Aims and Objectives: Zika virus (ZIKV) is a mosquito-borne flavivirus that was first identified in Uganda in 1947 in monkeys. The study was designed to assess the knowledge, attitude, and practices regarding ZIKV infection among rural health-care providers in Aligarh district, Uttar Pradesh, India.

Materials and Methods: A total of 600 health-care providers were selected through stratified random sampling in an interventional survey. A self-structured, closed-ended questionnaire was administered to each participant in two phases to record their demographic, professional characteristics, knowledge, attitude, and practices regarding ZIKV.

Results: Out of 600 health-care workers contacted, 585 (97.5%) agreed to participate in the survey. Multivariable linear regression analysis was carried out to assess the association of participant’s professional characteristics with their knowledge, attitude, and practices.

Conclusion: It showed that there was a wide gap between the level of awareness, knowledge, and practice among the different categories of health-care providers about the ZIKV. This study revealed that there was a very high probability of the risk of transmission of ZIKAV through health-care settings and hence health-care personnel must strictly adhere to Universal Precautions to prevent it.

Keywords: Attitude, health-care providers, knowledge, practice, Zika virus

INTRODUCTION

Scientists and policymakers are concerned about the outbreak of an emerging pandemic diseases (ZIKV), for which we neither have a strain-specific vaccine nor sufficient antiviral medications at the onset of its outbreak. ZIKV is a mosquito-borne flavivirus that was first identified in Uganda in 1947 in monkeys. ZIKV infection is a mosquito-borne illness like chikungunya (CHIK) virus and dengue (DEN). In 2015, the virus was first reported in Brazil and since then spreading explosively in countries of America and Caribbean. August 3, 2016, 68 countries and territories have reported evidence of mosquito-borne ZIKV emergency of international concern by the WHO. ZIKV has potential to spread rapidly to adjoining new countries, especially where the Aedes mosquito’s vector is present. Till date, no case of ZIKV infection has been detected in India. India needs to be particularly conscious about the spread of ZIKV disease, since the mosquito that carries the virus actually thrives in the country. DEN and CHIK which are also caused by the same mosquito (Aedes aegypti) that causes ZIKV infection is widely prevalent in India. In 2016, the total number of diagnosed cases of DEN accounted for 652 in Delhi itself.

Although ZIKV is primarily transmitted through the bite of Aedes species of mosquitoes, sexual transmission also has been documented. ZIKV RNA has been detected in a number of body fluids including blood, urine, saliva, and amniotic fluid. Therefore, transmission associated with occupational exposure to these body fluids is largely

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seen. There is a potential for exposure to large volumes of body fluids to ZIKV during the labor and delivery process, blood transfusion, and dental procedures.\[^{5-7}\] Hence, it is essential for all health-care providers to have sufficient knowledge to screen potential carrier and prevent further spread of ZIKV from patients to health-care personnel by following standard Universal Precautions in these settings. No such study has been conducted in India which will attempt to raise the awareness regarding ZIKV infection among health-care providers. Therefore, this study aims to find out the knowledge, attitude, and practices among health-care providers of primary health center (PHC) and community health center (CHC) of Aligarh district in Uttar Pradesh state of India as it is largely populated.

**AIM and OBJECTIVE OF THE STUDY**

1. To determine knowledge, attitude, and practices about ZIKV infection among Health Care Providers HCP in CHC and PHC of Gonda and Chandaus blocks
2. To determine demographic and professional variables of health-care providers.

**MATERIALS AND METHODS**

An interventional survey was conducted to assess the level of knowledge, attitude, and practices among health-care providers regarding ZIKV infection in various PHCs and CHCs of Aligarh district in Uttar Pradesh state. Intervention was provided in terms of health education session. This was followed by demonstration of standard universal precautions to be followed by all health-care providers of PHC and CHC of Gonda and Chandaus tehsils of Aligarh district in Uttar Pradesh state.

**STUDY AREA**

Uttar Pradesh is the fourth largest state in India comprising a population of 199,581,477 and one of the most populous states in the country. Uttar Pradesh is divided into 75 districts and 18 divisions. Western Uttar Pradesh includes 26 districts in six divisions:
1. Meerut division
2. Saharanpur division
3. Moradabad division
4. Bareilly division
5. Agra division
6. Aligarh division.

A major part of Western Uttar Pradesh is a part of National Capital Region of India. Aligarh is one of the largest cities in Uttar Pradesh. According to the 2011 census, Aligarh district has a population of 3,673,849. Aligarh district is divided into five tehsils, namely, Kol Tehsil, Khair Tehsil, Atrauli, Gabhana, and Iglas. These tehsils are further divided into 12 blocks.

There are thirty PHCs, 12 CHCs, 2 district male hospitals, and one district female hospital in Aligarh district which include approximately 7000 health-care providers. Out of them, two CHCs which further included four PHCs were randomly chosen. Two CHCs which were finally selected were Chandaus and Gonda.\[^{8}\] Among these two CHCs, the staffing pattern of health-care providers were 17 doctors (MBBS, BDS, BHMS, and BAMS), 89 (auxiliary nursing midwives, staff nurses, and ward boy), 33 (two dental hygienists, six optometrists, eight pharmacists, six laboratory technicians, five X-ray technicians, and six TB unit staff), and 461 (Accredited Social Health Activist [ASHAs] and sanganis).

**SAMPLING TECHNIQUE AND DATA COLLECTION**

A self-administered structured questionnaire written in English and validated through a pilot study was administered to each participant (health-care providers) in two phases as Phase 1 and Phase 2. In both phases, same set of questionnaire was provided to the same study subjects (health-care providers). After completion of Phase 1, a detailed health education session by means of powerpoint presentation followed by hands-on demonstration of standard precautions to be followed at all health-care settings for preventing ZIKV infection were being provided which was followed by Phase 2. Stratified random sampling technique was used for a sample size of 600 health-care workers in CHC and PHC of Aligarh district. It was voluntary participation, and informed consent was obtained from those who participated in the study. All the participating health-care providers were explained regarding the objective and purpose of the study. Permission to conduct the survey was obtained from the hospitals research/Ethical Committee (C.H.C. GONDA,ALIGARH(U.P)/OCT ‑ NOV 2016). Each subject approximately took 20 min to complete all sections in each phase. The questionnaire consisted of 29 questions designed to evaluate the knowledge, attitude, and practices of health-care providers toward ZIKV infection. The questionnaire was organized into four parts. The first part elicited information on demographic attributes of health-care providers including age, gender, educational qualification, and years of clinical experience. The second part assessed the participating health-care provider’s knowledge regarding ZIKV and included ten questions on source of information, mode of transmission, clinical manifestations, and diagnostic aid. The third and fourth parts were used to elicit the attitude and practice means to be followed by health-care providers. The participants were asked to respond to each item according to the responses provided in the questionnaire. Responses include multiple choice questions, in which the health-care providers were
instructed to choose only one appropriate response from the provided list of different options.

**Statistical analysis**

The obtained data were analyzed using Statistical Package for the Social Sciences (SPSS) software for Windows version 20 (Community Health Center(C..H.C.) GONDA,ALIGARH(U.P)/OCT‑NOV 2016). For the purpose of analysis, each question in knowledge, attitude, and practices section that were answered “positively” were given a score of 1 and each question that was answered negatively were given a score of 0. The individual score was added (summed) up to yield a total score. The Mann–Whitney U‑test was used to compare the knowledge, attitude, and practices related to ZIKV among health‑care providers. The paired t‑test was used to compare the means of scores for knowledge, attitude, and practices preintervention as well as postintervention. Correlation between knowledge, attitude, and practices was examined by Karl’s Pearson correlation method. P = 0.05 was used as a cutoff level for statistical significance.

**Results**

A total of 600 health‑care providers were contacted, of whom only 585 agreed to participate. The demographic profile of the participants is shown in Table 1. All categories of health‑care providers showed low level of knowledge, attitude, and practices in preintervention as compared to postintervention. Table 2 shows the preintervention and postintervention comparison of mean knowledge scores (KSs), mean attitude scores (ASs), and mean practice scores (PSs) with the gender of health‑care providers. Significant differences only in terms of mean KS were seen when mean percentage scores were compared with gender. Table 3 shows the pre- and post-intervention comparison of mean KS, AS, and PS with educational qualification of health‑care providers. Among all health‑care providers, pre- and post-intervention comparison of mean KS, AS, and PS showed that nursing staff, BAMS/BHMS, and other paramedical health‑care providers showed highly statistical significant increase in mean KS and mean AS postinterventionally. Table 4 shows that there is no statistical significant difference when mean KS, AS, and PS were compared with years of clinical experience in both pre- and post-intervention. Table 5 represents the pre- and post-intervention correlation between KS, AS, and PS. Pre- and post-intervention correlation between KS, AS, and PS was examined by Karl’s Pearson correlation coefficient method. A positive linear relationship was found preintervention between KS and AS, KS and PS, and AS and PS whereas postintervention between KS and AS and KS and PS. A negative

**Table 1: Comparison between educational qualification and gender of healthcare providers**

| Characteristics                   | n (%) |
|-----------------------------------|-------|
| Gender                            |       |
| Male                              | 117 (20) |
| Female                            | 468 (80) |
| Educational qualification          |       |
| BDS/BHMS/BAMS                     | 13 (2.22) |
| MBBS/MD                           | 4 (0.68) |
| Nurses                             | 84 (14.35) |
| Technicians                        | 29 (4.95) |
| Others - ASHAs-Sangani             | 455 (77.7) |
| Years of experiences               |       |
| 0-5                                | 156 (26.60) |
| 5-10                               | 170 (29.05) |
| 10-15                              | 166 (28.37) |
| Above 15                           | 93 (15.89) |

**Table 2: Pre- and post-intervention knowledge, attitude, and practice score comparison with gender of health-care providers**

| Sex          | Preintervention | Postintervention | P*       |
|--------------|-----------------|------------------|----------|
|              | KS   | AS   | PS   | KS   | AS   | PS   |          |
| Males        | Mean | 1.65 | 0.84 | 1.58 | 6.13 | 3.08 | 1.72    | <0.001 (S) | 0.28 (NS) | 0.274 (NS) |
| n            | 117.00 | 117.00 | 117.00 | 117.00 | 117.00 | 117.00 |          |
| SD           | 2.40 | 1.17 | 0.89 | 1.43 | 0.88 | 0.81 |          |
| Females      | Mean | 0.85 | 0.66 | 1.48 | 5.52 | 3.12 | 1.86 | <0.001 (S) |          |          |
| n            | 468.00 | 468.00 | 468.00 | 468.00 | 468.00 | 468.00 |          |
| SD           | 0.86 | 0.67 | 0.84 | 1.54 | 1.02 | 0.73 |          |
| Total        | Mean | 1.01 | 0.70 | 1.50 | 5.64 | 3.11 | 1.83 | <0.001 (S) | 0.68 (NS) | 0.082 (NS) |
| n            | 585.00 | 585.00 | 585.00 | 585.00 | 585.00 | 585.00 |          |
| SD           | 1.36 | 0.80 | 0.85 | 1.54 | 0.99 | 0.75 |          |

NS=Not significant, S=Significant, SD=Standard deviation, KS=Knowledge scores, PS=Practice scores, AS=Attitude scores, *Paired t-test.
ZIKV infection has been declared by the WHO as a global public health emergency of international concern at an alarming pace.\(^{[9]}\) ZIKV is transmitted by *Aedes* species, primarily *Aedes aegypti* and *Aedes albopictus*. The disease is primarily transmitted through the bite of an infected *Aedes* mosquito. The incubation period of ZIKV is generally 3 to 14 days, during which time the individual is asymptomatic but can still transmit the virus to others through mosquito bites. The symptoms of ZIKV are usually mild and include fever, rash, joint pain, and conjunctivitis. In some cases, more severe complications such as Guillain-Barré syndrome and microcephaly in newborns have been reported, especially in pregnant women. The diagnosis of ZIKV infection is typically made through laboratory testing, including a polymerase chain reaction (PCR) assay or serology.

Table 3: Pre- and post-intervention knowledge, attitude, and practice score of the health-care workers according to their educational qualification

| Educational qualification | KS  | AS  | PS  |
|---------------------------|-----|-----|-----|
| Preintervention           |     |     |     |
| BDS/BAMS/BHMS             |     |     |     |
| Mean                      | 7.77| 3.38| 2.15|
| n                         | 13.00| 13.00| 13.00|
| SD                        | 3.00| 1.50| 0.55|
| MBBS/MD                   |     |     |     |
| Mean                      | 5.00| 2.00| 2.00|
| n                         | 4.00| 4.00| 4.00|
| SD                        | 4.62| 2.31| 0.00|
| Nursing                   |     |     |     |
| Mean                      | 0.87| 0.87| 1.33|
| n                         | 84.00| 84.00| 84.00|
| SD                        | 1.36| 0.69| 0.92|
| BAMS/BHMS                 |     |     |     |
| Mean                      | 0.90| 0.48| 1.45|
| n                         | 29.00| 29.00| 29.00|
| SD                        | 0.31| 0.69| 0.74|
| Others                    |     |     |     |
| Mean                      | 0.81| 0.59| 1.52|
| n                         | 455.00| 455.00| 455.00|
| SD                        | 0.39| 0.61| 0.84|
| Total                     |     |     |     |
| Mean                      | 1.01| 0.70| 1.50|
| n                         | 585.00| 585.00| 585.00|
| SD                        | 1.36| 0.80| 0.85|
| Postintervention          |     |     |     |
| BDS/BHMS/BAMS             |     |     |     |
| Mean                      | 8.31| 3.62| 2.00|
| n                         | 13.00| 13.00| 13.00|
| SD                        | 0.85| 0.51| 0.00|
| MBBS/MD                   |     |     |     |
| Mean                      | 7.75| 3.75| 1.75|
| n                         | 4.00| 4.00| 4.00|
| SD                        | 0.96| 0.50| 0.50|
| Nursing                   |     |     |     |
| Mean                      | 6.15| 3.00| 1.80|
| n                         | 84.00| 84.00| 84.00|
| SD                        | 1.39| 1.06| 0.67|
| BAMS/BHMS                 |     |     |     |
| Mean                      | 6.48| 2.83| 1.59|
| n                         | 29.00| 29.00| 29.00|
| SD                        | 1.02| 0.93| 0.87|
| Others                    |     |     |     |
| Mean                      | 5.40| 3.13| 1.85|
| n                         | 455.00| 455.00| 455.00|
| SD                        | 1.48| 0.99| 0.76|
| Total                     |     |     |     |
| Mean                      | 5.64| 3.11| 1.83|
| n                         | 585.00| 585.00| 585.00|
| SD                        | 1.54| 0.99| 0.75|

\(^{a}\)One-way ANOVA, S=Significant, SD=Standard deviation, KS=Knowledge scores, PS=Practice scores, AS=Attitude scores

Table 4: Pre- and post-interventional comparisons between knowledge, attitude, and practice scores with years of experience of health-care providers

| Years of experience | KS  | AS  |
|---------------------|-----|-----|
| Preintervention     |     |     |
| <5 years            | 0.89| 0.64| 1.51|
| 5-10 years          | 1.25| 0.76| 1.48|
| 10-15 years         | 1.00| 0.76| 1.52|
| >15 years           | 0.78| 0.58| 1.52|
| Total               | 0.361|

\(^{b}\)One-way ANOVA, NS=Not significant, SD=Standard deviation, KS=Knowledge scores, PS=Practice scores, AS=Attitude scores

**Discussion**

ZIKV infection has been declared by the WHO as a global public health emergency of international concern at an alarming pace.\(^{[9]}\) ZIKV is transmitted by *Aedes* species, primarily *Aedes aegypti* and *Aedes albopictus*. The disease is primarily transmitted through the bite of an infected *Aedes* mosquito. The incubation period of ZIKV is generally 3 to 14 days, during which time the individual is asymptomatic but can still transmit the virus to others through mosquito bites. The symptoms of ZIKV are usually mild and include fever, rash, joint pain, and conjunctivitis. In some cases, more severe complications such as Guillain-Barré syndrome and microcephaly in newborns have been reported, especially in pregnant women. The diagnosis of ZIKV infection is typically made through laboratory testing, including a polymerase chain reaction (PCR) assay or serology.
mosquito which is the same mosquito that spreads DEN and CHIK viruses as well. ZIKV infection has been usually seen clinically with microcephaly and other central nervous system birth defects. No clinical update of ZIKV infection has been detected in India. India needs to be very cautious about the spread of ZIKV disease since the *Aedes* mosquito that carries the virus actually thrives in the country as seen by enormous increase in number of clinical cases affected by DEN and CHIK in recent times.\[^{10-12}\]

ZIKV infection is rapidly manifesting as a pandemic concern, making it important for all health-care providers to constantly update their knowledge so that they are able to screen the potential carriers and thereby prevent further spread of infection. Health-care providers at PHC and CHC are the key persons in delivering health-care services in case of epidemic, especially in rural population as these health-care providers are the first to come in contact with the patient. In India, major population (70%) still resides in rural areas, so the health-care providers at PHC and CHC are the key persons in delivering health-care services.\[^{13}\] The methodological strength in the outcome of the present study was that it was the first formal assessment of knowledge, attitude, and practices among health-care providers regarding ZIKV infection in India. In the present study, all categories of health-care providers showed low level of knowledge, attitude, and practices in preintervention as compared to postintervention. Pre- and post-intervention comparison of mean KSs, mean ASs, and mean PSs showed statistical significant difference when compared with the gender and educational qualification of health-care providers. India is a hyperendemic country for DEN and CHIK outbreak. In fact, the signs and symptoms of Zika infection are very similar with DEN and CHIK infection. In our country, there is no established diagnostic system for Zika. These might cause Zika infection could be missed being diagnosed during clinical visits. The ability to establish Zika disease as differential diagnosis is associated with better knowledge of ZIKV because it requires specific information to differentiate diagnosis of Zika disease.

However, no such study among health-care providers regarding this new emerging infectious disease (ZIKV) has been conducted in India. Thus, this study aims to assess the knowledge, attitude, and practices regarding ZIKV virus infection among health-care providers.

**Level of knowledge**

In our study, postintervention mean KSs (6.13 and 5.52) were found to be higher among both males and females as compared to preintervention mean KS (0.85 and 1.65). It was also seen that males had significantly higher KS than females. This difference could be due to the reason that males usually are more active socially and had more interactions than females. This reason holds true particularly for our country where customs and traditional barriers discriminate against females which is in agreement with the results of the similar studies by Kamate et al.\[^{14}\]

On the basis of educational qualifications, postinterventional mean KS was found to be significantly higher than preintervention KS among all the groups. Intergroup comparison also shows that mean KS was highest among MBBS/MD, BDS/MDS as compared to categories such as nursing, BAMS, technicians, and ASHAs. This could be due to lack of resources in terms of very few nursing journals and limited availability of continuing education for them to update their knowledge in India.\[^{15}\]

In the present study, intergroup comparison on the basis of clinical experience also showed that there is no statistical significant difference in mean KS among different categories of health-care providers. This finding suggests that even doctors as compared to paramedical health-care personnel have not shown keen interest in upgrading their knowledge related to recent outbreaks of pandemic diseases. Therefore, it can be presumed that lack of sufficient knowledge can result in possible transmission of the disease.\[^{16-20}\]

**Level of attitude**

Postintervention mean ASs were found to be significantly higher ($P < 0.05$) than preintervention among both males and females. Intergroup comparison showed that both pre- and post-intervention mean ASs did not show any significant difference between both the genders. These
findings are in similarity with study conducted by Gupta et al.\[19\] Thus, this indicates that males despite having better mean KS are not having the better attitude (AS) to practice any preventive measures for ZIKV disease.

Intergroup comparison on the basis of educational qualification showed that both pre- and post-intervention mean ASs were found to be significantly varied among BDS, BAMS, BHMS, and MBBS groups as compared to other paramedical health-care providers. The finding indicates that though there was a remarkable increase in postintervention mean AS in paramedical health-care providers (nurses, technicians, ASHAs, and Sanganis), there is still lack of awareness as they have showed low level of knowledge. Lack of resources and inability to regularly upgrade their knowledge makes them less interested in the recent updates of pandemic diseases (ZIKV).\[20\]

**Level of practice**

While comparing the mean PSs among all health-care providers in both pre- and post-intervention survey, lot of practice incompetency was being observed.

On comparing with other studies, our study showed that preintervention, 29.2% of health-care providers and postintervention 69.1% practiced sharps and needles disposal by needle destroyer which is comparable to studies done by Guruprasad and Chauhan\[21\] and Prabhu et al.\[22\] where 44% would destroy the needle using needle destroyer and 30.39% of the dental nurses dispose needles in a puncture-proof sealed box.

In terms of practice measures regarding ZIKV infection to be followed at all health-care settings, preintervention 43.2% whereas postintervention 85% of health-care providers adopted universal standard precautions for infection control. This was in accordance with several studies including Ebrahimi and Khosravi,\[23\] Alam,\[24\] Bhardwaj et al.,\[25\] Jaber,\[26\] and George et al.\[27\] Pre- and post-intervention disparity seen in our study regarding practice of universal precautions shows that health-care providers are not being subjected to regular training programs to update their knowledge. Lack of strict protocol and policy to follow standard precautions during health-care delivery also leads to suboptimal level of practice. All the health-care providers agreed and felt the need in our study for practical and/or training session regarding ZIKV outbreak. Thus, despite the need being felt for these sessions, the implementation is still lacking at all the levels of health-care providers including doctors.

**Strength**

This survey analyzes current situation of health-care provider’s knowledge, attitude, and practices about ZIKV infection. This could provide a baseline data for further improvement and understanding of ZIKV disease among health-care providers as they are ingenious component of our society and health-care field.

**Limitations**

The limitation of the current research is small sample size which is limited only to few PHC and CHC, hence finding may not be generalized to other health centers. Other limitations are that very few researches are done in this field.

**Conclusion**

ZIKV epidemic is the latest in the recent series of emerging viral infection with global health repercussion. It is the need of the hour to urgently address this public health emergency. There is a wide gap between the level of awareness, knowledge, and practices among the health-care worker about the ZIKV. The risk of transmission through health-care setting seems to be high and hence should be prevented by the following standard control measures. Current ZIKV disease outbreak and other infectious disease outbreaks provide an opportunity to emphasize the importance of adherence to published infection prevention strategies to prevent transmission of infectious diseases in all health-care settings. Health-care workers who are exposed to large volumes of body fluids during labor and delivery are at high risk and must adhere to all standard and universal precautions during these procedures.

**Recommendations**

- Despite above limitations, it is recommended that health-care providers should update their knowledge on timely basis
- Further training and sensitization centers must be established as a preventive step
- It is advised that regular continuing medical educations and sensitization/training session should be attended and the internet is used to read articles related to such outbreaks to constantly update their knowledge and safeguarding the interests of the people
- The results of this study should be shared with stakeholders such as block coordinator, physicians, private clinicians, hospital administrators, and all other health-care workers to safeguard the interest of the public.

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**Conflicts of interest**

There are no conflicts of interest.

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