



## Association between availability of PPE, training, and policy on universal precautions and their application in primary health facilities in Umuahia, Nigeria

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### Abstract

**Background/ Objective:** Universal precautions are a major component of infectious disease control in any health facility. The main objective of this study is to determine the association between the availability of personal protective equipment, the training of health workers, and the existence of policies on universal precautions among health workers in Umuahia North and Umuahia South Local Government Areas (LGAs) of Abia State, Nigeria.

**Methods:** A descriptive cross-sectional research design among 300 randomly selected health workers from 12 randomly selected health facilities in the two research LGAs. The research instruments were structured questionnaires. Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 25. Frequency tables were used for descriptive statistics, while logistic regression was used for the inferential statistics.

**Results:** In terms of exposure to training on universal precaution, the study found out that those who had training once did not make much use of universal precaution (AOR 0.92,  $p = 0.001$ ), but with twice or more training, the health workers made more use of universal precaution (AOR = 1.04,  $p = 0.050$ ). Policies on universal precautions were available in all the assessed facilities. Participants who had hand gloves available were more likely to use them than those that did not have them available (AOR = 2.05,  $p = 0.03$ ). Those who had antiseptics and running water were more likely to use them than those who did not (AOR = 2.39,  $p = 0.001$ ). Those who have universal precaution policies in their facilities were more likely to apply universal precautions than those who did not (AOR = 2.94,  $p = 0.002$ ).

**Conclusion:** It is concluded that health workers will apply universal precautions while carrying out their duties if they have personal protective equipment, antiseptics, running water, adequate training, and a sound policy in place.

**Keywords:** Universal precaution, infection control, health workers, personal protective equipment training, policy availability, health facilities

### Introduction

#### Background to the Study

Universal precautions are initial infection control measures brought out by the Centers for Disease Control and Prevention in 1985 to prevent transmission of bloodborne pathogens such as HIV and hepatitis B. These precautions necessitate that all blood and certain body fluids should be treated as potentially infectious, regardless of patient history or perceived risk. (Kopitnik & Kahwaji 2025).

Universal precautions are used in situations where there is a potential risk for exposure to blood and certain body fluids. It lays emphasis on the use of protective barriers, such as gloves, masks, and gowns, and the safe handling of sharp and contaminated materials to prevent the transmission of bloodborne pathogens. In contrast with body substance isolation or standard precautions, which were developed later to include a broader range of pathogens, universal precautions focus specifically on bloodborne exposures (Kopitnik & Kahwaji 2025).

Guidelines to enhance the safety of healthcare workers (HCWs) have been in place since the late 1970s and early 1980s to help reduce the rate at which HCWs are exposed to blood, fluids, needles and other sharp objects. Universal precaution, which is now regarded as standard precaution,

serves as the minimum infection prevention practice that applies to all patient care, regardless of the suspected or confirmed infection status of the patient, in any setting where healthcare is delivered (WHO, 2020).

Universal precautions in healthcare are recommended for healthcare workers, who rely on them to protect themselves and their patients from being infected and infecting others. However, the successful implementation of these strategies depends on the knowledge and attitudes of healthcare workers (HCWs). Some HCWs demonstrate limited knowledge of potential pathways of occupational exposure, such as the use of PPE and handwashing routines, which are standard precautions.

Despite the importance of the application of universal precaution by health workers to quality healthcare delivery, reports, including the World Health Organization (2020), revealed that shortages of personal protective equipment (PPE) are leaving health workers dangerously ill-equipped to care for patients due to limited access to supplies such as gloves, medical masks, respirators, goggles, face shields, gowns and aprons. It is no gainsaying that the shortage of personal protective equipment in health facilities globally and specifically in developing nations has been identified as one of the challenges faced by HCWs. It is also pointed out that poor availability of universal precaution facilities in

developing nations is responsible for the rising cases of occupational infections among healthcare professionals and accidental transmission of these infections to their patients, with such examples as COVID-19, Human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and other infectious diseases (WHO, 2020).

The Nigerian government, through the Federal Ministry of Health, has made efforts to equip the health sector by providing basic facilities such as pipe-borne water, ICT facilities and personal protective equipment (Mairafi, 2020) [33]. These facilities are provided for tertiary health facilities (teaching hospitals and federal medical centres) and some secondary health facilities (general hospitals), while most primary health care facilities suffer neglect due to shortages of personal protective equipment and infrastructure, such as running water. As a result, most health professionals run the risk of contracting infectious diseases themselves or spreading them to their patients and others.

## Methods

### 1. Research Design and Study Area

The study design is a descriptive cross-sectional study. Umuahia is the capital of Abia State in southeast Nigeria, and it has two local governments – Umuahia North and South Local Government Areas (LGAs). It is made up of five traditional clans, namely Ibeku, Ohuhu, Olokoru, Ubakala and Umuokpara. The 2006 national census put the population of Umuahia at 389,120. The inhabitants are mostly civil servants, traders, farmers, artisans, and students. The main religion of practice is Christianity, comprising various denominations from Orthodox to Pentecostals. There are also some Muslims and Traditionalists. There are 87 primary health centres and 63 private hospitals in the area, in addition to one secondary and two tertiary health facilities.

### 2. Study population

The study population included all health workers who worked at the selected primary healthcare centres. Inclusion criteria included all health workers who worked in the selected health facilities and were willing to participate in the study. Exclusion criteria include individuals not directly involved in the patient's care, even if they worked in a health centre, and those unwilling to participate in the study.

### 3. Sampling Technique

A multistage random sampling technique was used. At the first stage, a simple random sampling technique, using a lucky dip, was used to select six health centres from each

local government. Then a headcount report was generated from the health center's administrative department, and subsequently the systematic random sampling technique was used in the distribution of questionnaires to all health workers working at the selected centres.

## 4. Instrument

A structured questionnaire comprising section A (demographic characteristics of respondents), section B (knowledge and practice), section C (questions on availability of protective equipment) and section D (availability of policy on universal precaution).

## 5. Data Analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 25. Frequency tables and mean were used for descriptive statistics, while logistic regression was used for the inferential statistics.

## Results

### 1. Application of universal precaution and availability of personal protective equipment, training of health workers on the use of universal precaution and availability of policy on universal precaution

Table 1 presents the logistic regression analysis of the application of universal precaution and availability of personal protective equipment, training of health workers on the use of universal precaution and availability of policy on universal precaution. It was observed from the table that the availability of personal protective equipment, such as gloves (AOR 2.05;  $p = 0.03$ ), face masks (AOR 0.94;  $p = 0.001$ ), antiseptic/sterilizers (AOR 2.05;  $p = 0.002$ ), and running water (AOR 2.39;  $p = 0.001$ ), influenced the application of universal precaution. Additionally, the availability of gowns appears to have decreased the use of universal precautions due to the AOR being less than 0.96. Availability of goggles (AOR 1.60;  $p = 0.650$ ) did not influence the application of universal precaution by health workers.

### 2. Influence of training on the use of universal precaution

Table 2 shows variable results of the influence of training on the use of universal precautions. Individuals without training on universal precautions use them more frequently than those who have received training (AOR=2.12,  $p=0.010$ ), while individuals who have had training once or three times are less likely to use universal precautions (AOR=0.92,  $p=0.001$ , and AOR=0.89,  $p=0.002$ , respectively). Those who had training more than twice and more than three times used more universal precautions (AOR = 1.04,  $p = 0.050$  and AOR = 2.04,  $p = 0.006$ , respectively).

**Table 1:** Association of the application of universal precaution with availability of personal protective equipment

| Variable (N=300)                                               | Yes | No  | COR(95% CI)     | AOR(95% CI)     | p-value |
|----------------------------------------------------------------|-----|-----|-----------------|-----------------|---------|
| Availability of personal protective equipment                  |     |     |                 |                 |         |
| Each health worker has gloves for every procedure              | 296 | 4   | 2.65(1.80-3.95] | 2.05(1.54-2.83) | 0.003   |
| Each health worker has a face mask for every procedure         | 277 | 23  | 1.45(1.04-2.07) | 0.94(0.63-1.52) | 0.001   |
| Availability of goggles for every procedure that requires them | 152 | 148 | 1.15(0.96-1.23) | 1.06(0.82-1.43) | 0.650   |
|                                                                | 168 | 132 | 1.17(0.91-1.53) | 0.96(0.71-1.29) | 0.008   |
| Availability of gowns for every procedure that requires them   | 283 |     | 2.68(1.85-3.98) | 2.05(1.56-2.85) | 0.002   |
|                                                                | 298 | 17  | 4.15(2.13-7.17) | 2.39(1.02-5.73) | 0.001   |

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval

**Table 2:** Association of the application of universal precaution with training of health workers on the use of universal precaution

| Variable (N=300)                                                                        | Yes | No  | COR(95% CI)     | AOR(95% CI)     | p-value |
|-----------------------------------------------------------------------------------------|-----|-----|-----------------|-----------------|---------|
| Frequency of attendance to training on use of universal precautions in the past 3 years |     |     |                 |                 |         |
| None                                                                                    | 28  | 272 | 2.15(1.20-2.75) | 2.12(1.42-2.80) | 0.010   |
| Once                                                                                    | 160 | 140 | 1.41(1.14-2.05) | 0.92(0.78-1.85) | 0.001   |
| Twice                                                                                   | 189 | 111 | 1.05(0.97-1.43) | 1.04(0.80-1.48) | 0.050   |
| Thrice                                                                                  | 274 | 26  | 1.08(0.91-1.78) | 0.89(0.69-1.32) | 0.002   |
| More than thrice                                                                        | 289 | 11  | 2.45(1.75-3.87) | 2.04(1.58-2.89) | 0.006   |

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval

### 3. Availability of policies on the use of universal precautions

Table 3 shows that the availability of policies regarding the use of universal precautions (AOR = 2.94; p = 0.002) significantly influenced their application in health centres.

**Table 3:** Association of the application of universal precaution with the availability of policy on universal precaution

| Variables (N=300)                                | Yes | No | COR(95% CI)     | AOR(95% CI)     | p-value |
|--------------------------------------------------|-----|----|-----------------|-----------------|---------|
| Availability of policies on universal precaution | 298 | 2  | 2.35(1.94-4.87) | 2.94(2.62-4.43) | 0.002   |

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval

## Discussion

### 1. Association of the application of universal precaution with availability of personal protective equipment

The study indicates that health workers are twice as likely to use universal precautions when gloves are available (AOR = 2.05, p = 0.003) and more than twice as likely to use universal precautions when there is running water and disinfectant, which are essential for maintaining hygiene and preventing infection (AOR = 2.39, p = 0.001). However, the availability of goggles had no effect on the use of universal precautions (AOR = 1.06, p = 0.650), while the availability of gowns caused them to use less of the universal precautions (AOR = 0.96, p = 0.008). A study carried out by Wakagari *et al.* (2021) stated that the independent predictors of the respondents' satisfaction level about personal protective equipment were health workers who reported that PPE was adequately available in the hospital (adjusted OR=7.65, 95% CI: 5.09-11.51).

Therefore, the null hypothesis, which states that there is no statistically significant association between the application of universal precaution by the health workers and the availability of personal protective equipment, is hereby rejected, while the alternate hypothesis, which states that there is a statistically significant association between the application of universal precaution by the health workers and the availability of personal protective equipment, is hereby accepted.

### 2. Association of the application of universal precaution with training of health workers on the use of universal precaution

The study showed a significant association between the training of health workers on the use of universal precautions and the application of universal precautions. Findings from the study showed the variable influence of training on the use of universal precautions. Individuals without training on universal precautions used them more frequently than those who had received training (AOR=2.12, p=0.010); however, those who had training once or thrice were less inclined to use universal precautions (AOR=0.92, p=0.001, and AOR=0.89, p=0.002, respectively), suggesting that the effectiveness of training may diminish over time or that the training provided was

insufficient to encourage consistent use of these precautions. Those who had training more than twice and more than thrice used more universal precautions (AOR=1.04, p=0.050 and AOR=2.04, p=0.006, respectively). This showed that frequency of training influenced the use of universal precautions. This is similar to the work by Haile *et al.* (2017) [23], which states that compliance with personal protective equipment usage is correlated to years of experience and training. Lack of training is known to diminish compliance with personal protective equipment usage. (Lakshmi *et al.*, 2018).

Therefore, the null hypothesis, which states that there is no statistically significant association between the application of universal precaution by health workers and their training for the use of universal precaution, is rejected, while the alternate hypothesis, which states that there is a statistically significant association between the application of universal precaution by health workers and their training for the use of universal precaution, is hereby accepted.

### 3. Association of the application of universal precaution with availability of policy on universal precaution

The study showed a statistically significant association between the availability of policy on universal precaution and the application of universal precaution (AOR=2.94, p=0.002). Having a standard policy on the application of universal precautions among health workers enhances its use, thereby reducing their chances of contracting healthcare-related infections. This finding corroborates with the finding of Yilma *et al.* (2024) that found out that consistent implementation of universal precaution policies significantly reduced healthcare-associated infections and protects patients in healthcare settings.

Therefore, the null hypothesis, which states that there is no statistically significant association between the application of universal precaution by health workers and the availability of policy on universal precaution, is rejected, while the alternate hypothesis, which states that there is a statistically significant association between the application of universal precaution by health workers and the availability of policy on universal precaution, is hereby accepted.

## Conclusion and Recommendation

### Conclusion

Universal precaution is a major component of infectious disease control in any health facility. It is necessary for the protection of health workers and patients, but its use can be affected by factors such as the availability of personal protective equipment, the training of health workers on the use of universal precautions and the availability of policy on universal precautions. These factors have been shown to be significantly associated with improved compliance and the application of universal precautions among health workers in Umuahia's North and South local governments. The study therefore concludes that using universal precautions is necessary to protect health workers and patients and to encourage their use. Secondly, there is a need to put the mentioned factors into consideration while planning or implementing universal precautions in health facilities.

### Recommendations

1. Adequate equipment for universal precautions, such as protective eyewear, footwear, impervious gowns, and face masks, should always be made available to health workers to protect the health worker and the patient.
2. All health facilities should make relevant policies available for health workers, because this will promote their use of such policies.
3. The study showed that training for health workers had a significant influence on the use and application of universal precautions, so there is a need to train more health workers to improve their use.

### Limitation of the Study

A potential limitation is recall bias, as participants retrospectively reported their practices and training attendance regarding universal precautions. This may have resulted in misclassification of the outcome or exposures, potentially attenuating the observed associations.

### Declarations

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**Author contributions:** All authors contributed significantly to this work. CK: Conceptualization, methodology, investigation (data collection), formal analysis (initial data processing), writing the original draft, and project administration. OKI: Conceptualization, methodology, validation, supervision, formal analysis, writing, review and editing, and visualization. UUE: Conceptualization, methodology, supervision, formal analysis, writing, review and editing. All authors wrote, read and approved the final manuscript. All authors approved the final version of the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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### References

1. Adebamowo CA, Ezeome ER, Ajuwon JA, Ogundiran TO. Survey of the knowledge, attitude and practice of Nigerian surgery trainees to HIV-infected persons and AIDS patients. *BMC Surgery*,2002;2:7 doi: 10.1186/1471-2482-2-7.
2. Adebimpe WO, Asekun-Olarinmoye EO, Bamidele JO, Abodunrin O, Olowu AA. Comparative study of awareness and attitude to nosocomial infections among levels of health care workers in southwestern Nigeria. *Continental Journal of Tropical Medicine*,2011;5(2):5-10.
3. Abdulraheem IS, Olapipo AR, Amodu MO. Primary Health Care Services In Nigeria: Critical Issues and Strategies for enhancing the Use by the Rural Communities. *Journal of Public Health and Epidemiology*,2012;4(1):5-13. ISSN: 2141-2316.
4. Agu PU, Ogboi SJ, Ezugwu EC, Okeke TC, Aniebue PN. The knowledge, attitude, and practice of universal precaution among rural primary health care workers in Enugu South East Nigeria. *World J Pharm Pharm Sci*,2015;4(9):109-25.
5. Agu PU, Ogboi SJ, Ezugwu EC, Okeke TC, Aniebue PN. the Knowledge, Attitude, And Practice of Universal Precaution among Rural Primary Health Care Workers in Enugu Southeast Nigeria *World Journal of Pharmacy and Pharmaceutical Sciences*, 2015, 4(09). ISSN 2278 – 4357.
6. Akagbo SE, Nortey P, Ackumey MM. Knowledge of standard precautions and barriers to compliance among healthcare workers in the Lower Manya Krobo District, Ghana. *BioMed Central Research Notes*, 2017. doi: 10.1186/s13104-017-2748-9.
7. Akeem BO, Abimbola A, Idowu AC. Needle stick injury, pattern among health workers in primary health care facilities in Ilorin, Nigeria. *Academic Research International*,2011;1(3):419427.
8. Akinboro AA, Adejumo PO, Onibokun AO, Olowokere AA. Community Health care workers' risk perception of occupational exposure to HIV in Ibadan, South-west Nigeria *African Journal of Primary Health Care and Family Medicine*,2012;4(1):1–9.
9. Alaku DD, Stephen Y. The Role of Information and Communication Technology in Combating Medical Errors in Jos University Teaching Hospital, Plateau State. *Kaduna Journal of Humanities*,2017;1(3):402-425.
10. Amoran OO, Onwube OE. Infection control and practice of standard precautions among healthcare workers in northern Nigeria. *J Glob Infect Dis*,2013;5:156e63.

11. Amoran OE, Onwube OO. Infection Control and Practice of Standard Precautions among Healthcare Workers in Northern Nigeria. *Journal of Global Infection Disease*,2013;5(4):156-163.
12. Askarian M, Memish ZA, Khan AA. Knowledge, Practice, and Attitude among Iranian Nurses, Midwives and Students Regarding Standard Isolation Precaution. *Infection Control and Hospital Epidemiology*,2007;28(2):284-289.
13. Bamigboye AP, Adesanya AT. Knowledge and practice of universal precautions amongst qualifying medical and nursing students: A case of Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife. *Research J. Of Med And Med Sciences*,2006;1(3):112-116.
14. Bamigboye AP, Adesanya AT. Knowledge and practice of universal precautions among qualifying medical and nursing students: a case of Obafemi Awolowo University Teaching Hospital complex, Ile Ife. *Research Journal of Medical Science*,2006;1(3):112-116.
15. Beltremi EM, Williams IT, Shapiro CN, Chamberland ME. Risk and Management of Blood borne Infections in Health Care Workers. *Clinical Microbiological Review*,2000;13(3):385-407.
16. Diwe CK, Chineke HN. Prevalence of Needle Stick Injuries among Health Care Workers in Imo State University Teaching Hospital, Orlu, South East Nigeria. *Nigerian Journal of Family Practice*,2013;4(2):23-30.
17. Ekwere TA, Okafor IP. Hand hygiene knowledge and practices among healthcare providers in a tertiary hospital, South West Nigeria. *International Journal of Infection Control*, 2013. doi: 10.3396/IJIC.v9i4.032.13.
18. Federal Ministry of Health. National Strategic Health Development Plan (NSHDP) 2010-2015, 2010.
19. Federal Ministry of Health. National Health ICT Strategic Framework 2015-2020, 2015.
20. Fichman RG, Rajiv K, Ranjani K. The Role of Information System in Healthcare: Current Research and Future Trends. *Information System Research*, 2011;22(3):419-428. ISSN: 1047-7047.
21. Gordon M, Afayo R. Adherence to universal precautions in infection prevention among health workers in Kabarole District. *J Health Med Nurs*,2016;26:144-55.
22. Gyong JE. the Imperative of Research to the Success of Nursing and Midwifery Education and Practice in Nigeria. *The Zaria Sociological Journal*,2013, 2(1). ISSN 2360-8552.
23. Haile TG, Engeda EH, Abido AA. Compliance with standard precautions and associated factors among healthcare workers in Gondar University comprehensive specialized Hospital, Northwest Ethiopia. *Env Public Health*, 2017.
24. Ibeziako SN, Ibekwe RC. Knowledge and practice of universal precaution in a tertiary health facility. *Nigerian Journal of Medicine*,2006;15:250–254.
25. Idowu P, Cornford D, Bastin L. Health Informatics Deployment in Nigeria. *Journal of Health Informatics in Developing Countries*,2008;2:15-23. <http://www.jhdc.org/index.php/jhdc/issue/view/4>.
26. Isah HO, Sabitu K, Ibrahim MTO. Profile of institutional infrastructure for Implementing universal precaution in primary health care facilities in Sokoto State, Nigeria: Implication for occupational safety. *African J of CliSSn and Exp Microbiology*,2009;5:164-174.
27. Janjua NZ, Razaq M, Chandir S, Rozi S, Mahmood B. Poor knowledge – predictor of nonadherence to universal precautions for blood borne pathogens at first level care facilities in Pakistan. *BMC Infect Dis*,2007;7:81.
28. Johnson OE, Asuzu MC, Adebisi AO. Knowledge and practice of universal precautions among professionals in public and private health facilities in Uyo, Southern Nigeria- a comparative study. *Ibom Med J*,2012;5(1):9-19.
29. Karadag M. Occupational exposure to blood and body fluids among a group of Turkish nursing and midwifery students during clinical practice training: frequency of needle stick and sharp injuries. *Japan J Nurs*,2010;7(2):129-35.
30. Katowa P, Ngoma CM, Maimbolwas M. Compliance with infection prevention guidelines by healthcare workers at Ronald Ross General Hospital Mafulira district. *Medical Journal of Zambia*,2008;35(3):110-116.
31. Kelley E, Hurst J. Health Care Quality Indicators Project Conceptual Framework Paper Organization for Economic Co-operation and Development, 2006.
32. Kermode M, Jolley D, Langkham B, Thomas MS, Holmes W, Gifford SM. Compliance with Universal/Standard Precautions among Health Care workers in Rural North India *American Journal of Infection Control*,2015;33(1):27–33.
33. Mairafi DG. Public Health Implications of Malnutrition in Under-Five Children in Barkin Ladi LGA, Plateau State, Nigeria *OKADA Journal of Sociology*,2020;2(1):225-235.
34. Nicolini D, Powell J, Conville P, Martinez-Solano L. Managing Knowledge in Healthcare Sector: A Review. *International Journal of Management Reviews*,2008;10:245-263.
35. Nwoga HO, Ajuba M, Onwasigwe CN. Availability of infection control supplies in primary and tertiary government health facilities in Enugu Metropolis, Nigeria. *Niger Res J Clin Sci*,2019;9(1,2):43-52.
36. Nwoga HO, Ajuba MO, Ogugua I. Assessment of the knowledge, attitude and practice of standard precautions among healthcare workers in primary government health facilities in Enugu, South-East Nigeria. *Niger Res J Clin Sci*,2019;9(1,2):16-30.
37. Olorode OA, Oladunni OE. E-health in Biomedical- its Role and Challenges In Bayelsa State, Nigeria, Africa: Proceedings of the 1st International Technology, Education and Environment Conference, 2013.
38. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. Knowledge, attitude and practice of standard precaution of infection control by hospital workers in two tertiary hospitals in Nigeria. *J Infect Prevent*,2015;16(1):16-22.
39. Park SH. Personal protective equipment for healthcare workers during the Covid-19 Pandemic. *Infect Chemother*,2020;52(2):165-182.
40. Rampal L, Zakaria R, Sook LW, Zain AN. Needle stick and sharps injuries and factors associated among health care workers in a Malaysian hospital. *European Journal of Social Sciences*,2010;13(3):353-362.

41. Said HF, Michiyo H, Tomoya H, Mohammad ABS, Zakhro D, Nobuyuki H. Knowledge and practice of universal precautions among health care workers in four national hospitals in Kabul, Afghanistan *Journal of Infection in Developing Countries*,2014;4(8):535-542.
42. Tariku GH, Eshetu HE, Abdella AA. Compliance with standard precautions and associated factors among healthcare workers in Gondar University comprehensive specialized hospital, North-West Ethiopia. *J Environ Pub Health*, 2017.
43. Tobin EA, Asogun DA, Odia I, Ehidiemen G. Knowledge and practice of infection control among health care workers in a tertiary hospital in Edo State, Nigeria. *Direct Res J Health Pharmacol*,2013;1(2):20-7.
44. Wakgari D, Alemayehu W, Wondwossen A. Availability and use of personal protective equipment and satisfaction of healthcare professionals during Covid -19 pandemic in Addis Ababa Ethiopia. *Env Public Health*, 2021.
45. Williams CO, Campbell S, Henry K, Colleir P. Variables influencing worker compliance with universal precautions in the emergency department. *American Journal of Infection Control*,2014;22(3):138-148.
46. World Health Organization. *The Health of the People: What Works: the Africa Regional Health Report*, 2014.
47. World Health Organization. *Medication Errors: Technical Series on Safer Primary Care*, 2016. ISBN 978-92-4-151164-3.