with better knowledge of the mode of transmission of COVID-19 ($r_s = 0.117$, $p = 0.040$); also positively with symptoms of COVID-19 ($r_s = 0.142$, $p = 0.012$). Lowering the mask at the level of the chin or neck was more likely among respondents with less knowledge of the modes of transmission of COVID-19 ($r_s = -0.136$, $p = 0.016$) and of COVID-19 symptoms ($r_s = -0.115$, $p = 0.043$). The frequency of hand hygiene when leaving a public place was positively and significantly correlated with a better knowledge of: the mode of transmission of COVID-19 ($r_s = 0.157$, $p = 0.005$); COVID-19 symptoms ($r_s = 0.198$, $p = 0.000$); persons at risk ($r_s = 0.119$, $p = 0.036$); protective measures ($r_s = 0.184$, $p = 0.001$) and existence of asymptomatic people ($r_s = 0.158$, $p = 0.005$). All details obtained for the correlation between knowledge and practice among participants are presented in tables 4 and 5.

DISCUSSION

This cross-sectional study was conducted to assess and compare the knowledge and practices on COVID-19 between case and control participants. In our study, the mean age of the participants was $34.02 (\pm 11.85 \text{ SD})$ and 42.63% of them are under 29 years old. This mean age in our context would probably be related to the youth of the African population notably in Benin. Alemu et al⁸ reported a similar result in Ethiopia. Overall, our findings demonstrated that the respondents had a moderate level of knowledge and practice about the COVID-19 pandemic. Roy et al⁹ had a similar observation in their study carried out in India.

More than half of the cases (65.4%) and controls (68.3%) respondents knew about COVID-19 transmission mode through air droplets when an infected person coughs. For 53.9% of cases and 48.6% of controls, the virus could be transmitted through direct contact with the virus. According to Reuben et al¹⁰, 93.0% and 88.5% of the respondents in their study knew that the COVID-19 virus could be transmitted through air droplets (from patients' sneezing/coughing) and close contact with infected persons.

Table 1: Logistic regression between knowledge and health status of respondents.

Knowledge	Cases. n (%) / m (SD)	Controls. n (%) / m (SD)	Total n (%) / m (SD)	OR[CI _{95%}]	p
Mode of Transmission				-	-
Through direct contact with the virus	56 (53.9%)	101 (48.6%)	157 (50.3%)		
Indirect contact to contaminated objects or surfaces	40 (38.5%)	95 (45.7%)	135 (43.3%)		
Through air droplets when an infected person coughs	68 (65.4%)	142 (68.3%)	210 (67.3%)		
Through hand contact with eyes, nose and mouth after touching contaminated surfaces	25 (24.03%)	47 (22.60%)	72 (23.07%)		
Mode of Transmission (quantitative)	02.21 (01.40)	02.37 (01.31)	02.32 (01.34)	0.91 [0.76-1.09]	0.309
Symptoms of COVID-19				-	-
Cough	70 (67.31%)	166 (79.81%)	236 (75.64%)		
Fever	62 (59.62%)	155 (74.52%)	217 (69.55%)		
Headache	49 (47.12%)	91 (43.75%)	140 (44.87%)		
Shortness of breath	26 (25%)	59 (28.37%)	85 (27.24%)		
Sore throat	16 (15.38%)	59 (28.37%)	75 (24.04%)		
Muscle pain	31 (29.81%)	40 (19.23%)	71 (22.76%)		
Diarrhoea	23 (22.12%)	38 (18.27%)	61 (19.55%)		
Conjunctivitis	13 (12.50%)	28 (13.46%)	41 (13.14%)		
Loss of smell or taste	11 (10.58%)	05 (02.40%)	16 (05.13%)		
Skin rash or discoloration of fingers/toes	03 (02.88%)	06 (02.88%)	09 (02.88%)		
Loss of speech	0 (0.00%)	06 (02.88%)	06 (01.92%)		
Symptoms of COVID-19 (quantitative)	02.86 (01.56)	03.17 (01.47)	03.07 (01.51)	0.87 [0.74-1.02]	0.086
People at Risk				-	-
Pregnant women	02 (01.92%)	08 (03.84%)	10 (03.21%)		
Overweight or Obese people	03 (02.88%)	04 (01.92%)	07 (02.24%)		
People with cancer	03 (02.88%)	09 (04.33%)	12 (03.84%)		
People with diabetes	26 (25.00%)	77 (37.02%)	103 (33.01%)		
People with high blood pressure	24 (23.08%)	74 (35.58%)	98 (31.41%)		
People with respiratory problems	27 (25.96%)	53 (25.48%)	80 (25.64%)		
Elderly people	68 (65.38%)	158 (75.96%)	226 (72.43%)		
People at Risk (quantitative)	01.63 (01.36)	02 (01.41)	01.88 (01.40)	0.82 [0.69-0.98]	0.029
Protective measures against COVID-19				-	-
Go out only when necessary	08 (07.69%)	20 (09.62%)	28 (08.97%)		
Maintaining social distance of at least 1 meter	73 (70.19%)	174 (83.65%)	247 (79.17%)		
Avoids contact with infected people	25 (24.04%)	50 (24.04%)	75 (24.04%)		
Teleworking	03 (02.88%)	05 (02.40%)	08 (02.56%)		
Hand washing with soap and water	91 (87.50%)	189 (90.87%)	280 (89.74%)		
Cover mouth with a tissue or elbow when sneezing or coughing	13 (12.50%)	47 (22.60%)	60 (19.23%)		
Wearing a cloth-mask when physical distancing is not possible	82 (78.85%)	166 (79.81%)	248 (79.49%)		
Protective measures against COVID-19 (quantitative)	02.83 (01.10)	03.12 (0.92)	03.02 (01)	0.73 [0.57-0.94]	0.015
Incubation period of COVID-19					<0.001
No	67 (64.42%)	80 (38.46%)	147(47.12%)	2.89 [1.77-4.72]	
Yes	37 (35.38%)	128 (61.54%)	165 (52.88%)	1	
Existence of asymptomatic carriers					0.826
No	16 (15.38%)	34 (16.35%)	50 (16.03%)	0.93 [0.48-1.77]	
Yes	88 (84.62%)	174 (83.65%)	262 (83.97%)	1	
COVID-19 transmission through asymptomatic carriers					0.138
No	22 (21.15%)	30 (14.42%)	52 (16.67%)	1.59 [0.87-2.93]	
Yes	82 (78.85%)	178(85.58%)	260 (83.33%)	1	

OR: Odds Ratio ; CI95% : 95% Confidence Interval; m: mean; SD: Standard Deviation.

Table 2: Logistic regression between wearing mask practices and health status of respondents

Practices	Cases. n (%)	Control. n (%)	Total. n (%)	OR[CI _{95%}]	p
Type of mask					0.517
Cloth masks	57 (54.81%)	122 (58.65%)	179 (57.37%)	0.85 [0.53-1.37]	
Surgical masks/ FFP2	47 (45.19%)	86 (41.35%)	133 (42.63%)	1	
Wearing a mask at home in the presence of others					0.030
Never/Rarely	75 (72.12%)	172 (82.69%)	247 (79.17%)	1.84 [1.05-3.23]	
Often/Always	29 (27.88%)	36 (17.61%)	65 (20.83%)	1	
Wearing a mask on the street					0.106
Never/ Rarely	16 (15.39%)	19 (9.18%)	35 (11.22%)	1.80 [0.88-3.66]	
Often/ Always	88 (84.61%)	188 (90.82%)	276 (88.78%)	1	
Wearing a mask in individual transport					0.009
Never/Rarely	05 (4.81%)	01 (0.48%)	06 (1.92%)	1.51 [0.92-2.49]	
Often/ Always	40 (38.46%)	64 (30.77%)	104 (33.33%)	1	
Wearing a mask in public transportation					0.273
Never/Rarely	03 (2.91%)	6 (2.90%)	09 (2.90%)	1.19 [0.29-4.93]	
Often/Always	53 (51.46%)	126 (60.87%)	179 (57.74%)	1	
Wearing a mask in the main workplace					0.272
Never/ Rarely	18 (17.31%)	28 (13.53%)	46 (14.79%)	1.41[0.73-2.71]	
Often/Always	76 (73.08%)	167 (80.68%)	243 (78.14%)	1	
Wearing a mask in a public place					0.022
Never/Rarely	11 (10.68%)	08 (3.85%)	19 (6.11%)	2.98[1.16-7.67]	
Often/Always	92 (89.32%)	200 (96.15%)	292 (93.89%)	1	
Lowering the mask below the chin or neck					0.562
No	13 (12.50%)	31 (14.90%)	44 (14.10%)	1.22 [0.61-2.45]	
Yes	91 (87.50%)	177 (85.10%)	268 (85.90%)	1	

OR: Odds Ratio ; CI_{95%} : 95% Confidence Interval.

Table 3: Logistic regression between hygiene and preventive measures, practices and health status of respondents

Practices	Cases. n (%)	Control. n (%)	Total. n (%)	OR[CI _{95%}]	p
Hand washing before entering in public place					> 0.99
Never/Rarely	12 (11.54%)	24 (11.54%)	36 (11.54%)	1 [0.47-2.08]	
Often/Always	92 (88.46%)	184 (88.46%)	276 (88.46%)	1	
Hand washing when leaving a public place					0.320
Never/Rarely	62 (59.62%)	136 (65.38%)	198 (63.46%)	1.27 [0.78-2.07]	
Often/Always	42 (40.38%)	72 (34.62%)	114 (36.54%)	1	
Hand washing before leaving the home					0.003
Never/ Rarely	58 (55.77%)	151 (72.60%)	209 (66.09%)	0.47 [0.30-0.77]	
Often/Always	46 (44.23%)	57 (27.40%)	103 (33.01%)	1	
Hand washing after returning home					0.340
Never/Rarely	21 (20.19%)	52 (25%)	73 (23.40%)	0.76 [0.42-1.34]	
Often/ Always	83 (79.81%)	156 (75%)	239 (76.60%)	1	
Hand washing after touching non-disinfected objects or surfaces					0.275
Never/ Rarely	64 (61.54%)	141 (67.79%)	205 (65.71%)	0.76 [0.46-1.24]	
Often/ Always	40 (38.46%)	67 (32.21%)	107 (34.29%)	1	
Hand contact with the face, eyes or mouth					0.800
Never/ Rarely	35 (33.65%)	73 (35.10%)	108 (34.61%)	1.06 [0.65-1.76]	
Often/ Always	69 (66.35%)	135 (64.90%)	204 (65.39%)	1	
Handshake to other persons					0.11
Never/Rarely	96 (92.31%)	179 (86.05%)	275 (88.14%)	0.51 [0.21-1.12]	
Often/Always	08 (07.69%)	29 (13.95%)	37 (11.86%)	1	
Cleaning/disinfection of objects or surfaces at home					0.122
Never	38 (36.54%)	101 (48.56%)	139 (44.55%)	0.67 [0.31-1.42]	
One to six times a week	52 (50%)	82 (39.42%)	134 (42.95%)	1.13 [0.54-2.37]	
Every day	14 (13.46%)	25 (12.02%)	39 (12.50%)	1	
Cleaning and disinfection of objects or surfaces at the workplace					0.250
Never	35 (37.23%)	80 (40.03%)	115 (39.89%)	0.68 [0.38-1.21]	
One to three times a week	23 (24.47%)	59 (30.25%)	82 (28.37%)	0.60 [0.32-1.15]	
Every day	36 (38.30%)	56 (28.72%)	92 (31.83%)	1	
OR: Odds Ratio ; CI _{95%} : 95% Confidence Interval.					

Table 4: Correlation between knowledge and wearing mask practices toward COVID-19 among participants

Practices	Knowledge r_s^* (p-value)						
	Mode of transmission	Symptoms	Persons at risk	Incubation Period	Existence of asymptomatic carriers	COVID-19 transmission through asymptomatic people	Protectives Measures
Wearing of face mask at home in the presence of others	0,117 (0,040)	0,142 (0,012)	0,011 (0,848)	-0,147 (0,009)	0,049 (0,386)	-0,001 (0,979)	0,152 (0,007)
Wearing a mask on the street	0,118 (0,037)	0,111 (0,051)	0,009 (0,880)	-0,046 (0,421)	0,142 (0,012)	-0,016 (0,779)	0,060 (0,720)
Wearing a mask in individual transport	0,248 (0,009)	0,256 (0,007)	0,277 (0,017)	0,145 (0,132)	0,143 (0,135)	0,064 (0,506)	0,122 (0,204)
Wearing a mask in the public transportation	-0,013 (0,858)	-0,029 (0,697)	-0,119 (0,103)	0,009 (0,907)	0,138 (0,058)	0,010 (0,895)	-0,105 (0,153)
Wearing a masks in the main workplace in the presence of others	0,137 (0,020)	0,192 (0,001)	0,137 (0,020)	0,102 (0,083)	0,282 (0,000)	0,098 (0,095)	0,113 (0,055)
Wearing a mask in a public place in the presence of others	0,133 (0,019)	0,158 (0,005)	0,040 (0,487)	0,062 (0,280)	0,124 (0,028)	-0,083 (0,147)	0,019 (0,735)
Lowering the mask at chin or neck level	-0,136 (0,016)	-0,115 (0,043)	-0,019 (0,739)	-0,032 (0,574)	-0,026 (0,642)	0,041 (0,469)	-0,011 (0,845)

Table 5: Correlation between knowledge and hygiene practices toward COVID-19 among participants

Practices	Knowledge r_s^* (p-value)									
	Mode of transmission	Symptoms	Persons at risk	Incubation Period	Existence of asymptomatic carriers	COVID-19 transmission through asymptomatic carriers	Protectives Measures			
Hand hygiene before entering public places	-0,084 (0,136)	0,003 (0,954)	0,017 (0,762)	0,214 (0,000)	0,075 (0,189)	0,118 (0,038)	0,045 (0,424)			
Hand hygiene when leaving a public place	0,118 (0,037)	0,198 (0,000)	0,119 (0,036)	-0,015 (0,793)	0,158 (0,005)	0,004 (0,942)	0,184 (0,001)			
Hand hygiene after returning at home	0,161 (0,004)	0,150 (0,008)	0,089 (0,118)	0,072 (0,204)	0,209 (0,000)	0,056 (0,323)	0,127 (0,024)			
Hand hygiene after touching non-disinfected objects or surfaces	0,240 (0,000)	0,262 (0,000)	0,201 (0,000)	0,070 (0,215)	0,207 (0,000)	0,100 (0,078)	0,106 (0,061)			
Cleaning/disinfection of objects or surfaces at home	0,041 (0,467)	0,029 (0,614)	0,008 (0,885)	-0,041 (0,476)	0,042 (0,460)	-0,129 (0,023)	0,015 (0,788)			
Cleaning and disinfection of objects or surfaces at the workplace	0,123 (0,036)	-0,011 (0,847)	0,094 (0,111)	0,131 (0,025)	0,088 (0,136)	-0,004 (0,941)	-0,030 (0,614)			
Give a handshake to others	0,151 (0,008)	0,021 (0,714)	0,019 (0,740)	0,008 (0,891)	-0,038 (0,500)	0,036 (0,530)	0,043 (0,446)			

Some authors reported in their studies that the most commonly listed modes of transmission were direct contacts such as handshaking (94.3%), respiratory droplets (52.1%), and indirect contact with contaminated inanimate objects (33.3%)⁸. This study showed that overall, both controls and cases had low levels of knowledge about COVID-19 symptoms. The most known symptoms were cough (67.31% of cases and 79.81% of controls) and fever (59.62% of cases and 74.52% of controls). In contrast, few respondents (22.12% of cases and 18.27% of controls) reported diarrhea as symptoms of COVID-19. According to Gheorghe et al¹¹, the poor knowledge about diarrhea as a manifestation of COVID-19 is potentially dangerous, as it was shown that these people shed the virus for about 6 weeks, i.e. longer than those with airway symptoms. The study of Adesegun et al¹² showed that the most common symptoms that the population knew were difficulties in breathing (96.9%), dry cough (96%), and fever (93%), with much fewer respondents being aware of gastrointestinal symptoms like vomiting (17.8%) and diarrhea (19.2%). Similar results were also seen in another study where the more listed symptoms were cough (93.6%), breathing difficulties (75.4%) and fever (74.4%)¹³. In the current study, the incubation period was more known by controls (61.54%) than cases (35.38%) interviewees. This difference may indicate limited access to credible and timely information about the virus². Other cross-sectional surveys conducted in India and China reported 72% and 66.40% correct responses about the incubation period, respectively^{4,14}.

Most of the cases (65.38%) and controls (75.96%) reported elderly people as people at risk. This could be explained by the higher mortality observed in these groups, which has been reported in the media. About half of the respondents felt that only elderly individuals with comorbidities go on to develop severe disease¹². It's interesting to note that only 1.92% of cases and 3.84% of controls knew about the fact that the pregnant women were people at risk. This variation in the level of knowledge may be reflective of the current COVID-19 information landscape in the country². Our study also revealed that most respondents were aware of the major preventive strategies for COVID-19, particularly handwashing with soap and water (87.5% among cases and 90.87% among controls) and wearing a mask when social distancing is not possible (78.85% among cases and 79.81% among controls). Moreover, 78.85% of cases and 85.58% of controls knew about the fact that asymptomatic people can transmit the disease. According to Adesegun et al¹², about 86.4% of the respondents reported that COVID-19 transmission occurred through asymptomatic carriers. Several studies carried out in Asian countries have indicated high levels of COVID-19 knowledge among the general population and healthcare workers^{4,15}. The higher proportion of knowledge among Asian populations would probably attributable to the fact that they are the first populations affected by the epidemic and have been exposed to health information for longer.

Regarding practice, more than half both in cases and controls, participants indicated that they wore cloth

masks. Chughtai et al¹⁶ claimed that in community settings, cloth masks may be used to prevent the spread of infections by sick or asymptotically infected persons, and the public should be educated about their correct use. It is important to mention that only 27.88% of cases and 17.61% of controls often or always wear a face mask at home in the presence of others. However, the vast majority of cases (89.32%) and controls (96.15%) often or always wore a mask in a public place in the presence of other persons. Moreover, most of them often or always wear a face mask in the main workplace (78.14%) and on the street (88.78%). Most cases (70.19%) and controls (83.65%) observed the social distancing at least one meter. According to Rahman and Sathi¹⁷, the majority of respondents wore a face mask (91.4%) and kept a safe physical distance when outdoors (87.1%). Considering hand washing as a major preventive measure, up to 85% often or always washed their hands before entering public places in the presence of others. This result is consistent with other reports¹². Ferdous et al¹⁸, reported that actions such as hand washing after coming from outside can play an important role in COVID-19 prevention. Globally, there was no difference in knowledge and practice rate among the study groups (cases and controls). However, preventive practices have to be reinforced and control strategies should be enhanced.

The sufficient knowledge on protective measures (OR = 2.98, CI 95% [1.16-7.67], $p = 0.022$) and incubation period (OR = 2.89, CI 95% [1.77-4.72], $p = 0.029$) of COVID-19 were significantly associated with COVID-19 health status of respondents. Interestingly, the wearing of a face mask in a public place in the presence of others was significantly related to COVID-19 health status. Therefore, it would benefit from being reinforced with other less respected measures such as avoiding handshaking with others and crowded places. Although significant efforts are still needed to achieve a very good level of compliance, communication with prevention measures seems to have a positive impact.

This study found that knowledge on COVID-19 transmission mode was positively and significantly correlated with wearing a mask when going outside (in a public place in the presence of others) and at home. A study in Bangladesh reported a similar association between knowledge and the wearing of masks¹⁷. Although some negative correlations were found, knowledge on the modes of transmission of COVID-19 and its symptoms, the incubation period of COVID-19, protective measures, and the existence of asymptomatic carriers were overall, significantly and positively correlated with protective measures regarding the wearing of masks, hand hygiene and cleaning/disinfection of objects or surfaces at home or work. In addition, lowering the mask to the chin or neck level was positively influenced by less knowledge of the modes of transmission of COVID-19. This confirms the importance of communication concerning COVID-19 to improve compliance with protective measures and limit risk actions. Several studies reported the same findings about the correlation between knowledge and practice of COVID-19^{16,19}.

This survey had some limitations. Firstly, it followed a cross-sectional study design, therefore, causal inferences may not be established. Secondly, compared with face-to-face interviews, self-reporting has limitations. Thus, participants might have answered knowledge and practice questions positively based on what they perceive to be expected of them². A further limitation of the current study is the possibility of participants giving socially desirable responses. At the design stage of the study, no information was available on the incidence or prevalence of COVID-19 in Benin. The screening was done on a very limited part of the population. Thus a non-probabilistic sampling method was used. Therefore, the participants surveyed may not be representative of Benin. Future studies could overcome this limit.

CONCLUSION

In summary, highlighted that both case and control respondents had moderate knowledge and practice on COVID-19 preventive measures and symptoms. Overall, there was no difference in knowledge and practice between cases and controls. However, controls had better knowledge than the cases in terms of the incubation period and protective measures. Controls had also better practice about wearing masks in a public place. Thus, it is important to implement massive education campaigns. That would increase population knowledge about COVID-19 and promote the adoption of protective measures to stop its spread in Benin.

Conflict of Interest

The authors declare no conflict of interests.

Funding

This study was supported by the Macky SALL Research Fund of the African and Malagasy Council for Higher Education: 2020-2022 (<https://www.lecames.org/>). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors' Contribution

Nonvignon Marius Kêdoté: Conceptualization; Data curation; Formal analysis; Funding acquisition; Methodology; Project administration; Resources; Supervision; Validation; Review & Editing. **Aymeric Joaquin Darboux:** Conceptualization; Data curation; Methodology; Project administration; Validation; Formal analysis; Software; Supervision; Original draft; Review & Editing. **Sonagnon Claude-Gervais Assogba:** Conceptualization; Methodology; Validation; Supervision & Review. **Roch Houngnihin:** Conceptualization; Methodology; Validation; Supervision & Review. **Ange Dossou:** Conceptualization; Methodology; Validation ; Supervision & Review. **Essé Agossou:** Conceptualization; Methodology; Validation; Supervision & Review. **Luc Salako Djogbénu:** Conceptualization; Funding acquisition; Methodology; Validation & Review. **Fatou Bintou Sarr:** Conceptualization; Funding acquisition; Methodology; Validation & Review. **Jacques François Mavoungou:**

Conceptualization; Funding acquisition; Methodology; Validation & Review.

Acknowledgments

The authors would like to thank the Ministry of Health in Benin, the health area coordinator involved in the study planning, the staff of screening and treatment sites for their support, and the participants for their great collaboration for the success of this study.

REFERENCES

1. Angelo AT, Alemayehu DS, Dacho AM. Knowledge, Attitudes, and Practices Toward Covid-19 and Associated Factors Among University Students in Mizan Tepi University. *Infect Drug Resist.* 2021;14:349–60.
2. Azln AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices toward COVID-19: A cross-sectional study in Malaysia. *PLoS ONE.* 2020;15(5):e0233668.
3. Ngwewondo A, Nkengazong L, Ambe LA, Ebogo JT, Mba FM, Goni HO, et al. Knowledge, attitudes, practices of/toward COVID 19 preventive measures and symptoms: A crosssectional study during the exponential rise of the outbreak in Cameroon. *PLoS Negl Trop Dis.* 2020;14(9):e0008700.
4. Zhong BL, Luo W, Li HM, Zhang Q-Q, Liu XG, Li WT, et al. Knowledge, attitudes, and practices toward COVID-19 among chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online crosssectional survey. *Int J Biol Sci.* 2020;16(10):1745-52.
5. Alnasser AHA, Al-Tawfiq JA, Al-Kalif MSH, Shahadah RFB, Almuqati KSA, Al-Sulaiman BSA, et al. Public Knowledge, Attitudes, and Practice toward COVID-19 Pandemic in Saudi Arabia: A Web-Based Cross-Sectional Survey. *Med Sci.* 2021;9(1).
6. Okello G, Izudi J, Teguzirigwa S, Kakinda A, Van Hal G. Findings of a Cross-Sectional Survey on Knowledge, Attitudes, and Practices about COVID-19 in Uganda: Implications for Public Health Prevention and Control Measures. *Biomed Res Int.* 2020; 2020:ID 5917378.
7. Informations coronavirus (COVID-19). <https://www.gouv.bj/coronavirus/>. Accessed 09 June 2021.
8. Alemu T, Amare S, Legesse S, Abera A, [Ayalew M](#), Bezabih B. COVID-19 Knowledge, Attitude, Practices and Their Associated Factors Among Dessie City Residents, Northeast Ethiopia: A Cross-Sectional Study. *Risk Manag Health Policy.* 2021;14(1):439–51.
9. Roy D, Tripathy S, Kar SK, [Sharma N](#), [Verma SK](#), [Kaushal V](#). Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian J Psychiatr.* 2020;51:102083.
10. Reuben RC, Danladi M, Saleh DA, Ejembi PE. Knowledge, Attitudes and Practices Toward COVID-19: An Epidemiological Survey in North-Central Nigeria. *J Community Health.* 2021;46(3):457-70.
11. Gheorghe AS, Negru ȘM, Nițpir C, Mazilu L, Marinca M, Gafton B, et al. Knowledge, attitudes and practices related to the COVID-19 outbreak among Romanian adults with cancer: a cross-sectional national survey. *ESMO Open.* 2021;6(1):100027.
12. Adesegun OA, Binuyo T, Adeyemi O, [Ehioghae O](#), [Rabor DF](#), [Amusan O](#), et al. The COVID-19 Crisis in Sub-Saharan Africa: Knowledge, Attitudes, and Practices of the Nigerian Public. *Am J Trop Med Hyg.* 2020;103(5):1997-2004.
13. Choffor-Nchinda E, Atanga LC, Fokouo Fogha JV, Nyada FB, Me-Meke GP. COVID-19 knowledge, attitude and practice one year after in Cameroon. *Health Sci Dis.* 2021;22(7):52-7.

14. Gohela KH, Patela PB, Shah PM, [Patel JR](#), [Pandit N](#), [Raut A](#). Knowledge and perceptions about COVID-19 among the medical and allied health science students in India : An online cross-sectional survey. [Clin Epidemiol Glob Health](#). 2021;9(1):104–9.
15. Giao H, Nguyen TNH, Tran VK, [Vo KN](#), [Vo VT](#), [Pham LA](#). Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. *Asian Pac J Trop Med*. 2020;6(13):260-5.
16. Chughtai A, Seale H, Macintyre CR. Effectiveness of Cloth Masks for Protection Against Severe Acute Respiratory Syndrome Coronavirus 2. *Emerg Infect Dis*. 2020;26(10):1-5.
17. Rahman A, Sathi NJ. Knowledge, Attitude, and Preventive Practices toward COVID-19 among Bangladeshi Internet Users. *Electron J Gen Med*. 2020;17(5):em245.
18. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia JA, Gozal D. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh : An online-based cross-sectional study. *PLoS ONE*. 2020;15(10):e0239254.
19. Al ahdab SA. cross-sectional survey of knowledge, attitude and practice (KAP) toward COVID-19 pandemic among the Syrian residents. *BMC Public Health*. 2021;21(296):2-7.