Asymptomatic Bacteruria among Healthy Cohort Using Dipstick Urinalysis from a Tertiary Health Care Facility in South East Nigeria

Onyeka Chukwudalu Ekwebene and Simeone Tyotswam Yanmeer

ABSTRACT

Dipstick urinalysis is a simple and cost effective method for screening of urinary abnormalities, thus enabling early detection and prompt management of renal pathologies. The aim of the study was to determine the pattern of urinalysis profile among apparently healthy cohorts using medical doctors of Nnamdi Azikiwe University Teaching Hospital. One hundred (100) medical doctors aged 20 to 50 years were selected through convenience sampling in a descriptive cross sectional study from August 20, 2020 to September 10, 2020. Ninety-One (91%) had their urine tested with dipstick test strips by Wellkang Ltd. Abnormal urinary findings occurred in 48 (52.8%) of the subjects which were blood 5 (5.50%), glucose 8 (8.80%), protein 15 (16.50%), nitrite 10 (11.00%), leucocyte 6 (6.60%) and Ascorbic acid 4 (4.40%). The prevalence of urine abnormality was higher in the 25-30year age group (48.4%), though not statistically significant ($P>0.05$). No significant association existed between pH and urine abnormality ($p=0.5$). No significant association existed between specific gravity and urine abnormality ($p=0.5$). It was concluded that the prevalence of urine abnormalities was significantly high (52.8%) with proteinuria and (11.0%) nitrites being the commonest abnormalities. Routine dipstick urinalysis is a cheap and simple method for early identification of urine abnormalities in apparently healthy cohorts using medical doctors and a positive dipstick test for proteinuria should prompt further evaluation for the presence of kidney disease. It is recommended that Urinalysis should be instituted as a routine test for medical doctors in hospitals because of its importance in disease surveillance.

Keywords: Urinalysis, Dip stick, Urinary tract infection, Kidney.

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Onyeka Chukwudalu Ekwebene *

Faculty of Medicine, Nnamdi Azikiwe University, Nigeria.

(e-mail: chukwudaluonyeka@gmail.com)

Simeone Tyotswam Yanmeer

Faculty of Public Health and Applied Human Sciences, Kenyatta University, Kenya.

**Corresponding Author*

I. BACKGROUND

Urinalysis refers to the chemical analysis of urine. However, it can be defined as identification or separation of ingredients of a substance. In practice, routine urinalysis refers to (1) macroscopic analysis which includes assessment of physical characteristics and chemical analysis (2) Microscopic analysis for formed elements [1].

From historical perspective, the significance of urinalysis in diagnostic medicine came to limelight over a century ago when William Roberts, an English Physician published the first paper on the observation of bacteria in fresh urine [2]. Moreover, the first extensive description of the use of urine for diagnostic purpose came from Hippocrates, who in his prolific writing stated that bubbles on the surface of urine indicates kidney disease and long standing illness as a result of high concentration of protein [3]. The analysis of urine includes physical, chemical, and microscopic examination for the diagnosis of genitourinary, metabolic, endocrine, and genetic disorder [4]. Invariably, culture result of carefully obtained urine sample is considered the gold standard for the diagnosis of urinary tract infection [5].

The most frequent reoccurring question for renal medicine in underdeveloped countries is how to create

strategic plans that can detect as early as possible those subjects who are at risk of developing renal disease later in life. This will help to create individual-oriented preventive measures that will limit the need for dialysis and transplantation. The cost effective and cheap way of screening apparently healthy individuals is urinalysis and several studies have been made using reagent strips, recording their effectiveness in identifying urinary abnormalities at relatively low cost [6].

The most commonly employed technique worldwide for detecting UTI is by using diagnostic dipstick, which measures parameters like protein, leukocyte esterase, blood and nitrate reductase levels [7]. A more reliable but time-consuming technique of bacterial culturing is preferred, involving the use of appropriate media for selected bacterial growth [8]. However, this microbiological assay has the limitation of requiring a minimum of 48 hours to make observations from the culture plates, to ascertain the presence and levels of bacteriuria. Furthermore, the inability of this technique to detect and identify viable but non-culturable microbes may exclude some pathogenic bacteria, which might later cause symptomatic bacteriuria [9]. The occurrence of such viable but nonculturable microbes has been reported for many Gram-negative

bacteria, including human pathogenic *E. coli* which is the commonest pathogen, causing more than 80% of UTIs [10]. In other words, there is the need for a more reliable and faster method for UTI diagnosis.

The three major steps of urine formation are Glomerular filtration, Tubular Reabsorption and Tubular Secretion. In Glomerular filtration, blood flows into the glomerulus via the afferent arteriole and filterable components of blood like water, glucose, amino acids, sodium chloride and urea move from the glomerular capsule through the Bowman's capsule into the nephron. The fluid filtered is called the glomerular filtrate. Non-filterable components like cells, serum albumins exit in blood through the efferent arteriole. In Tubular reabsorption, there is active or passive extraction of solutes and water from the tubular fluid into the renal interstitium and then subsequent transport into the bloodstream. Tubular Secretion is the process of active transport of materials from the peritubular capillaries to the renal tubular lumen [11].

A study demonstrated that haematuria next to proteinuria was a potent predictor of end-stage renal disease (ESRD) with male gender being a significant risk factor. However, it has been shown that up to 50% of the long-term sequelae of occult UTI in young children appear preventable by urine testing. Early detection of renal disease which may progress rapidly or slowly to ESRD, depending on the nature of the disease, may be an important strategy for preventing chronic renal disease in a resource limited setting where dialysis and renal replacement therapy (RRT), the standard management protocol for ESRD are inaccessible because of non-availability of funding and donors [11].

Doctors were chosen, as they form an important part of the healthcare team and have increased risk of having abnormal urine components. Also, medical doctors once trained, are in a better position to help the other groups at risk resolve basic health issues with regards to the genital tract diseases. Furthermore, there is paucity of baseline epidemiologic data on routine dipstick urinalysis among medical doctors and hence, the prevalence of urine components abnormality as detected by the dipstick urinalysis is being studied so as to establish early intervention(s). Dipstick Urinalysis is a non-invasive method that aids the early detection of urinary pathologies.

The objective of this study is to determine the prevalence of urine abnormality among medical doctors, to determine the most prevalent Dipstick Urinalysis parameter among the study population, to determine the components of urine that shows abnormality and to determine the association of urine abnormality with respect to age, pH, specific gravity, genotype and blood group.

II. METHODOLOGY

A. Study Area

The study was conducted at the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi. Nnamdi Azikiwe University Teaching Hospital (NAUTH) is a tertiary health institution located at Nnewi-Ojoto-Oba Road, Nnewi, Nnewi North LGA of Anambra State, South-East Nigeria.

Nnewi is the second largest city in Anambra State in south-eastern Nigeria [12]. As of 2006, Nnewi has an estimated population of 391,227 according to the Nigerian census. The city spans over 1076.9 square miles (2,789 km²) in Anambra State [13]. NAUTH provides a wide range of medical, surgical, diagnostic, out-patient, rehabilitative and support services to a catchment population of about 30,994,559. It has a functional Accident and Emergency Unit and provides 24-hour emergency services all year round [14].

B. Study Design

The study is descriptive and cross-sectional which employed 100 medical doctors from Nnamdi Azikiwe University Teaching Hospital exempting female doctors who were already on their menstruation in the period of this study.

C. Sample Size Determination

The following formula [15] were used to develop the sample size:

$$n = \frac{Z^2 PQ}{D^2}$$

where

n = Minimal sample size.

Z = Standard normal deviation at 95% confidence level which is 1.96.

P = Prevalence = 5.25% = 0.0525 [16]

Q = 1 - P = 1 - 0.0525 = 0.9475.

D = Level of precision required = 0.05.

$$\begin{aligned} n &= \frac{1.96^2 \cdot 0.0525 \cdot 0.9475}{0.05^2} \\ n &= \frac{3.8416 \cdot 0.0525 \cdot 0.9475}{0.025} \\ n &= \frac{0.19109559}{0.025} \\ n &= 76.4 \end{aligned}$$

n = approximately 76.

Attrition

10% of 76 = 7.6

7.6 + 76.0 = 83.6 approximated to 86.

Thus, minimal sample size is 86.

However, to improve the reliability of the study results, we increased the sample size to 100.

D. Sampling Method/Technique

The Convenience sampling technique was used. Study participants were selected based on the ease of access to them.

E. Study Instruments

The following instruments were used to collect data for the study:

- Urine dipstick reagent strips (COMBI 11).
- Sterile universal container.
- Surgical Gloves.

- Paper towel/Tissue paper.
- Data collection forms.
- Blue pens.
- Stopwatch.
- Basins.

F. Data Collection

Structured questionnaires were used to record the participants biodata (age, gender). Each recruited participant was given a sterile leak-proof universal bottle which was properly labelled with his/her serial number to take home. They were instructed on how to carefully obtain an early morning urine specimen: to clean their perineum, separate the labia for females and collect clean catch mid-stream urine. The urine specimens were examined using the G. SURETEST 11S (manufactured by Wellkang Ltd, England, United Kingdom) which is a dipstick test for eleven components of urine: specific gravity, leucocytes, nitrite, pH, blood, protein, glucose, ascorbic acid, ketones, urobilinogen, and bilirubin. The urine was tested immediately by the researcher with the assistance of two specially trained enrolled doctors. The urine was properly mixed in its container prior to testing. The duration of the test was determined using a timer. The reagent strips were completely immersed into the fresh urine for 1 second and drawn across the rim of the container to remove excess urine. Thereafter, they were held in a flat horizontal position. After 60 seconds, the test strip was compared with the appropriate color chart on the bottle label and the results were recorded. Color changes that appeared only along the edges of the test pads or after more than 2 minutes have passed were of no significance.

G. Data Analysis

Data entry and analysis was done using Statistical Package for Social Sciences (SPSS) version 20.0

H. Ethical Considerations

The entire study with special focus on the objectives, and techniques involved were explained clearly to all participants and an informed consent/ethical approval with the number NAUTH/CS/66/VOL.13/VER2/97/2020/027 was obtained from Nnamdi Azikiwe University Teaching Hospital Ethical Committee. The participants were assured of the confidentiality and anonymity of their responses and results which enabled them to provide sincere answers and appropriate urine specimens. The urine specimens were properly discarded immediately after use. Participants were also assured that the information given would be used strictly for academic and/research purposes.

III. RESULT

The result of the socio demographic parameter as presented below show that majority of the medical personal sampled are within the age bracket of 25–30 years 44 (48.40%), male 52 (57.10%), single 59 (64.80%), Christian 90 (98.90%) and have MBBS as their highest level of educational qualifications 86 (94.50%). Most of them are of Igbo 88 (96.70%), reside in Nnewi 85 (93.40%) with

genotype AA 63 (69.20%) and are majorly of the cadre of house officers 63 (69.20%).

TABLE 1: SHOWING THE SOCIO DEMOGRAPHIC DISTRIBUTION OF THE MEDICAL DOCTORS SAMPLED

Socio demographic variable	Frequency	Percentage
<i>Age</i>		
20 – 24	22	23.1
25 – 30	44	48.4
31 – 34	16	17.6
35 – 40	5	5.5
41 – 44	2	2.2
45 – 50	2	2.2
<i>Sex</i>		
Female	39	42.9
Male	52	57.1
<i>Marital Status</i>		
Married	32	35.2
Single	59	64.8
<i>Highest Level of Education Qualification</i>		
FWACS	1	1.1
FWACP	2	2.2
MBBS	86	94.5
<i>Religion</i>		
Islam	1	1.1
Christian	90	98.9
<i>Rank</i>		
House officer	63	69.2
Resident	14	15.4
Medical officer	11	12.1
Consultant	3	3.3
<i>Ethnic Group</i>		
Efik	1	1.1
Hausa	1	1.1
Yoruba	1	1.1
Igbo	88	96.7
<i>Place of Residence</i>		
Awka	1	1.1
Enugu	1	1.1
Ibadan	1	1.1
Onitsha	2	2.2
Nnewi	85	93.4
<i>State of Origin</i>		
Abia	5	5.5
Anambra	44	48.4
Delta	2	2.2
Ebonyi	2	2.2
Enugu	14	15.4
Imo	21	23.1
Jos	1	1.1
Kogi	1	1.1
Lagos	1	1.1
<i>Blood Group</i>		
A-	1	1.1
A+	22	24.2
AB-	1	1.1
AB+	10	11.0
B-	2	2.2
B+	14	15.4
O-	6	6.6
O+	35	38.5
<i>Genotype</i>		
AA	63	69.2
AS	28	30.8

The abnormal urine components present in the urine samples of the medical personal sampled as presented in Table 2 includes blood 5 (5.50%), glucose 8 (8.80%), protein 15 (16.50%), nitrite 10 (11.00%), leucocyte 6 (6.60%) and Ascorbic acid 4 (4.40%).

TABLE 2: SHOWING ABNORMAL URINE COMPONENTS OF MEDICAL DOCTORS SAMPLED

Abnormal urine component	Frequency	Percentage
<i>Blood</i>		
Negative	86	94.5
Positive	5	5.5
<i>Bilirubin</i>		
Negative	91	100
Positive	0	0
<i>Urobilinogen</i>		
Negative	91	100
Positive	0	0
<i>Ketones</i>		
N	91	100
Yes	0	0
<i>Glucose</i>		
Negative	83	91.2
Positive	8	8.8
<i>Protein</i>		
Negative	76	83.5
Positive	15	16.5
<i>Nitrite</i>		
Negative	81	89.0
Positive	10	11.0
<i>Leucocytes</i>		
Negative	85	93.4
Positive	6	6.6
<i>Ascorbic Acid</i>		
Negative	87	95.6
Positive	4	4.4

TABLE 3: SHOWING SPECIFIC GRAVITY OF URINE OF THE MEDICAL DOCTORS SAMPLED

Variable	Frequency	Percent
Specific gravity (n = 91)		
1.0050	1	1.1
1.0100	2	2.2
1.0150	11	12.1
1.0200	10	11.0
1.0250	18	19.8
1.0300	49	53.8

*Normal range = 1.010 – 1.030.

Result above show that though the urine of majority of the medical personal sampled fall within the normal range of specific gravity (1.010–1.030), they were majorly on the high normal side 49 (53.80%).

TABLE 4: SHOWING pH OF URINE OF THE MEDICAL DOCTORS SAMPLED

Variable	Frequency	Percent
pH		
5	34	37.4
6	54	59.3
6.5	0	0
7	2	2.2
8	1	1.1
9	0	0

*Normal range = 4.5 – 8.0.

Table 5 shows that there is no relationship between the presence of urine abnormalities and the socio demographic parameters analysed ($P>0.05$).

TABLE 5: CHI-SQUARE ANALYSIS SHOWING RELATIONSHIP BETWEEN URINE ABNORMALITIES AND AGE, BLOOD GROUPS, GENOTYPE AND MARITAL STATUS

Socio Demographic Variables	Presence of Urine Abnormality		χ^2 -value	P-value
	Negative	Positive		
Age			4.275	0.639
20 – 24	14	7		
20 24	1	0		
25 – 30	27	17		
31 – 34	9	7		
35 – 40	3	2		
41 – 44	1	1		
45 – 50	0	2		
Blood Group			10.020	0.188
A-	0	1		
A+	15	7		
AB-	1	0		
AB+	6	4		
B-	1	1		
B+	5	9		
O-	2	4		
O+	25	10		
Genotype			0.372	0.486
AA	40	23		
AS	15	13		
Marital Status			1.104	0.370
Married	17	15		
Single	38	21		

IV. DISCUSSION

A. Demographic Data of Study Participants

The result of the socio demographic parameter as presented above showed that majority of the medical doctors sampled are within the age bracket of 25–30 years 44 (48.40%), male 52 (57.10%), single 59 (64.80%), Christian 90 (98.90%) and have MBBS as their highest level of educational qualifications 86 (94.50%). Most of them are of Igbos 88 (96.70%), reside in Nnewi 85 (93.40%) with genotype AA 63 (69.20%) and are majorly of the cadre of house officers 63 (69.20%). A total of 91 medical doctors participated in this study. This is closer to that obtained in a study by Ugwuja & Ugwu (250) [17] but is much lower than that obtained in studies by Fouad M and Boriae M (2500) [18] and Silverberg D et al (23, 4, 27) [19]. The reason for the variations could be due to the differences in the size of the study population.

B. Prevalence of Urine Abnormality

An overall abnormal urine analysis (one or more components) was found in 48 urine samples (52.8%) in our study. This is comparable to the prevalence of 35% obtained in a study by Tjale MC [20], but is much higher than the values of 5.25% and 15.4% obtained respectively in studies by Oviasu E et al [16] and Khallid & Haddad [21]. The prevalence of urine abnormality in this study appears to be significantly high, in other words if one considers the calculated rate of false positive/transient abnormality of 32.1% (in the first screening) and 13.8% (in the second screening) by Fouad and Boriae [18] the persistent abnormality rate could be much lower. Thus, it can be inferred that the prevalence of urine abnormality varies from one study to the other.

C. The Relationship Between Urine Abnormality and Selected Demographics

There was no significant relationship between urine abnormality and the socio-demographic parameters analysed ($P > 0.05$). The results of this study indicated more abnormalities among participants in the age 25–30 years (48.4%) even though there was no significant association between the socio-demographic parameters and urine abnormality. This is unlike findings by Oviyasu et al [16] in which abnormalities occurred more in the 14–16-year age group. More abnormality among participants with blood group O+ was identified in this study and non in AB+. This study also recorded more abnormalities among participants with AA Genotype and least in AS genotype. Abnormality in urine was more among singles than married participants.

D. Abnormality in the Urine Components

In this study, protein was the most frequent urine abnormality identified 15(16.5%), followed by nitrite 10(11.0%). The other abnormalities were very few and include leucocytes 6(6.6%), blood 5(5%) and ascorbic acid 4 (4.4%).

These findings are comparable to those obtained in a study by Fouad and Boraie [18] which showed that the prevalence of asymptomatic urinary abnormalities among the studied individuals were Hematuria, proteinuria, and leukocyturia in 26.4%, 3.8%, and 11.5% respectively. In the second screening, hematuria and leukocyturia were significantly decreased to 9.8% ($P < 0.01$) and 6% ($P = 0.03$) respectively, although proteinuria also decreased to 2.6% but insignificantly.

Our finding was in contrast with that of Khallid and Haddad [21] in which 8.1 % had pyuria, 6.1 % had haematuria and 4.8 % had albuminuria.

However, results of urine components from most studies showed low values and on the other hand our values were higher. The reason for these variations may be due to differences in methodology and sociodemographic characteristics of the study cohort, or due to epidemiologic variations between the study areas [22].

Proteinuria can be a major cause of underlying kidney disease or a transient finding among medical doctors. False positive findings can arise because of mucus, pus, blood, or highly alkaline ($\text{pH} > 8$) and highly concentrated urine; false negative ones, because of diluted urine [23]. In our study, collection of first early morning urine sample helped in excluding orthostatic proteinuria as a cause of isolated proteinuria in medical doctors. High prevalence of proteinuria (33%) in our study may indicate early presentation of renal disease as studies in both animal and humans have shown that proteinuria is a mediator as well as a marker of progressive glomerular damage [24]. The levels of proteinuria are one of the strongest predictors for renal function deterioration [25]. Asymptomatic proteinuria warrants further work-up to detect and even prevent ESRD [26].

The prevalence of Leucocyte esterase and nitrite in our study were 6(6.6%) and 10(11.0%) respectively. This is comparable with findings by Isezuo et al [27] who found Leukocyte esterase to be present in female participants.

In our study, the prevalence of nitrite was 11.0%. This is in tandem with the findings by Isezuo et al [27] in which Nitrite was the commonest abnormality (12%).

These differences in urinary abnormalities may reflect susceptibility to prevalent diseases in different locales and other confounding factors. For instance, false positives may be due to exposure to cold, prolonged recumbence, and contamination of urine samples with menstrual blood in females. However, we tried to minimize contamination of urine samples with menstrual blood by excluding females who were menstruating or had recently finished menstruating as at the period of study. Unfortunately, none of our participants with these urinary abnormalities were followed-up to ascertain the level of renal involvement, if any. We believe this would be an interesting research area for future studies.

Result showed that though the urine of majority of the medical doctors sampled fall within the normal range of specific gravity (1.010–1.030), they were majorly on the high normal side 49 (53.80%).

100% of the urine samples had a normal pH (normal range 4.5–8). There was no significant association between pH and urine abnormality ($p = 0.5$).

V. CONCLUSION

The prevalence of urinary abnormality among medical doctors of Nnamdi Azikiwe University Teaching Hospital Nnewi is significantly high (52.8%), as detected by dipstick urinalysis. The most prevalent urine abnormality is protein (16.5%). There was no significant association between socio-demographic parameters and urine abnormality ($P > 0.05$), though the age group 25–30 years showed more abnormalities. We therefore think and stand to be corrected that Routine dipstick urinalysis is a cheap and simple method for early identification of urine abnormalities in apparently healthy medical doctors and a positive dipstick test for proteinuria should prompt further evaluation for the presence of kidney disease.

VI. RECOMMENDATIONS

- All medical doctors should have routine urine screening programmes for the early detection and treatment of renal diseases.
- Dipstick urinalysis should be performed twice to rule out transient urine abnormalities.
- A widespread dipstick urinalysis screening program should be implemented to determine the exact prevalence of dipstick urinary abnormalities among medical doctors in Nigeria, as there are no studies on the subject.
- More health promotion programs need to be implemented among health practitioners in order to increase the awareness and improve their health behaviours.

VII. COMPETING INTERESTS

The authors declared that they have no competing interests and no funding for this research work.

VIII. LIMITATIONS OF THE STUDY

Part of the limitations to this study includes:

- There was no fund for this study because such study should be a prospective study and also urine culture would have been done as well which is capital intensive.

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Ekwebene Onyeka Chukwudalu was born in Onitsha, Anambra State, South Eastern Nigeria. He had his primary and secondary school education in nnewi and Eziagu respectively in Anambra state and university in Nnamdi Azikiwe University Awka, where he graduated from the department of Parasitology and Entomology in 2013 as the best male student. He obtained a second degree in same university and graduated in flying colours from the faculty of medicine where he obtained MB; BS (Bachelors in Medicine and Bachelors in Surgery) in 2019. Because of his passion for education he obtained a Post Graduate Diploma in Education from Nnamdi Azikiwe University, Awka in 2019. He obtained an upper credit in the 2010 HADLICEX (HIV/AIDS AND DRUG LITERACY CERTIFICATE EXAMINATION), In 2014 He obtained a general and advanced certificate in occupational Health, Safety and Environment (HSE 2,3) from Project Management Development Center. He has a Professional Development Certificate training in Leadership and Management in Health from University of Washington.

He is presently working as an assistant doctor in El-norah and Shekinah Glory M-Specialty Hospital Atani. He is also the founder of Sunrise Apparel Signatures, a registered and fast growing fashion industry. He has 5 articles with a peer reviewed journal.

Ekwebene Onyeka Chukwudalu is a member of Royal Society of Tropical Medicine and Hygiene, member of PAC-NET women health and youths development initiative, member of Malaria Eradication And Safe Health Initiative (MESHI). He was also a facilitator/Resource person who trained principals and head teachers in Anambra State for Covid-19 preventive measures in preparation of school reopening.

Tyotsam Simeone Yanmeer was born in Gboko-Nigeria. In 2009, He bagged First class with distinction in Bachelor of Science (BSc) Biotechnology with interest in Pharmacogenomics and Certificate course in Bioinformatics at Manipal University, India, upon completion of his primary and high school in West Africa.

In 2014/2015, he obtained double honors degree with distinction in Doctor of Medicine (MD) and Masters in Public Health (MPH) at DR. Francisco .Q. Duque Medical Foundation & the Institute of Graduate Studies, Lyceum North-Western University (LNU), Philippines respectively. Currently undertaking his Doctor of Philosophy (PHD) degree in Reproductive Health at the Faculty of Public Health and Applied Human Sciences, Kenyatta University, Nairobi-Kenya. His interest in research prompted him to obtain CITI Certified Program in 2018 & participated in the Indo-Australian Conference on human variations & Pharmacogenomics and Indo-USA Workshop on Mitochondrial research & Medicine in India. He has jointly researched on Malaria Epidemiology in Africa and Water & Sanitation practices of the coastal community in Pantar district-Dagupan City, Philippines. He worked as Team Lead on NAIIS Project for a wide range of multilateral, bilateral & Non-governmental agencies including the United Nations (WHO, UNICEF, World Bank), USAID, Center for disease Control, USA, and Global Fund.

In 2019, He was a speaker on maternal health, child health & Social issues at PARIS World Health Organization (WHO) Simulation Conference held in Paris -France. He also volunteered on pulse polio immunization program as a member of Rotaract club - **R. I. Dist. 3180** sponsored by UNICEF, India.