Impact of Training of Health Workers on Pharmaceutical Wastes Management in Lagos State, Nigeria

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*Abstract-*The properties that make pharmaceuticals useful are probably the same properties that make them hazardous. Training for the proper and safe management of healthcare waste, including pharmaceutical and cytostatic waste in hospitals is of great importance for dealing properly with these types of hazardous healthcare waste. This training has to be in accordance with the legal framework and good practice guidelines on PWM. The major objective of this study is to assess the level of training received by health workers in Lagos State, Nigeria on pharmaceutical waste management. Majority of the respondents in this study were females, 68.4%. Over 42% of the respondents were seen in the most frequent age group of 31 – 40 years. Over 30% of the respondents work in general hospitals, 46.5% of respondents from the pharmacy unit and 43.4% of the respondents have been in service between 1 – 5 years. The highest level of PWM training was seen among the staff of comprehensive health centers, 36.7% while general hospitals and specialist hospitals recorded the least values of 28.6% and 13.5% respectively. It was discovered that nursing unit recorded the highest level of training with 32.9% followed by medical with 27.4%, pharmacy and environmental were in the third and fourth positions with 26.3% and 26.1% respectively while the laboratory department recorded 25%. It is therefore concluded that that intervention is needed both in the part of institutional management and government to embark on regular training of health workers across all health institutions in Lagos State.

Keywords: Medical waste, training, Healthcare workers, Environmental, hazards, Pharmaceutical Wastes

I. INTRODUCTION

Pollution from pharmaceuticals in the aquatic environment is now recognized as an environmental concern in many countries. This instigated researches on the chemical, identification, and quantification of pharmaceuticals; assessment of their transformation pathways in wastewater treatment plants or in other parts of the environment; evaluation of theirpossible biological activities; and formulation and the uses of advanced treatment processes for their removal [1]. Due to their special behavior that cannot be compared to other organic pollutants, pharmaceuticals are considered aspecial type of pollutants. Over the last decade, the scientific community has embraced research in this specific field and the outcome has been immense [1].

According to WHO [2] "guideline on Safe management of waste from healthcare activities" pharmaceutical waste includes expired, unused, spilled and contaminated pharmaceutical products, prescribed and proprietary drugs, vaccines and sera that are no longer required, and, due to their chemical or biological nature, need to be disposed of carefully[3]. The group also includes items discarded during the handling of pharmaceuticals, such as bottles, vials, and boxes containing pharmaceutical residues, gloves, masks and connectingtubing [4].

It is known that environments nowadays receive continuously mixtures of drugs on a global scale [4]. The most popular uses of drugs, among others, include human medicine, where they serve as tools for the treatment or prevention of various diseases, veterinary drugs or husbandry growth promoters with applications on many different aspects of agriculture. Pharmaceuticals include more than 4000 molecules with different physicochemical and biological properties and distinct modes of biochemical action [5], [6].

Pharmaceuticals have been reported to be present in wastewater, surface ground, and drinking water. More than 80 pharmaceuticals were detected in sewage, ground and surface water to the level of some µg/L and traces in drinking water in studies carried out in ten countries[7]. Pharmaceutical wastes from effluents have been found to have acute and chronic health risks. Behavioral changes, accumulation in tissues, reproductive damage, and inhibition of cell proliferation are some of the health risks [8].

Radhakrishna *et al.* [8] stated that around the world, thousands of tons of pharmaceuticals and health care products are used annually for diagnosis, treatment or prevention of health conditions. But what are to be done to the leftover/expired drugs of pharmaceuticals in homes and hospitals? A large number of pharmaceuticals in our water systems are been identifying around the world. The possible pathways that lead to the presence of pharmaceuticals include human excretion, veterinary excretion, agriculture uses, pharmaceutical company wastes and improper disposal of drugs. Among this, improper disposal of drugs is currently becoming one of the main gateways to the presence of pharmaceuticals in environmental waterways. A long term

exposure to these traces of pharmaceuticals has a hazardous effect on human especially on vulnerable populations, including pregnant women, newborn, and children. The most Common practice followed for disposal of drugs in hospitals and households is by environmentally unfriendly route like flush them down the toilet or throw them in the trash [9].

In hospitals where the production of pharmaceutical waste is unavoidable, hospital policies are to be put in place to ensure the safe segregation, handling, and disposal of waste and that all persons handling any such waste shall exercise care to avoid injury or risk of harm to themselves or others, including general public [10].

It is necessary to train healthcare personnel handling healthcare wastes for HCWM. After training, staffs become familiar with the main categories of healthcare waste and required procedures for their handling. As a minimum, managers responsible for healthcare waste system in hospital should conduct audit activities throughout the facility, to identify where these waste streams are produced, to obtain an initial estimate of the types and quantities of waste generated, and to assess how the waste is handled and disposed of. A rapid assessment, combining observations with interviews and survey questionnaires, provides sufficient data to identify problems and begin the process of addressing them[3]. All hospital staff is committed to the protection of human health and the environment [11].

In Nigeria, not many people are aware that pharmaceutical waste contributes substantially to environmental pollution and hazards. This is reflected by lack of awareness, training and specific policies to address the menace of pharmaceutical waste. objectives of this study are to identify the major methods used in tomanage pharmaceutical wastes in the health facilities in Lagos state, Nigeria and to assess the level of training of health workers on Pharmaceutical wastes management (PWM).

II. METHODOLOGY

A. Study area

Lagos is an administrative and commercial center of Nigeria, located in the Southwest of the country. It is the smallest in terms of land space, but the second most populous state and the most economically important state of the country, and also the second fastest growing city in Africa and the seventh fastest in the world. The population is an estimated 21 million (2011) which is 10 % of Nigeria's population, recently projected at 167 million by the National Population Commission. Lagos is a large metropolis. The social, economic, political and commercial reality of the nation finds their relevance in Lagos. No other city in Nigeria has the blend of all the attributes that are in Lagos. Lagos is ranked among the least liveable cities in the world. If on the average every inhabitant generates just 1 kg of refuse per day, it means that in a day we have 12 million kg (10,800 tons) and therefore, in a month, a volume 302,400 tons of refuse will be generated, including the pharmaceutical wastes.

According to Healthcare Facilities Monitoring and Accreditation Agency (HEFAMAA, 2016), an Agency of Lagos State Ministry of Health, there are registered: 26 General Hospitals, 256 Public Healthcare Centers

B. Study population

The target population of this survey consisted of selected 376 healthcare workers in all the health facilities. The healthcare workers for the purpose of this study are those who deal directly or indirectly with medicines.To be included in this study, the Healthcare Workers (HCWs) must be involved with the handling of pharmaceuticals and the health facility must be located in selected local government in Lagos State. Any facility that did not meet the inclusion criteria was excluded.

C. Data collection

Data were collected using self-developed anonymous structured questionnaires, containing open and closed-ended questions. The questionnaires had sections on demographic characteristics, health facilities information and methods adopted by healthcare workers to dispose of pharmaceutical waste. The questionnaire was validated prior to administration to HCW by using 30 healthcare workers from one of the local government (LGA) also within Lagos State that is not in the selected LGA for the preliminary study.

D. Ethical consideration and participants consent

Ethical approval for this study was sought and obtained from Lagos State University Teaching Hospital (LUTH) and National Orthopedic Hospital Igbobi (NOHI) Health Research and Ethics Committee (HREC). The approval for permission to participate by the health care workers was also obtained from the Health Service Commission, (HSC) Lagos state. The procedures were explained to the individual participants and thereafter their consent to participate in the study was obtained. The participants that declined not to be part of the study were excluded. Confidentiality was ensured by excluding all the names of the hospital and individual surveyed

E. Sampling Technique

The required sample size was obtained by using a multistage sampling technique. Four local governments were selected by simple random sampling from the twenty local governments that exist in Lagos State. Two Local governments were randomly picked from Lagos West, one randomly picked from Lagos Central and Lagos East. All the public health facilities in each of these LGA were clustered as (tertiary, secondary and primary). The health facilities were selected using stratified sampling methods. Questionnaires were administered to all the health workers in each of the selected health facility.

F. Data Analysis

Statistical Package for Social Sciences (SPSS version 20) was used for the analysis of the data. Chi-Square statistical test of significance was used to determine the level of significance of the association between variables at 95 % confidence level. Level of significance was set at $p \leq 0.05$.

III. RESULTS

There were 376 respondents of which 119 (31.6%) were males and 257 (68.4%) were females with Male: Female ratio of 1:2. The mean age was 37 ± 10 years with minimum and maximum of 18 and 76 respectively. The most frequent age group was 31 – 40 years with 159 (42.3%) respondents followed by 109 (29.0%), 62 (16.5%) and 40 (10.6%) seen for age groups 21 – 30, 41 – 50 and above 50 respectively while the least value of 6 (1.6%) was seen for 20 years and below. Most of the respondents, 126 (33.5%) work in general hospitals followed by 72 (19.1%) for tertiary hospitals. 52 (13.8%) were from specialist hospitals, 44 (11.7%) from basic health centers, 36 (9.6%) from the private hospital while 30 (8.0%) and 16 (4.3%) were from comprehensive health centers and other health institutions respectively. There were 175 (46.5%) respondents from pharmacy unit followed by 79 (21.0%) from Nursing, 62 (16.5%) from the medical unit while laboratory, environmental facilities, and other units recorded 28 (7.4%), 23 (6.1%) and 9 (2.4%) respectively. Most respondents, 163 (43.4%) have been in service between 1 – 5 years, 80 (21.3%) have been practicing their professions between 6 – 10 years, 52 (13.8%) have spent over 20years while 34 (9%) have spent between 16 – 20 years.

Approximately 20% of the institutions use regular garbage, red, yellow and black biohazard bags for pharmaceutical wastes disposal, 16% use brown biohazard bags, 14% use sharp containers, approximately 19% employ the services of LAWMA, 7.5% engage burn their wastes in open containers, 3% bury theirs around premises and 4.5% burn them under the supervision of NAFDAC and LASEPA (Table II).

41.2%) return expired drugs directly to the manufacturers, approximately 19% mix them with medical waste, sharps or any other form of waste, 19.9%) return expired drugs to sales representatives, 16.5% use reverse distributor while 3.5% use other methods (Figure I).72.3% have not received any training on pharmaceutical waste management while only 27.4% have had any PWM training (Figure II). Likewise, the majority 68.9% never read PWM guidelines or policies in their entire career while only 31.1% have read any (Figure III).The highest level of PWM training was seen among the staff of comprehensive health centers, 36.7% followed by 34.7% for tertiary institutions, private hospitals recorded the third highest level of PWM training with 30.6% while general hospitals and specialist hospitals recorded the least values of 28.6% and 13.5% respectively (Table III).the highest level of training with 32.9% followed by medical with 27.4%, pharmacy and environmental were in the third and fourth

positions with 26.3% and 26.1% respectively while the laboratory department recorded 25% (Table IV).

Table I   Socio-demographic characteristics of the Respondents (n = 376)

Parameter	Frequency	Percentage
Gender		
Male	119	31.6
Female	257	58.4
Age Category		
20 & below	6	1.6
21 – 30	109	29.0
31 – 40	159	42.3
41 – 50	62	16.5
Above 50	40	10.6
Health facility		
Tertiary Hospital	72	19.1
General Hospital	126	33.5
Specialists Hospital	52	13.8
Comprehensive Health Centre	44	11.7
Private Hospital	30	8.0
Others	36	9.6
	16	4.3
Department		
Nursing	79	21.0
Medical	62	16.5
Pharmacy	175	46.6
Environmental facilities	28	7.4
Others	23	6.1
	9	2.4
Number of years of practice		
1 – 5	163	43.4
6 – 10	80	21.3
11 – 15	47	12.5
16 – 20	34	9.0
Above 20	52	13.8

Table II:Method of disposal of pharmaceutical wastes among health facilities

| Response	Frequency	Percentage
Pour/flush down the drain	43	11.44%
Put in the regular garbage	73	19.41%
Put in a red biohazard bag	75	19.95%
Put in a yellow biohazard bag	74	19.68%
Put in a brown biohazard bag	60	15.96%
Put in a black biohazard bag	74	19.68%
Put in a sharps container	54	14.36%
Burnt in open container	28	7.45%
Burnt within premises with general waste	17	4.52%
Buried within or near the premises	11	2.93%
Carried away by LAWMA in the presence of the company's staff	71	18.88%
Burnt in the presence of NAFDAC or LASEPA and company's staff	17	4.52%
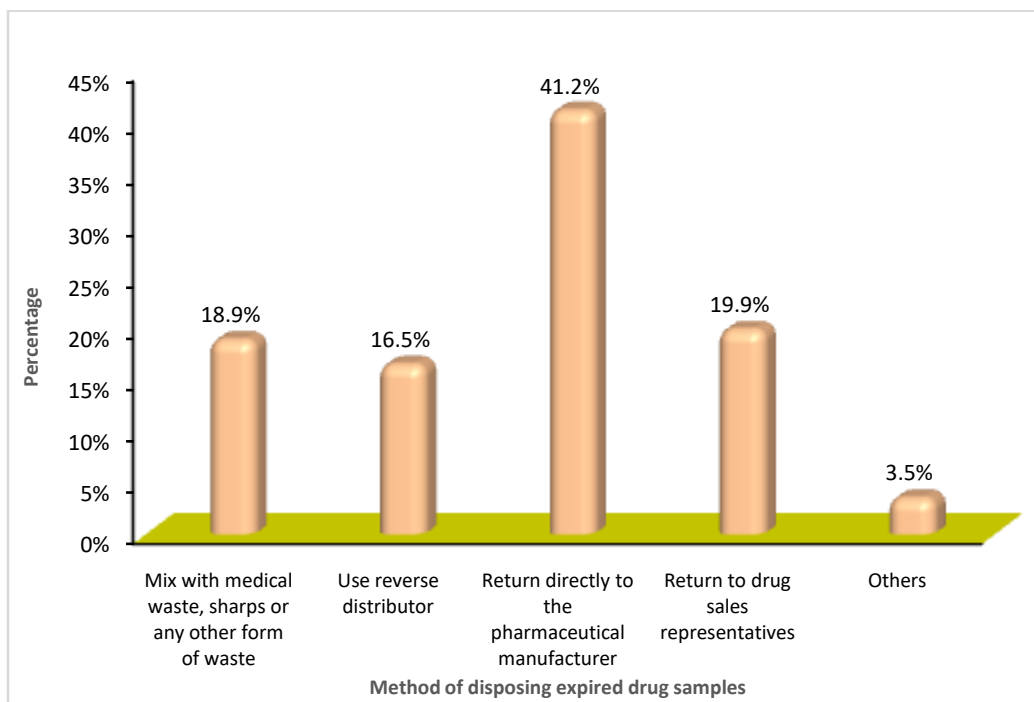
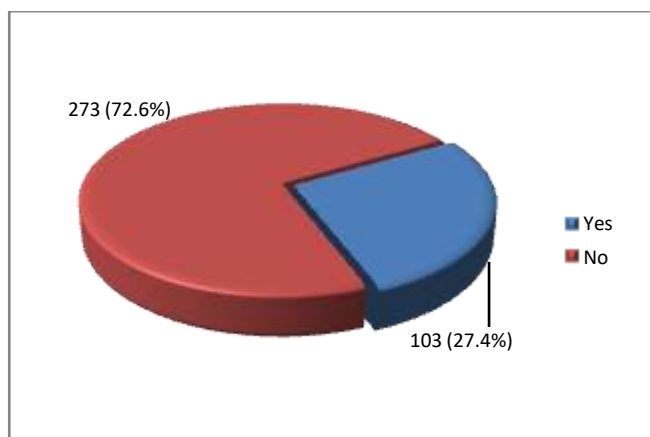Figure I   How do you dispose of expired drug samples?

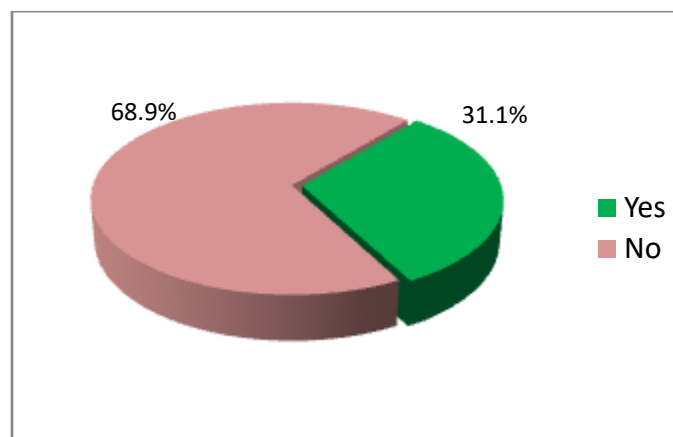Figure II: Ever been trained in pharmaceutical waste management?

Figure III Ever read PWM guidelines or policies

Table III: Training on pharmaceutical waste management across health facilities (p = 0.023)

Ever been Trained on PWM?	Health facility (%)						
	Tertiary Hospital	General Hospital	Specialist Hospital	Basic Health Centre	Comprehensive Health Centre	Private Hospital	Others
Yes	25 (34.7%)	36 (28.6%)	7 (13.5%)	13 (29.5%)	11 (36.7%)	11 (30.6%)	-
No	47 (65.3%)	90 (71.4%)	45 (86.5%)	31 (70.5%)	19 (63.3%)	25 (69.4%)	16 (100.0%)
Total	72 (100.0%)	126 (100.0%)	52 (100.0%)	44 (100.0%)	30 (100.0%)	36 (100.0%)	16 (100.0%)

Table IV: PWM training status across units/departments (p = 0.759)

Trained?	Hospital Unit/Department (%)					
	Nursing	Medical	Pharmacy	Laboratory	Environmental Facilities	Others
Yes	26 (32.9%)	17 (27.4%)	46 (26.3%)	7 (25.0%)	6 (26.1%)	1 (11.1%)
No	53 (67.1%)	45 (72.6%)	129 (73.7%)	21 (75.0%)	17 (73.9%)	8 (88.9%)
Total	79 (100.0%)	62 (100.0%)	175 (100.0%)	28 (100.0%)	23 (100.0%)	9 (100.0%)

IV. DISCUSSION

Socio-demographic information of the respondents included sex, age category, place of work, working unit/department and number years in practice. Majority of therespondents in this study were females, 68.4%. Over 42% of the respondents were seen in the most frequent age group of 31 – 40 years,age group 21 – 30 recorded 29.0% of the respondents, while the least frequent age group was those within 20 years, 1.6%.Over 30% of the respondents work in general hospitals followed by tertiary hospitals with 19.1% while 8.0% and 4.3% were from comprehensive health centers and other health institutions respectively.

There were 46.5% of respondents from the pharmacy unit followed by 21.0% from Nursing, while laboratory, environmental facilities, and other units recorded 7.4%, 23 6.1%, and 2.4% respectively. 43.4% of the respondents have been in service between 1 – 5 years, 21.3% have been practicing their professions between 6 – 10 years 9% have spent between 16 – 20 years. In a recent study done in Turkey hospitals, 67.5% of participants were female. 41.2% were between the age group 35–44. 42.5% were working in private and 21.7% in state-owned hospitals. 50.4% are head-nurses, and 18.3% are hospital managers [12].

It was discovered that most of the institutions use biohazard bags for pharmaceutical wastes disposal while few others either employ the services of LAWMA, engage in open burning, bury around premises or burn them under the supervision of NAFDAC and LASEPA.

41.2% return expired drugs directly to the manufacturers, others mix them with medical waste, sharps or any other form of waste, return expired drugs to sales representatives or use a reverse distributor. Majority of the respondents,72.3% have not received any training on PWM training. Likewise the majority, 68.9% never read PWM guidelines or policies in their entire career.

The finding of this research contradicts some of the research in the literature. One of the literature researches indicated that the majority(69.9%) of health employees had received training of the subject of medical wastes [13]. Also, similar research that evaluated the level of information of hospitalhealthcare workers on waste management showedthat, in general, among the professional healthcare workers,62.1% of medical doctors, 54.5% of nurses and47.6% of laboratory technicians had more information on the subject[14]. In a

similar manner, a study showedthat medical doctors, nurses and laboratory technicianswere better informed on waste disposal than the cleaning personnel[1].

The low level of training on PWM saw among health workers in this study is not peculiar to any health institution. It is generally below 40% across all health institutions. The highest level of PWM training was seen among the staff of comprehensive health centers, 36.7% while general hospitals and specialist hospitals recorded the least values of 28.6% and 13.5% respectively. In-depth analysis was done to determine the level of training across health workers in various units. It was discovered that nursing unit recorded the highest level of training with 32.9% followed by medical with 27.4%, pharmacy and environmental were in the third and fourth positions with 26.3% and 26.1% respectively while the laboratory department recorded 25%.

Ozder et al.[11]which found out in their study that with the exception of hospital managers, approximately half the number of other healthcare managers (personnel responsible for medical waste, head doctor, nurse, and head nurse) were observed to have participated in at least one training course on the subject. This ratio in personnel responsible for medical waste and responsible nurses is higher (respectively 66.7% and 65.8%)[12]. This study is, therefore, an eye-opener to the need to lay more emphasis on training of health personnel on PWM in Lagos State, Nigeria.

V. CONCLUSION

The major objective of this study is to assess the level of training received by health workers in Lagos State, Nigeria on pharmaceutical waste management. This study discovered that the majority of health workers (above 60%) in Lagos State health institutions are yet to receive adequate knowledge or training on PWM. Most of them don't even read guidelines for waste management. It is therefore suggested that that intervention is needed both in the part of institutional management and government to embark on regular training of health workers across all health institutions in Lagos State.

REFERENCES

[1]. Fatta-Kassinos, D., Meric, S., & Nikolaou, A. (2011). Pharmaceutical residues in environmental waters and wastewater: current state of knowledge and future research. *Analytical and bioanalytical chemistry*, *399*(1), 251-275.

[2]. World Health Organization. (2017). Safe management of wastes from health-care activities: a summary.

[3]. Jovanović, V., Manojlović, J., Jovanović, D., Matic, B., & Đonović, N. (2016). Management of pharmaceutical waste in hospitals in Serbia–challenges and the potential for improvement. *INDIAN JOURNAL OF PHARMACEUTICAL EDUCATION AND RESEARCH*, *50*(4), 695-702.

[4]. Boxall, A. B., Rudd, M. A., Brooks, B. W., Caldwell, D. J., Choi, K., Hickmann, S., ... & Ankley, G. T. (2012). Pharmaceuticals and personal care products in the environment: what are the big questions? *Environmental health perspectives*, *120*(9), 1221.

[5]. Ngwuluka, N. C., Ochekpe, N. A., & Odumosu, P. O. (2011). An assessment of pharmaceutical waste management in some Nigerian pharmaceutical industries. *African Journal of Biotechnology*, *10*(54), 11259-11264.

[6]. Beausse, J. (2004). Selected drugs in solid matrices: a review of the environmental determination, occurrence, and properties of principal substances. *Trac Trends in Analytical Chemistry*, *23*(10-11), 753-761.

[7]. Patneedi, C. B., Prasadu, D., Sharma, R. S. K., Sekhar, D. C., & Rao, D. V. (2015). MICROWAVE MEDIATED SYNTHESIS IN PHARMACEUTICAL CHEMISTRY.

[8]. Radhakrishna, L., Nagarajan, P., Vijayanandhan, S. S., & Ponniah, T. (2014). Knowledge, Attitude, and practice (KAP) towards disposal of medicines: A qualitative study among health care professionals in South India. *Wild J Pharm Res*, *3*, 1955-63

[9]. White, J. R., Belmont, M. A., & Metcalfe, C. D. (2006). Pharmaceutical compounds in wastewater: wetland treatment as a potential solution. *The scientific world journal*, *6*, 1731-1736.

[10]. Emmanuel, J. (2007). Survey of health care waste characteristics and generation data from different countries. *New York, United Nations Development Programme Global Environment Facility Global Demonstration Project on Health Care Waste*.

[11]. Ozder, A., Teker, B., Eker, H. H., Altındis, S., Kocaakman, M., & Karabay, O. (2013). Medical waste management training for healthcare managers-a necessity?. *Journal of environmental health science and engineering*, *11*(1), 20.

[12]. Akbolat M, Işık O, Dede C, Çimen M. (2011). Evaluation of the level of knowledge of healthcare professionals about medical wastes. *University of Acibadem Health Sciences Journal*, 2(3):131–140.

[13]. Vishal, B., Swarn, L., Mahesh, M., Arvind, A., Sanjay, A., & Uma, S. (2012). Knowledge assessment of hospital staff regarding biomedical waste management in a tertiary care hospital. *Nat J Community Med*, *3*(2), 197-200.

[14]. Mathur, V., Dwivedi, S., Hassan, M. A., & Misra, R. P. (2011). Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*, *36*(2), 143.