COVID-19 IMPACT UPON BIOMEDICAL-WASTE AND OUR ENVIRONMENT

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ABSTRACT

Medical science and medical facilities are divine but at the same time waste generated from it, if not treated and disposed properly then it becomes dangerous for our life and also for our environment. It has direct impact upon human health and environment. Outbreak of COVID-19 pandemic in the whole world result in rapid influx of Bio-medical waste (BMW). It is a viral disease and spread very fast. COVID-19 BMW (C-BMW) contents mainly personal protective kits (PPE), chemicals, masks, single used plastic, rapid antigen kits (RAT Kits) and many others and come under the yellow category BMW (Y-BMW). This paper focuses on massive amount of BMW produced during COVID-19 pandemic in my study area. This massive amount of BMW becomes alarming issue. Central pollution control board (CPCB) developed a software named "COVID-19 BMW" for waste tracking which can track BMW at the time of generation, collection and disposal.

Keywords: C-BMW, COVID-19, pandemic, RAT Kits

1. INTRODUCTION

For providing modern and better healthcare facilities in hospitals and in healthcare centers before and during this COVID-19 pandemic are major cause of BMW and C-BMW. The term "Health Care Waste" or "Bio-Medical Waste" includes all the wastes from any medical procedure in healthcare facilities, research centers and laboratories (WHO,2017).

On March11,2020, the World Health Organization (WHO) declaresCOVID-19 to be a pandemic. It also effects BMW management practices along worldwide. The generation of medical waste in Wuhan, China, increased by 600% during the COVID-19 outbreak (Jiajun,2020). Increased production, inappropriate handling, and restrictions on recycling to stop the spread of the virus have created a dangerous situation (Zambrano Monserrate et al.,2020). Several scholars have cited the management of BMW throughout this outbreak as a serious source of worry (Wang et al.2020; Boora et al.2020; Gupta and Agrawal,2020; Misra et al.2020; Shammi et al.2020), It could make it more likely for the disease to spread through several channels. To capture the ongoing scholarly debate on COVID-19-related BMW, a thorough review of research publications has been conducted (Yang et al.2018; Mardani et al.2019; Moher et al.2015). There are so many deaths due to this pandemic outbreak in the world which leads to build up the piles of dead bodies around our environment and during this pandemic the BMW kg/day also rises. It is viral disease and effect BMW management at large extent due to its fast-spreading nature.

Some of the elements influencing waste management include the behaviour of waste producers, waste segregation, human resource capacity (staff and authority), a well-established transportation system with treatment and disposal infrastructures, and monitoring functions (Amitha and Manoj,2020; Di Foggia and Beccarello,2020; Datta et al.2018).

During COVID pandemic central pollution control board (CPCB) developed a software named "COVID 19 BMW" for waste tracking which is capable of tracking BMW at each stage of production, acquisition, and disposal. In a later modification of the guidelines (CPCB, 2020a), guidance on

Used personal protective equipment (PPE) disposal

Electronic tracking app "COVID-19 BMW"

Sanitation and safety of waste handler

Segregation of BMW and general waste

Infection prevention training to waste handler

The average BMW related to COVID-19 is about 169 MT in August 2020, (CPCB 2020b). This huge amount of COVID-19 BMW (C-BMW) content mainly PPE kits, masks, single used plastic, chemicals. According to estimates, each COVID patient in India produces over 3.41 kg per day, which is nearly twice as much than the BMW produced on average days. (Manasi et al., 2014).

2. MATERIAL AND METHODS

Current research has been carried out in Siwan, Bihar, India within a time period of three years (January 2019 to December 2021).

Primary and secondary data were collected from Bihar State Pollution Control Board (BSPCB) Patna and District Health Society (DHS) of Siwan.

Data collection of "Daily Collection Report of Biomedical Waste" of Sadar hospital and many private hospitals in Siwan (Bihar) by Medicare Environmental Management Pvt. Ltd. Muzaffarpur, Bihar, India.

3. RESULT AND DISCUSSION

According to the Bihar State Pollution Control Board (BSPCB) Patna, the pervious data of BMW of Bihar showed the huge amount of BMW generated during 2019, 2020 and 2021. Overall total BMW generated per day in Bihar State in year 2019 was 34812.90 kg, in year 2020 it was 27846.15 kg, and in year 2021 it was 20548.81 kg (Table.1, Table.2, and Table.3) while in year 2019 the total amount of BMW generated in Siwan District per day was 917.42 kg, in year 2020 it was 5874.48 kg, and in year 2021 it was 384.53 kg (Table.4.). The percentage of BMW generated in Siwan in year 2019 was 13%, in year 2020 was 82% and in year 2021 was 5%(Fig.1.).

3.1 TABLE- DISTRICT WISE BIOMEDICAL WASTE GENERATION-2019

SL. NO.	NAME OF THE STATE/UNION TERRITORY	DISTRICT	QUANTITY OF BIOMEDICAL WASTE GENERATED(KG/DAY)
1.	BIHAR	ARWAL	79.29
2.	BIHAR	ARARIA	429.8
3.	BIHAR	AURANGABAD	450.57
4.	BIHAR	BANKA	215.92
5.	BIHAR	BUXAR	251.82
6.	BIHAR	BHOJPUR	769.19
7.	BIHAR	BEGUSARAI	981.75
8.	BIHAR	BHAGALPUR	1926.95
9.	BIHAR	DARBHANGA	1363.14
10.	BIHAR	EAST CHAMPARAN	1252.46

11.	BIHAR	GAYA	1316.42
12.	BIHAR	GOPALGANJ	562.47
13.	BIHAR	JAMUI	348.61
14.	BIHAR	JEHANABAD	238.4
15.	BIHAR	KATIHAR	782.64
16.	BIHAR	KISHANGANJ	561.5
17.	BIHAR	KHAGARIA	412.64
18.	BIHAR	KAIMUR	237.98
19.	BIHAR	LAKHISARAI	111.81
20.	BIHAR	MUNGER	363.63
21.	BIHAR	MUZAFFARPUR	1611.47
22.	BIHAR	MADHEPURA	430.17
23.	BIHAR	MADHUBANI	464.94
24.	BIHAR	NALANDA	1424.62
25.	BIHAR	NAWADA	430.0
26.	BIHAR	PATNA	7895.37
27.	BIHAR	PURNEA	1297.64
28.	BIHAR	ROHTAS	588.26
39.	BIHAR	SITAMARHI	554.93
30.	BIHAR	SAMASTIPUR	1971.56
31.	BIHAR	SHEOHAR	121.49
32.	BIHAR	SIWAN	917.42
33.	BIHAR	SARAN	810.25
34.	BIHAR	SUPAUL	439.03
35.	BIHAR	SAHARSA	629.93
36.	BIHAR	SHEIKHPURA	142.28
37.	BIHAR	VAISHALI	1596.24
38.	BIHAR	WEST CHAMPARN	830.31
TOTAL			34812.90

3.2 TABLE-DISTRICT WISE BIOMEDICAL WASTE GENERATION-2020

SL. NO.	NAME OF THE STATE/UNION TERRITORY	DISTRICT	QUANTITY OF BIOMEDICAL WASTE GENERATED(KG/DAY)
1.	BIHAR	ARWAL	24.14
2.	BIHAR	ARARIA	21.0
3.	BIHAR	AURANGABAD	455.97
4.	BIHAR	BANKA	2.6
5.	BIHAR	BUXAR	249.6
6.	BIHAR	BHOJPUR	245.44
7.	BIHAR	BEGUSARAI	1056.22
8.	BIHAR	BHAGALPUR	430.63
9.	BIHAR	DARBHANGA	889.55
10.	BIHAR	EAST CHAMPARAN	2642.64
11.	BIHAR	GAYA	741.48
12.	BIHAR	GOPALGANJ	1035.0
13.	BIHAR	JAMUI	575.1
14.	BIHAR	JEHANABAD	1731.0
15.	BIHAR	KATIHAR	558.78
16.	BIHAR	KISHANGANJ	496.45
17.	BIHAR	KHAGARIA	5060.18
18.	BIHAR	KAIMUR	245.63
19.	BIHAR	LAKHISARAI	90.31
20.	BIHAR	MUNGER	204.69
21.	BIHAR	MUZAFFARPUR	620.97
22.	BIHAR	MADHEPURA	334.73
23.	BIHAR	MADHUBANI	1146.19
24.	BIHAR	NALANDA	557.46
25.	BIHAR	NAWADA	405.0
26.	BIHAR	PATNA	1777.0
27.	BIHAR	PURNEA	681.73
28.	BIHAR	ROHTAS	807.28

39.	BIHAR	SITAMARHI	489.8
30.	BIHAR	SAMASTIPUR	86.61
31.	BIHAR	SHEOHAR	110.35
32.	BIHAR	SIWAN	5874.48
33.	BIHAR	SARAN	371.5
34.	BIHAR	SUPAUL	478.5
35.	BIHAR	SAHARSA	127.9
36.	BIHAR	SHEIKHPURA	130.5
37.	BIHAR	VAISHALI	595.04
38.	BIHAR	WEST CHAMPARN	30.64
		TOTAL	27846.15

3.3 TABLE-DISTRICT WISE BIOMEDICAL WASTE GENERATION-2021

SL. NO.	NAME OF THE STATE/UNION TERRITORY	DISTRICT	QUANTITY OF BIOMEDICAL WASTE GENERATED(KG/DAY)
1.	BIHAR	ARWAL	64.79
2.	BIHAR	ARARIA	210.76
3.	BIHAR	AURANGABAD	449.22
4.	BIHAR	BANKA	146.13
5.	BIHAR	BUXAR	170.57
6.	BIHAR	BHOJPUR	540.74
7.	BIHAR	BEGUSARAI	855.38
8.	BIHAR	BHAGALPUR	1079.3
9.	BIHAR	DARBHANGA	1113.8
10.	BIHAR	EAST CHAMPARAN	607.3
11.	BIHAR	GAYA	1027
12.	BIHAR	GOPALGANJ	860
13.	BIHAR	JAMUI	74.6
14.	BIHAR	JEHANABAD	271.7
15.	BIHAR	KATIHAR	486
16.	BIHAR	KISHANGANJ	429.3

17.	BIHAR	KHAGARIA	263.3
18.	BIHAR	KAIMUR	135.4
19.	BIHAR	LAKHISARAI	205.7
20.	BIHAR	MUNGER	396.63
21.	BIHAR	MUZAFFARPUR	1563
22.	BIHAR	MADHEPURA	271.5
23.	BIHAR	MADHUBANI	374
24.	BIHAR	NALANDA	405
25.	BIHAR	NAWADA	262.4
26.	BIHAR	PATNA	4263
27.	BIHAR	PURNEA	553.1
28.	BIHAR	ROHTAS	292.34
39.	BIHAR	SITAMARHI	335.44
30.	BIHAR	SAMASTIPUR	487
31.	BIHAR	SHEOHAR	47.4
32.	BIHAR	SIWAN	384.53
33.	BIHAR	SARAN	430.6
34.	BIHAR	SUPAUL	122.23
35.	BIHAR	SAHARSA	307.16
36.	BIHAR	SHEIKHPURA	87.12
37.	BIHAR	VAISHALI	683.74
38.	BIHAR	WEST CHAMPARN	291.63
		TOTAL	20548.81

3.4 TABLE- YEAR WISE GENERATION (WT.) OF BIOMEDICAL WASTE IN SIWAN DISTRICT

YEAR 2019	YEAR 2020	YEAR 2021
917.42 kg/day	5874.48 kg/day	384.53 kg/day
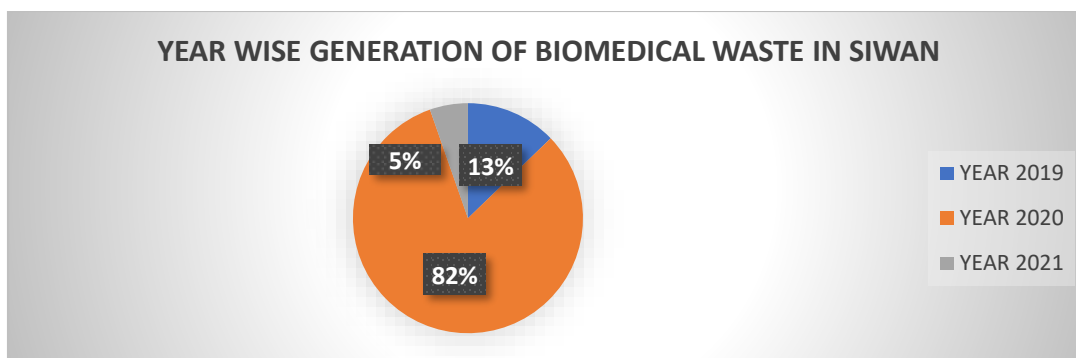
Fig.1. Percentage of BMW Generation in Siwan District

In the duration of pandemic COVID-19 the amount of BMW produced increased many folds in comparison to the normal days in all over the world and in India also. Estimation shows that health-care waste generation rise by 600% in the middle of COVID-19 outbreak in Wuhan in China (Jiajun, 2020) and each COVID -infected patient in India generate 3.41kg/day approximately which is nearly double than the BMW generated during normal days (Manasi et al., 2014). In Siwan District rise in BMW graph also increased by many folds during the pandemic time. The percentage of BMW generated in Siwan in year 2019 was 13%, in year 2020 was 82% and in year 2021 was 5%(Fig.1.). The huge gap of BMW generation in year wise in our district is arised due to pandemic COVID-19 impact. In comparison to 2019, the COVID-19'year i.e., 2020 showed that there was increased in BMW graph by approximately 6 times and again this graph gone down and decreased by 16 times in year 2021. There were many isolation centers made in the Siwan District during the COVID-19 time for the treatment of COVID-19 patients i.e., Sadar Hospital Siwan, Ayurvedic Medical College Siwan, DIET, Mahadeva, Unani Medical college, Maharajganj and etc. These isolation centers are major cause of C-BMW and specially Y-BMW. Biomedical waste generated/bed/day was increased at large extent during the treatment of COVID-19 patients and this finally increased the total BMW produced in the Siwan District. In Siwan District BMW/bed/day was 0.37 kg/bed/day in 2019, 3.92 kg/bed/day in 2020 and 0.13 kg/bed/day in 2021 were noted (Table.5., Table.6., and Table.7.).

3.5 TABLE-AVERAGE BMW/BED/DAY OF SIWAN DISTRICT-2019

HCF (Approximate)	Total No. Of Beds (Appx.)	Total No. Of Active Beds (Approximate)	Average BMW/Day	Average BMW/Bed/Day
1200	3500	2500	917.42 Kg	0.37 Kg

3.6 TABLE-AVERAGE BMW/BED/DAY OF SIWAN DISTRICT-2020

HCF (Approximate)	Total No. Of Beds (Appx.)	Total No. Of Active Beds (Approximate)	Average BMW/Day	Average BMW/Bed/Day
1200	3500	1500	5874.48 Kg	3.92 Kg

3.7 TABLE-AVERAGE BMW/BED/DAY OF SIWAN DISTRICT-2021

HCF (Approximate)	Total No. Of Beds (Appx.)	Total No. Of Active Beds (Appx.)	Average BMW/Day	Average BMW/Bed/Day
1500	4000	3000	384.53 Kg	0.13 Kg

In year 2019 Siwan produced 917.42 kg/day while its periphery district Gopalganj and Saran produced 562.47 kg/day and 810.25 kg/day respectively (Table.8.), in year 2020 Siwan District produced 5874.48 kg/day and its periphery District Gopalganj and Saran produced 1035 kg/day and 317.5 kg/day respectively (Table.9.). While in year 2021 Siwan produced 384.53 kg/day and its periphery District Gopalganj and Saran produced 860 kg/day and 430.6 kg/day respectively (Table.10.). Its year-wise percentage of wt. are shown

in pie-chart, in year 2019 its percentage was 40% in Siwan, 25% in Gopalganj, and 35% in Saran (Fig.2.). In year 2020 its percentage of wt. was 81% in Siwan, 14% in Gopalganj, and 5% in Saran (Fig.3.). And in year 2021 its percentage of wt. was 23% in Siwan, 51% in Gopalganj, and 26% in Saran (Fig.4.). As a whole comparative BMW produced in Siwan District and its periphery district Gopalganj and Saran in year 2019, 2020 and 2021 were shown graphically in Fig.5. This graph indicates a clear line between pandemic and non-pandemic time BMW generation and this graph also indicates that Siwan is more BMW producer during pandemic COVID-19 among its periphery district, i.e., Gopalganj and Saran District. There are a number of gaps in the country's current management system for BMW that may have created a terrible working environment for BMW-COVID-19 management. Lack of knowledge, the critical need for technical and non-technical staff training, poor segregation, etc. are some of the issues that must be addressed to improve effective implementation (Pandey et al.2020; Krishna et al., 2018; Archana et al., 2016; Goyal et al., 2017; Soyam et al., 2017; Sudeep et al., 2017). In non-pandemic situations, costs for the safe management and disposal of hazardous health-care waste are often ten times greater than those for general waste (WHO, 2018); in contrast, in India, it has been found that fund storage is the main challenge to effectively adopting BMWM (Datta et al., 2018). If COVID-19-related BMW management is taken into account, this cost estimate may have climbed significantly.

Additional emphasis on innovation of environmentally friendly technologies and capacity building of healthcare workers and waste-handlers are other concerns to be prioritized for safe collection, treatment, and disposal of BMW. Authorities can benefit from BMW management's experience in this worldwide crisis in order to create a system that is ready for safe disposal in the post-COVID-19 scenario and to offer guidance for future disaster preparedness. (Goswami et al.,2021).

3.8 TABLE-COMPARATIVE STUDY OF BMW IN SIWAN DISTRICT AND ITS PERIPHERY OF 2019

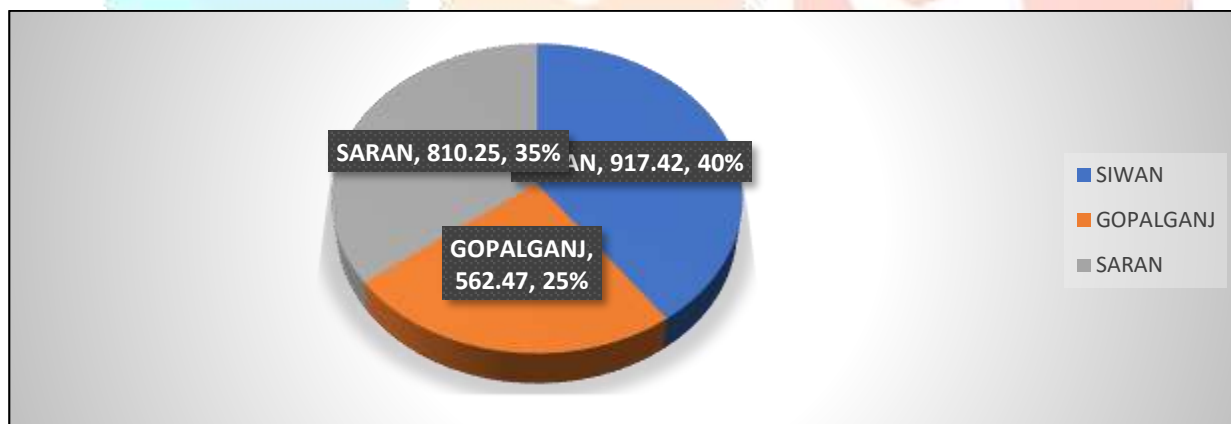| AREA	SIWAN	GOPALGANJ	SARAN
KG/DAY	917.42 KG	562.47 KG	810.25 KG

Fig.2. BMW of Siwan District and its Periphery in 2019

3.9 TABLE-COMPERATIVE STUDY OF BMW IN SIWAN DISTRICT AND ITS PERIPHERY OF 2020

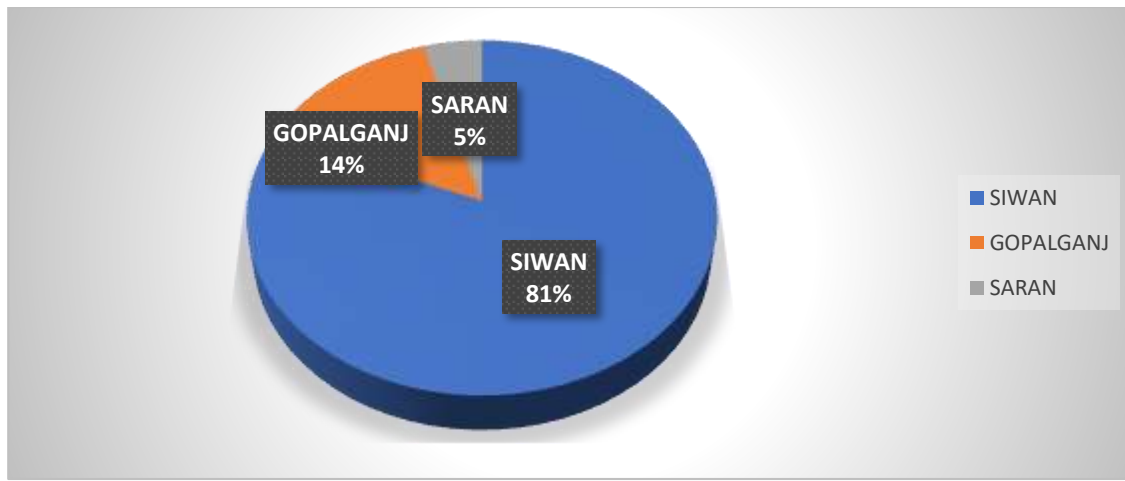| AREA	SIWAN	GOPALGANJ	SARAN
kg/day	5874.48	1035	371.5

Fig.3. BMW of Siwan District and its Periphery in 2020

3.10 TABLE-COMPERATIVE STUDY OF BMW IN SIWAN DISTRICT AND ITS PERIPHERY OF 2021

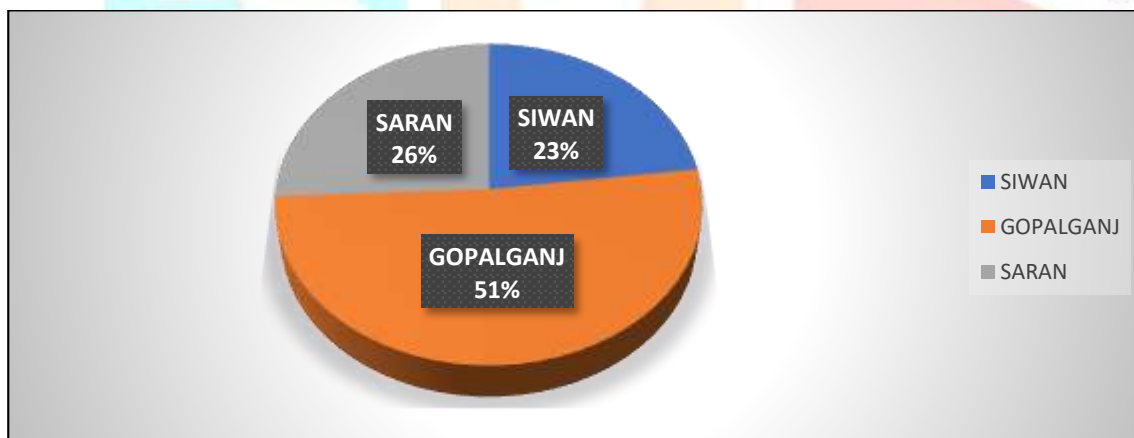| AREA	SIWAN	GOPALGANJ	SARAN
KG/DAY	384.53	860	430.6

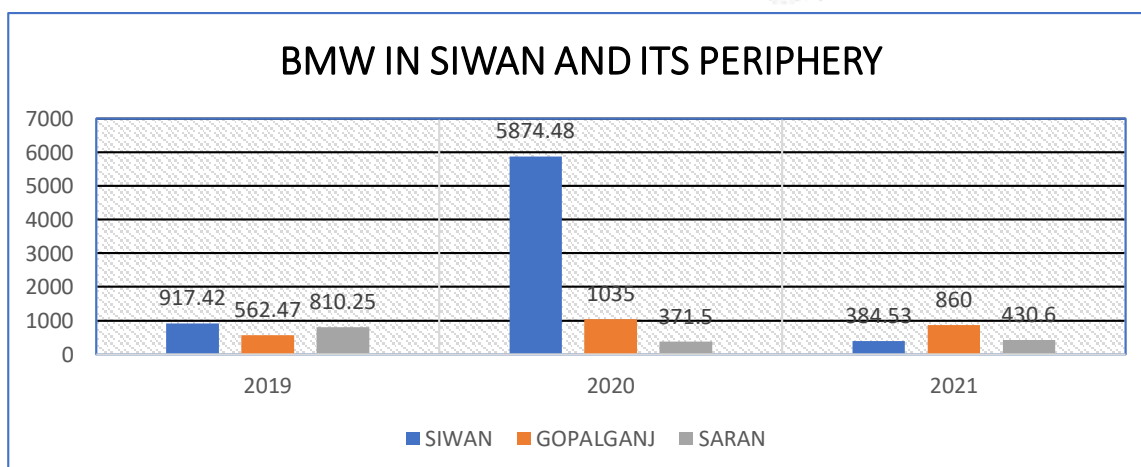Fig.4. BMW of Siwan District and its Periphery in 2021

FIG.5. GRAPH OF COMPERATIVE STUDY OF BMW IN SIWAN DISTRICT AND ITS PERIPHERY OF 2019, 2020 AND 2021

4. CONCLUSION

Siwan is loaded patient zone area. So many health-care facilities are found here that's why it attracts no. of patients from its periphery area. And in this manner, it become a huge amount of BMW generator. A very high graph was seen during the COVID-19 pandemic in this area in comparison to its periphery district i.e., Gopalganj and Chapra. Huge amount of BMW imposes a heavy burden upon its immediate environment. The huge amount of BMW also affects the BMW/bed/day of this area, during COVID-19 pandemic it attains a peak in graph with value 3.92 kg/bed/day. Other than COVID-19 pandemic it also produces massive amount of BMW. Violation of rules and regulations are major hinderance in proper and scientific management of BMW in the town. So, it is very necessary to take a legal action against this, for healthy and cleaner environment.

5. ACKNOWLEDGEMENT

6. CONFLICT OF INTEREST

No conflict of interest.

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