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Contents

Original Articles

Biomedical Waste Management: Pre and Post Covid-19 Pandemic 9
Kavitha M.G., Ramachandra Rao S, Visanth.V.S

Review Articles

Antimicrobial Resistance and Antimicrobial Stewardship 19
Sayan Bhattacharyya

Short Communication

A Study of Malaria in National Capital Territory of Delhi 25
Arvind Nath

Guidelines for Authors 31

Original Article

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Biomedical Waste Management: Pre and Post Covid-19 Pandemic

Kavitha M.G.[1], Ramachandra Rao S[2], Visanth. V.S[3]

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Abstract

India is a developing nation with a vast health care network, effectively managing biological waste is a significant concern. The rising demand of health care services also gives light into effective biomedical waste. Because it has so many implications as a danger factor for both the health of patients, hospital employees, and extending beyond the confines of the medical institution to the general population, hospital waste generation has thus become a top issue. By doing effective management of biomedical waste management, we secure environment, as well as human health for current and future generation. India is one of the nation's most severely affected by the COVID 19 pandemic. The immediate change in the healthcare sector compels the government to update the current biomedical waste management regulations. This paper reviews the changes occur in the management of biomedical waste in India and amendments in the law in order to improve the public health & safety during the pandemic while handling biomedical waste.

Keywords: Biomedical waste rules; Covid-19; CPCB.

INTRODUCTION

Since 2016, the healthcare sector in India has been growing at a Compound Annual Growth Rate of over 22%. Hospitals, medical equipment, health insurance, clinical trials, telemedicine, and medical tourism are all part of India's healthcare sector. In India, the hospital sector makes up 80% of the entire healthcare market.[1] The industry is going in a tremendous momentum. This rising demand of health care services also gives light into effective biomedical waste management. Human immunodeficiency virus (HIV) and hepatitis B virus (HBV) exposure worries in the 1980s and 1990s raised concerns about potential risks associated with medical waste. Because it has so many implications as a danger factor for both the health of patients, hospital employees, and extending beyond the confines of the medical institution to the general population, hospital waste generation has thus become a top issue.[2] By doing effective management of biomedical waste management, we secure environment, as well as human health for current and future generation.[3] Hospital cleanliness and infection control are impacted

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by how medical waste is managed. At the UN Sustainable Development Summit held in January 2015 in New York, the member states of the UN approved 17 Sustainable Development Goals that must be accomplished by them by the year 2030.[4] Among these 17 goals, SDG 3 is "Good Health and Well Being," and crucial since it strives to offer everyone access to the highest caliber of healthcare. One of the biggest obstacles to providing humanity with the highest quality healthcare services is biomedical waste, which has become a major issue in recent years. Biomedical Waste has been defined as is "any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the Production or testing of biological or in health camps."[5] According to World Health Organization (WHO) 85% of the waste produced by the health care setting are non-hazardous and 15% are hazardous. The term "Health Care Waste" or "Biomedical Waste" includes all the wastes from any medical procedure in healthcare facilities, research centres and laboratories. The classification is based on presence of infectious substances, radioactivity, presence of sharps, genotoxic, cytotoxic, other toxic chemicals, and biologically aggressive pharmaceuticals.[6]

Hospital patients, healthcare staff, and the general public might become ill as a result of improper biological waste management handling and practices. A Report released by the World Health Organization (WHO, 2003) on the burden of diseases caused by needle stick injuries (NSIs) in healthcare workers, there were 3 million accidental injuries that resulted in 37% of new HBV infections, 39% of new HCV cases, and roughly 5.5% of new HIV cases.[7] This will result in 9.2 million DALYs, or disability-adjusted life years between 2000 and 2030.[8] Ultimately effective biomedical management will be able to reduce and manage these occupational dangers. A situational analysis study and performance predictors were done in 2014 by the International Clinical Epidemiology Network (INCLEN) Program Evaluation Network (IPEN) in 25 districts across 20 Indian states. According to the survey, 82% of primary care, 60% of secondary care, and 54% of tertiary care health facilities in the 25 study districts lack a reliable BMW management system or one that needs significant improvement.[9]

India is one of the nation's most severely affected by the COVID-19 pandemic.[10] The GOI also implemented many preventive and precautionary measures as a result of the increasing infectivity rate. Health care settings are seeing a significant demand for PPE from all strata of health care workers due to the fear of infection. Which led to a significant increase in the use of personal protective equipment.[11] The fear frequently leads to the overuse of PPE, which frequently intensifies the issue by producing many BMWs that are challenging to store and transport with the limited resources and manpower available during a crisis.[12] The actions taken to abolish single-use plastics quickly transitioned to a massive reliance on single-use plastics like PPEs for pandemic COVID 19 prevention and control.[13] The immediate change in the healthcare sector compels the government to update the current biomedical waste management regulations. Since India is a developing nation with a vast health care network, effectively managing biological waste is a significant concern.

BMW DEVELOPMENTS IN INDIA

Under the Environmental Protection Act of 1986, the Government of India by Ministry of Environment and Forest published the first-Bio-Medical Waste (Management and Handling) Rules in 1998.[14] Central Pollution Control Board (CPCB) the apex organization in country in the field of pollution control. It was established in 1974 under the Water (Prevention and Control of pollution) Act, 1974. By offering technical support and direction and mediating conflicts between them, it coordinates the actions of the State Pollution Control Boards.[14] In the years 2000, 2003, 2011, the BMW 1998 regulations faced amendments. Due to the lack of agreement on classification and standards, the document of the BMW guidelines for 2011 was left as a draught and was not made public.[15] The Biomedical Waste Management Rules 2016, which replace BMW rule 1998, were published by GOI in response to later revisions to the previous BMW rules.[14-15]

2016 Biomedical Waste Rules: Key Features

The intent of the rules has been broadened to cover a variety of health camps, including immunization, blood donation, and surgical camps. The occupant of an HCF's responsibilities have changed. The second major changes come in the duty of an occupier. The individual who has administrative responsibility over the HCF that is producing BMW is the occupier. According to 2016 rule the laboratory waste, microbiological waste, and blood bags must undergo mandatory pre-treatment before disposal either at CBMWTF or on-site.[16] It is recommended that the sterilization/disinfection procedure adhere to National AIDS Control Organization (NACO) or WHO guidelines. Every HCF has been instructed to gradually stop using chlorinated plastic bags, gloves, and blood bags within the next two years in order to stop the release of dangerous dioxins and furans while burning such wastes. In addition, the new regulation mandates the inclusion of bar codes for better tracking and identification on all bags and containers used for BMW treatment and disposal.[16] All the health care facilities instructed to immunize the health care workers against Hepatitis B and Tetanus and provide training on BMW rules and handling. In addition, all significant accidents, including those brought on by fire risks, blasts, handling BMW, and corrective action taken by the required authority, should be reported and are required to maintain and update on day-to-day basis the bio-medical waste management register and display the monthly record of BMW. To facilitate segregation and eliminate misunderstanding caused by the earlier high number of categories, the 2016 announcement further reduces the number of categories to four. The Ministry of Environment and Forests (MoEF) would examine HCFs once a year through state health secretaries, the State Pollution Control Boards (SPCB), and the Central Pollution Control Board, in contrast to the 2011 guidelines, that did not include a provision for a monitoring authority (CPCB).[16] If a Common Biomedical Waste Treatment Facility (CBMWTF) is available at a distance of 75 kilometres, no HCF may build an on-site BMW treatment and disposal facility. If no CBMWTF is available, the occupier must install the necessary BMW treatment facility, such as an incinerator, autoclave, microwave, or shredder, after obtaining prior approval from the required authority.[16]

The amendments bring more clarifications in BMWM and make improving in segregation, transport, and disposal of waste by increasing the coverage and simplified the authorization. In order to strengthen the application of environmentally sound management of biomedical waste in India and underline the effort to safeguard the environment and human health from infectious biomedical waste, the 2016 Rules have been revised once in 16th March 2018, 20th Feb 2019 and 10th May 2019. The modifications state that after March 27, 2019, chlorinated plastic gloves and bags are no longer permitted. The phase out of blood bags has been waived in compliance with the 2018 revisions to the BMW regulations.[17]

Bio Medical Waste Management Scenario in Pre Covid-19

According to the 2016 BMWM Rules, there must be enough CBWTFs put up to cover the entire state or all HCFs in order to treat and dispose of biomedical waste. 2018 Annual report states that there 200 total number of CBWTFs in the country and 12,326 captive treatment facilities installed by HCFs.[18] About 614 tonnes of bio-medical waste are produced each day overall, of which 534 tonnes are handled in CBWTFs and captive treatment facilities. It would suggest that 80 tonnes are left untreated. There are enough CBWTFs in the states of Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Chandigarh, Madhya Pradesh, Punjab, and Haryana. However, the report suggests that during the period 2006 to 2018, the use of captive waste treatment incinerators was reduced from 225 to 120, and the CBWTF was increased from 155 to 200. Several states, including Andaman & Nicobar, Assam, Arunachal Pradesh, Chhattisgarh, Goa, Himachal Pradesh, Jharkhand, Karnataka, Lakshadweep, Manipur, Meghalaya, Sikkim, Mizoram, Nagaland, Odisha, Rajasthan, Kerala, Tamil Nadu, Tripura, & Uttarakhand, use deep burials to dispose of biomedical waste, which is not recommended as per CPCB guidelines. The status of Biomedical Waste Management (BMW) scenario in India before Covid-19 is shown in Table 1.[18]

Status of Bio Medical Waste Scenario in India: Before Covid-19

(CPCB Annual Report 2018)

Table 1: CPCB Annual Report 2018

No. of Health care Facilities (HCFs)	2,70,416
No. of bedded HCFs	97,382
No. of Non-bedded HCFs	1,73,831
No. of beds	22,06,362
No. of CBWTFs	200*+28**
No. of HCFs granted authorization	1,10,356
No. of HCFs having Captive Treatment Facilities	12,326

No. of Captive Incinerators Operated by HCFs	120
Quantity of bio-medical was tegeneratedin Tones / day	614
Quantity of bio-medical was tetreated in Tones/day	534
No. of HCFs violated BMW Rules	27,301
No. of Show-cause notices /Directions issued to defaulter:	16,956HCFs

COVID 19 SCENARIO IN INDIA

The first cases of COVID-19 in India were reported on 30th January 2020.[19] Lock down was the initial strategy taken by the GOI to prevent and control the pandemic; however, number of cases were increased and followed by this surge of cases the effective biomedical waste management become the prime concern of many developing countries including in India.[20] The Central Pollution Control Board (CPCB), has released guidelines for handling, treatment and safe disposal of BMW generated during treatment, diagnosis and quarantine of patients confirmed or suspected to have the novel coronavirus disease (COVID-19).[21] These recommendations are based on the most recent understanding of COVID-19 and procedures now in use for the management of infectious waste produced in hospitals during the treatment of viral and other contagious diseases like HIV, H1N1, etc. Number of amendments came into act referred as Revision 1, Revision 2, Revision 3, Revision 4 and Revision 5, need assessment make all these revisions.[21]

Disposal of Solid Biomedical Waste

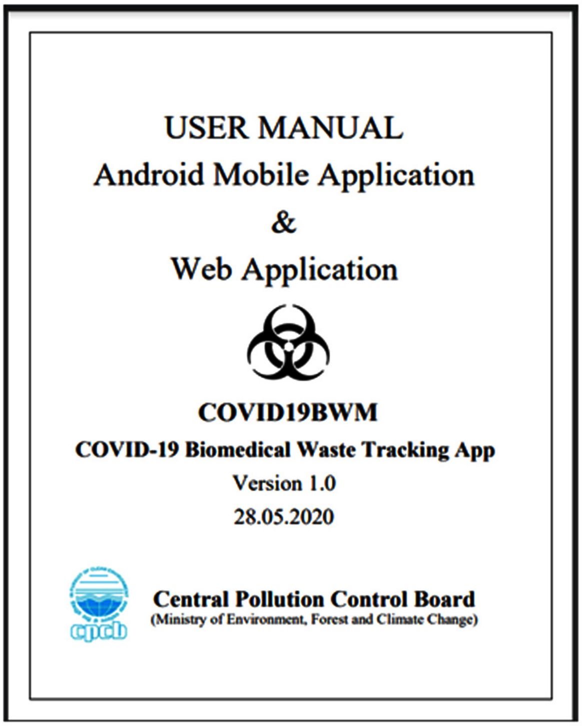
- ❖ The instructions include using double layered bags in the COVID-19 isolation sections and color coded bins for onsite segregation. For disposable PPEs, gloves, and masks, there should be additional, temporary bins in addition to the usual containers (e.g., N95 mask for cleaning and sterilization).[22]

Source: CPCB

- The confirmed COVID-19 positive patient's feces should be collected in a diaper and classified as yellow category BMW, or they can be collected in a pan and flushed in the toilet. For handling the BMW at COVID-19 sites, special carrier trolley and segregation bags should be available.[22]
- For better assessment, handling, and disposal of BMW, the bags and containers should be clearly labelled as "COVID-19."

Source: AIIMS, Delhi

- Daily cleaning should be done with a 1-2% sodium hypochlorite solution on the exterior and interior of the containers and trolleys. A separate record should be maintained for BMW generated from COVID-19 related activities.[22]
- The necessary training and personal safety equipment should be provided to all individuals involved in the handling of BMW (COVID-19). These persons ought to abide by the standard operating procedures, practice good cleanliness and infection prevention practises, and go through routine health examinations. Education, training, and awareness should be provided alongside this on a consistent basis.[22]


USER MANUAL
Android Mobile Application
&
Web Application

COVID19BWM
COVID-19 Biomedical Waste Tracking App
Version 1.0
28.05.2020

Central Pollution Control Board
(Ministry of Environment, Forest and Climate Change)

Source: CPCB

- The central pollution control board's official app (COVID-19 BWM) can be downloaded by facilities, who can then register in the app and easily upload their information.
- The transportation of BMW should be done in special vehicles that are disinfected after each trip. In an effluent treatment plant, liquid waste should be treated chemically, and the disinfection procedure should guarantee the inactivation of coronaviruses.[23-24]

BMW Transport Vehicle

Source: CPCB

Disposal of liquid waste and waste water from hospitals and laboratories

Due to its physical nature, liquid trash is managed differently than solid waste, hence the procedures used to handle solid waste do not apply to liquid waste. The treatment of the liquid waste is the responsibility of every healthcare facility running a STP as well as the terminal sewage plant operators. The hospital and all involved in its handling should make sure that the coronavirus is inactivated or killed. The SOPs established by the pollution control board must be rigorously adhered to by all STP. PPE should be worn by the employees managing the wastewater treatment process. During the pandemic, it is possible to avoid using the STP's treated water.[22-24]

Annual Report Information: A Comparison with Previous year 2019 and 2020

Over time, there are more healthcare institutions than ever before. The total number of healthcare facilities was 3,22,425 in 2019; however, this figure has now climbed to 3,52,014 with increase in the number of beds. Out of the 3,52,014 HCFs, 1,60,736 HCFs are authorized, reflecting an increase in the overall number of healthcare facilities.[25] The overall amount of biomedical waste produced per day was estimated to be 774 tones, of which 656 tones per day were non-COVID biomedical waste and 118 tones per day were COVID biomedical waste. The number of common biomedical waste treatment facilities has increased from 202 to 208, while the number of captive treatment facilities has reduced from 18,015 to 17,206 for the treatment and disposal of generated biomedical waste.[25] Detailed comparison on biomedical waste management scenario is given below.[25]

CPCB Annual Report 2019 & 2020

Particulars	Year 2019	Year 2020
No. of HCFs	3,22,42	35,20,14
No. of Bedded HCFs	1,06,796	1,13,186
No. of Non-bedded HCFs	2,15,780	2,37,938
No. of Beds	24,86,327	2,5,44,116
No. of CBWTFs	202	208
No. of HCFs Utilizing CBWTFs	2,35,571	2,44,282
Number of HCFs granted authorization	1,53,885	1,60,736
No. of HCFs having Captive Treatment Facilities	18,015	17,206
No. of Captive Incinerators Operated by HCFs	136	125
Quantity of bio-medical waste generated in Tonnes/day	619	774
Quantity of bio-medical waste treated in Tonnes/day	544	708
No. of HCFs violated BMW Rules	29,062	22,261
No. of Show-Cause notices/Directions issued to defaulter HCFs	17,435	13, 389

According to information provided in the SPCBs/PCCs' annual reports for the year 2020, there are now 208 CBWTFs operating in the nation, and 33 more are being built. There are no CBWTFs for the treatment and disposal of biomedical waste in the following states: Andaman & Nicobar, Arunachal Pradesh, Goa, Ladakh, Mizoram, Nagaland, Sikkim, and Tripura. However, CPCB asked the above mentioned State Boards to submit a proposal for the construction of CBWTFs so that they may receive funding from the Ministry of Environment, Forests, and Climate Change.[26]

CONCLUSION

Proper Biomedical waste management (BMWM) is not just a legal necessity but also a social responsibility. Management of biomedical wastes is one of the major social responsibilities of individuals as well as Government / State officials. For the proper management of biomedical waste there is a need for thorough sensitization of health care professionals as well as community members using behavior change and communication (BCC) and information education and communication technique (IEC) on a regular basis. Certain precautionary measures and protocols should be followed as a part of BMWM which include vaccination against Hepatitis B, provision of appropriate personnel protective equipment's (PPEs), and maintenance and managements of records. Biomedical waste, if not managed properly, will pose significant environmental and health impact. Recommend monitoring and legal action as significant steps in the management of biomedical wastes.

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Antimicrobial Resistance and Antimicrobial Stewardship

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Abstract

Antimicrobial resistance (AMR) is a real problem across the world. In fact, it is fast emerging as a pandemic. Bacteria acquire resistance antibiotics by many mechanisms. However, AMR also exists in parasites and fungi. Strategic plans and concerted efforts are needed to counter the exceedingly high burden of AMR.

Keywords: Antibiotic; Antimicrobial; Stewardship.

INTRODUCTION

Antimicrobials are a boon to the medical world. Antimicrobial stewardship is the need of the hour, keeping in mind the mounting cases of AMR or Antimicrobial resistance across the world. The problem is especially acute in developing countries of South East Asia, Africa and South America. It is estimated that by 2050, the total number of deaths due to AMR will be higher than deaths due to cancer and road traffic accidents, combined. Only two new classes of antibiotics have come up in the last decade. The development of new antibiotics needs time and lot of money. Hence existing antibiotics should be used cautiously and judiciously.

Antimicrobial resistance due to antimicrobial misuse was predicted long ago by Alexander Fleming, the discoverer of the first natural antibiotic, Penicillin. Now, many bacteria causing infections are resistant to one or more classes of antibiotics. The antibiotic resistance is more pronounced in Gram negative bacteria. However, it is also common in Gram positive bacteria like *Staphylococcusaureus* and *Enterococcus* spp. Often clinicians have to resort to last line antibiotics like Vancomycin and Colistinfor treating drug-resistant bacteria. These pathogens which are notorious for antibiotic resistance are also termed by the acronym ESKAPE pathogens (*Enterococcus spp., Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa* and *Escherichia coli*. They mostly cause nosocomial infections but can also lead to community acquired infections. Interestingly, AMR is a problem not only in the hospital set up but also in the community. According to our own experience, now about 30-46% of uropathogenic Escherichiacolifrom the community are resistant in vitro to Nitrofurantoin, a drug commonly used to treat UTI.

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The role played by environment in AMR

In India open air defecation is still very common in remote villages and this can disseminate drug resistant pathogens into the soil and water.[1] Use of antibiotics in crop production, as manure and in animal husbandry also compounds the problem and makes persistance of multi drug resistant bugs in the environment easier.[2] Poor sanitation, effluents from the pharmaceutical industry and healthcare facilities also renders persistence of antibiotic resistant bacteria easier.[2] In 2021, the WHO, World Organization for Animal Health, FAO and UNEP (United Nations Environmental Program) joined hands to form the One Health quadripartite to combat the health risks including AMR, at the human, animal and plant ecosystem interface.[2]

Key players for high burden of AMR

Several things go into attaining the high burden of AMR in clinical settings, like poor knowledge of antibiotics among the masses, improper implementation of the regulatory acts, improper drug - drug combinations and many other reasons. Other factors can be listed below:

a. Consumption of antibiotics in inadequate doses.

b. Consuming antibiotics when not at all necessary.

c. Availability of antibiotics over the counter.

d. Using antimicrobials as daily injection, thus reducing compliance.

e. Using antibiotics empirically, without sufficient knowledge of susceptibility pattern of common pathogens in the given area.

f. Improper escalation and de-escalation of antibiotics.

g. Lack of knowledge of difference between in vivo and in vitro susceptibility of pathogens to antimicrobials.

h. Budgetary constraints hampering proper surveillance of AMR.[3]

i. Health systems in low income and middle -income countries often have less functional and infrastructural resources to cater to a large population, more so in rural areas, and there universal access to primary healthcare services and antibiotics becomes a major challenge.

j. Prescribing of antibiotics by unqualified medical practitioners or quacks in many peripheral areas.

k. Poor educational status and low awareness among people lead to many myths which can promote self-medication of antibiotics.

l. Hospital acquired bacterial pathogens often possess biofilms comprising bacterial colonies and exopolymeric matrix (EPM), which impairs penetration of antibiotics to the bacterial cells.

m. Use of antibiotics like Colistin and colistimethate rampantly in animal husbandry and also as growth promoters leads to dissemination of dangerous drug-resistant bugs in the community.

ANIMAL HUSBANDRY AND AMR

Antibiotics are often used inadvertently and sometime purposefully in animal husbandry. The use of the antibiotic Avoparcin in food of animal in Europe was primarily responsible for spread of VRE or Vancomycin resistant Enterococci across the world. Effluents from the abattoirs and animal facilities can contain high load of drug resistant n bacteria which get mixed with soil and water and thus can spread AMR to man also.

The pathogens which top the table in AMR

Among bacteria, Methicillin resistant Staphylococcus aureusor MRSA tops the list of pathogens having high load of AMR, followed by multidrug resistant excluding extensively drug resistant tuberculosis (MDR TB), third generation cephalosporin resistant *E-coli*, carbapenem resistant Acinetobacter baumannii, fluoroquinolone resistant *E-coli*, carbapenem resistant K pneumoniae, and third generation cephalosporin resistant K pneumoniae.[4]

Among the pathogenic fungi, non-albicans Candida, particularly Candida auris is notorious for exhibiting antifungal resistance to many antifungal classes of compounds. They are always resistant to Fluconazole. Among parasites, Plasmodium falciparum and Leishmania donovani are often resistant to the available antimicrobials. Among viruses, HIV is notorious for developing resistance to HAART in cases of poor compliance.

Mechanisms of Antimicrobial resistance in microbes

Many mechanisms are there for antibiotic resistance in microbes. In bacteria, the common mechanisms are thickening of cell wall (as in VISA or Vancomycin indeterminate Staphylococcus aureus), altered antibiotic binding site in cell wall or ribosomes (as in MRSA or aminoglycoside or macrolide resistant bacteria). Sometimes, antibiotics are broken down by enzymes of bacteria, as in Beta-lactamases (like ESBL and metallo beta-lactamases) expressed by gram negative bacteria like Escherichia coli and Klebsiella pneumoniae. Aminoglycoside-modifying enzymes confer resistance to this group of drugs in Enterococcus spp.

How to reduce the menace of AMR

Health education is the primary step to reduce the high burden of AMR. Other things like antibiotic stewardship and practising this stewardship will help in reducing the high load of AMR in the community.

Antibiotic ward rounds are also a good way to mitigate the load of AMR. In this, a team of clinicians, laboratory scientists or microbiologist and nurses carry out rounds of patients admitted to the hospital and scrutinize their antibiotic prescriptions for proper dosage and adverse effects keeping in mind their pre-existing health conditions. Pharmacodynamics of a particular drug are also important things to be remembered before prescribing it. India has a National Action Plan on Antimicrobial Resistance. Our national policy for containment of AMR was introduced in 2011. India also saw the Delhi Declaration on AMR, which was endorsed at the Inter-Ministerial Consultation on AMR in April 2017.[5] India also has National action plan on A3MR (NAP) promulgated in 2021, to counter the challenge of AMR, by 6 key mechanisms which include training, spreading awareness about AMR, Information education communication (IEC) activities and other means. Antivirulence strategies or drugs, and also novel therapeutic options like efflux pump inhibitors, also may play a role in the future to bring down the cases of AMR. Awareness programs about AMR and antibiotic awareness week observation can also play decisive role in promoting safe and judicious use of extant antimicrobials. Global action plan and also GLASS are good initiatives to combat AMR. Most importantly, a concerted effort by medical professionals, veterinarians and environmentalists should generate a holistic or one health view point for managing AMR.

DISCUSSION

AMR is a real public health problem across the world, especially in the developing countries of Asia, South America and Africa. It would not be wrong to put it as the next pandemic to hit the world very soon. In 2008, about 29% of isolates of Staphylococcus aureus were found to be methicillin resistant across the World, and by 2014, this figurerose to a whopping 47%.[5] All governments must try and collaborate to bring down the burden of AMR. It affects Gross domestic product adversely, and also imparts a substantial financial burden to the patient.[6] In fact, only AMR can be held responsible for causing loss of about 700000 lives a year.[3] Many factors are responsible for such high burden of AMR, like antibiotic misuse and abuse. In fact, antibiotic misuse, overuse, and improper hygiene and sanitation along with poor implementation of infection control policy are the major drivers for AMR across the world. It had been reported that about 70% of medically important antimicrobial compound are approved for use in veterinary practice.[7] This can lead to a grave situation of antibiotic resistance in most bacterial pathogens. The “ESKAPE” pathogens mentioned earlier cause most of drug resistant nosocomial infections. However now other emergent pathogens are also coming up, like Clostridium difficile, carbapenem-resistant Enterobacteriaceae (CRE) and drug-resistant Neisseria gonorrhoeae which have been reported by US Centers for Disease Control and Prevention (CDC).[8] Vaccination for infections, wherever applicable, and also proper biomedical waste disposal, may also be pivotal for control of antimicrobial resistance. Maintaining good hygiene and proper handwashing alone can bring reduce infections and usage of antimicrobials by about 40%.[3] In this way, pneumococcal vaccination, wherever applicable, can bring down the burden of cases of antibiotic resistant Pneumococcal infections by half or even more.[3]

Other things like including AMR in medical and paramedical curricula may also be helpful.Nurses and other healthcare providers also need to be educated about AMR and infection control to make control of AMR a success.We also need to publish more and more scientific data onthe epidemiology and newer diagnostic methods of AMR. At this moment, the development of an effective in-hospital surveillance and antimicrobial stewardship with unified antimicrobial protocols also seems to be the need of the hour.[5] This can be carried out by the hospital infection control committee. Surveillance for AMR is also needed very badly. The National policy on AMR in India has recommend 3 types of surveillances, namely comprehensive surveillance, sentinel surveillance and point prevalence.[9] We must also promote new and rapid diagnostics to allay misdiagnosis of infections and thus enhance proper antibiotic usage.[10] Clinicians must use broad spectrum antibiotics sparingly, and escalate and deesclatare antibiotics judiciously. Overall, we must also act the community level to make more people aware of the perils of AMR. Public should be more 3 aware of antibiotics and the need to use them sparingly and judiciously. The US government performed the AMR Challenge from 2018 to 2019 using a one health approach, to accelerate the fight against AMR. More such efforts are needed. Concordant with the theme of World antibiotic awareness week 2022, people of diverse disciplines must converge and act together in the wake of one health, to bring down the high burden of AMR.

CONCLUSION

AMR is a real cause for worry and if not tackled now, it is likely to become a major headache for clinicians as well as laboratory people. All must try to bring down AMR to manageable levels by proper diagnostics, spreading awareness and promoting antibiotic stewardship.

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A Study of Malaria in National Capital Territory (NCT) of Delhi

Arvind Nath

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Abstract

Background: To the best knowledge of the author, there is no available literature on the status of Malaria in NCT of Delhi. Hence the preparation of this document.

Objectives: To find out the parameters of Malaria in NCT of Delhi till as recently as possible.

Methods: By studying the documents prepared by the National Centre for Vector Borne Diseases (NCVBD) and doing a web search on Malaria in NCT of Delhi.

Results: It is seen that the Annual Parasite Incidence (API) of Malaria in NCT of Delhi had come down to the very low level of 0.02 in 2018 and that there were only 102 cases of Malaria in NCT of Delhi during 2021 as of September 28th of that year.

Conclusions: NCT of Delhi is very close to achieving near-elimination goals but will have to take active measures to reach it.

Keywords: Malaria; Delhi; API; NCVBD; WHO.

INTRODUCTION

NCT of Delhi is in the northern part of India. It is bordered byHaryana in the North, West and South and by Uttar Pradesh in the East.

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MATERIAL & METHODS

The study design included analysis of the annual reports of the Malaria Division of the National Centre for Vector Borne Diseases Control (NCVBDC) for 2017 and 2018 and a web search for information on Malaria in NCT of Delhi.

RESULTS

According to the most recent data available on the NCVBDC website (data for 2018), the API for NCT of Delhi was 0.02.[2] It's comparison with the API from 2017 can be seen from the following table:

Further search revealed the following information on Malaria cases in NCT of Delhi during 2019, 2020

Fig. 1: Map of NCT of Delhi [*Source:* (1)]

and 2021 and is shown in the following table:

Table 1: API of NCT of Delhi, 2017 and 2018

Union Territory	Year	
	2017	2018
NCT of Delhi	0.03	0.02

Sources: (2) and (3)

Table 2: Data on Malaria Cases in NCT of Delhi, 2019, 2020 and 2021

Reference Period	Number of Malaria Cases
January 1, 2019, to August 17, 2019	111
January 1, 2020, to September 25, 2020	149
January 1, 2021, to September 28, 2021	102

Sources: (4) and (5)

DISCUSSION

Beginning in 2017, there is a decline in the incidence of malaria in NCT of Delhi with a mild increase during 2020.

In 2016, the Government of India adopted a framework for Malaria Elimination in India covering the period 2016 – 2030.[6] This was based on WHO's Global Technical Strategy for Malaria covering the period 2016 – 2030 which was adopted in 2015 and updated in 2021.[7]

The aim is to reach zero Malaria cases by 2027 and then wait for three years before WHO can grant Malaria-free status certification. It is already nearly the middle of 2022 and India is about to reach the halfway mark of the period from 2016 to 2027.

CONCLUSION

Although NCT of Delhi did not reach zero Malaria cases in 2021, it did reach an API of 0.02 during 2018. Therefore, it is a good candidate for being the first administrative territory in the country close to being able to achieve near elimination goals.

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[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

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[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

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[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

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[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

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[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

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