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What is the impact of Covid-19 on the Antenatal Care Services Utilization in Public-Private-Rural-Urban Hospitals of India during the COVID-19 Pandemic Period of 2020-2021 compared to pre-pandemic era 2018-2019?

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RESEARCH ARTICLE

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Abstract: The ongoing coronavirus (COVID-19) pandemic is well documented to have a disastrous effect on the health-care services, particularly pregnancy-related health services. In order to provide the information to the scientific community and policy makers with accredited evidence and data in the country, this retrospective cross-sectional mixed research study aims to find out the impact of the COVID-19 pandemic on antenatal services utilization among pregnant women of India attending public/private/rural/urban health facilities in 36 states and union territories. Hence, the researcher hopes that result and analysis will be beneficial to important stakeholders as well as policy makers in designing strategies for prioritizing pregnancy healthcare even within the ongoing COVID-19 pandemic period.

Overall, 96990524 women registered for ANC during the study period. The analysis shows that the covid-19 pandemic era has a negative impact on several indicators. The study revealed that there is a significant increase in ANC service utilization at urban health facilities of all the services as compared to the pre-pandemic era on a cumulative all-India basis.

Enhancing women's knowledge of protective health services, prioritizing maternal care-related health services during ongoing COVID-19, and improving the accessibility of ANC service should be emphasized for getting maximum benefit to the neediest.

Keywords: *antenatal care, health facility, utilization, coronavirus disease, pregnant women, India*

INTRODUCTION

Antenatal care services are well documented by several researchers to be affected by the COVID-19 pandemic despite the truth that pregnant women are considered a vulnerable group [1]. However, the SARS-CoV-2 pandemic has led to maternity services disruptions in providing antenatal care due to the government enforced covid-19 restrictions regarding social distancing, etc., which has negatively impacted access to routine antenatal care.

The SARS-CoV-2, which causes disease (COVID-19), has spread globally since emerging in December 2019, and the World Health Organization (WHO) declared this a global pandemic on March 11, 2020[2]. Total number of 343,516,850 confirmed cases and **5,594,994** deaths **275,116,452 recovered** were reported globally as of January 21, 2022, 10:43 GMT [3].

The WHO defines Antenatal care as the care given to a pregnant mother before birth, and it involves education, screening, counseling added with the treatment of problems, and immunization [4]. Antenatal care is the first contact opportunity for a pregnant woman to get connected with available-accessible-affordable health services and linking herself with pregnancy-related complications to an established health-referral system.

Maternal mortality is significantly high. Almost 295 000 women died during and following due to pregnancy and childbirth-related causes in 2017. The great majority of these deaths (94%) were reported in low-resource settings, and the majority could have been prevented [5]. Antenatal healthcare is targeted to reduce maternal morbidity and mortality by providing and educating about health promotion, danger signs, birth preparedness, and proper timely care for pregnancy complications. The WHO recommends a minimum of 04 ANC visits per pregnancy for pregnant women. NFHS Studies conducted in different states of India reported that educational status, maternal age, number of living children, occupation, place of residence, religion, socio-economic status, and previous obstetric history were significant factors associated with the use of antenatal care service [6].

The COVID-19 pandemic challenged not only India but global

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countries to provide good quality, essential maternal and newborn health services [7]. Pregnant women and newborns have experienced difficulties accessing health services due to lockdown measures or found to be reluctant to visit health facilities due to fear of possible infection[8]. The disruption of maternity services and moving resources away from most essential pregnancy care, due to COVID-19 response, increased risks of maternal morbidity and mortality [9]. Anxiety, domestic violence, and mental health problems in pregnant women were reported to be increased during the ongoing covid-19 pandemic [10,11]. The indirect effects of COVID-19 on various other diseases at the population level, as a result of lockdown, social restrictions, and reorganization of health systems, is evident in several research studies[12]

The negative impact of containment and covid-19 policies on mortality at the emergency department is also evident from several research studies [13]. To the best of the researcher/author's knowledge, there is no published research till today 22-01-2022 exploring the effect of the COVID-19 pandemic on antenatal care services utilization by analysing 20 accredited times bound indicators for pregnant women in the country. This kind of research study is not done only in India, but also on a global basis, the author has not found such a study which can clearly mark the impact of covid-19 on ANC through several processes or output indicators.

In order to provide the information to the scientific community and policy makers with accredited evidence and data in the country, this retrospective cross-sectional mixed research study aims to find out the impact of the COVID-19 pandemic on antenatal services utilization among pregnant women of India attending public/private/rural/urban health facilities in 36 states and union territories. Hence, the researcher hopes that result and analysis will be beneficial to important stakeholders as well as policy makers in designing strategies for prioritizing pregnancy healthcare even within the ongoing COVID-19 pandemic period.

Materials and Methods

Study Setting

The study was conducted by continuous observation of health facilities data found in HMIS of MoHFW, which is also available online. The population covered is 36 states and union territories of India. According to the data obtained from HMIS, the total ANC registered during this period is 96990524 numbers of females. In the country there are private, public, rural, and urban hospitals, delivering ANC services. The financial burden of ANC services in the public hospital of India is cost-free, covered by state and central governments. For getting treatment at private health facilities the pregnant women or family have to pay as oope (out of pocket expense) until unless covered by some government-sponsored scheme.

Study Design and Period

A health facility-based retrospective mixed cross-sectional study was conducted for pregnant women who attended ANC and takes the available services in the selected health facilities from 1st January 2018 to 31st May 2021. The first documented covid-19 case in India was found in January 2020[14]. Hence the year before 2020 i.e. 2018 and 2019 is the pre-pandemic period utilized for comparison with the ongoing covid-19 pandemic period i.e.2020 and 2021 (up to May as data from the accredited source is available till this month). The average per month is calculated and the pandemic era is compared with the pre-pandemic era to find out the impact of covid-19 on ANC services utilization.

Population

The actual population was all the pregnant women who attended ANC or utilized ANC related health services in the selected health facilities of choice, during the data collection period of this research study was considered as the study population. Accordingly, a total of 96990524 numbers of female pregnant women who fulfilled the inclusion criteria were included in the study.

Sample Size and Sampling Technique

A total of 96990524 women registered for ANC were included in the study with a purposive sampling technique. The data required for this study is collected from HMIS of the Ministry of Health and Family Welfare (MoHFW) which is the most accredited data source in India. The total number of indicators included for the study was 25. The data collected is analysed with the help of Microsoft office.

Study Variables and Operational Definition

The outcome variable of this research study was antenatal care utilization. Antenatal care utilization for this study was defined as

1. The total number of pregnant women registered for ANC
2. Out of the total ANC registered, the number registered within 1st trimester (within 12 weeks)
3. Number of PW given TT1/ Td1
4. Number of PW given TT2 / Td2
5. Number of PW given TT Booster/ Td Booster
6. Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets

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7. Number of PW provided full Course 360 Calcium tablets
8. Number of PW given one Albendazole tablet after 1st trimester
9. Number of PW received 4 or more ANC check ups
10. Number of PW given ANC Corticosteroids in Pre Term Labour
11. Out of the new cases of PW with hypertension detected, cases managed at the institution
12. Number of Eclampsia cases managed during delivery
13. Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs
14. Number of PW having severe anaemia (Hb < 7) treated
15. Number of PW tested for Blood Sugar using OGTT(Oral Glucose Tolerance Test)
16. The number of PW tested positive for GDM
17. Number of PW given insulin out of total tested positive for GDM
18. Number of PW tested using POC test for Syphilis
19. Number of pregnant women tested for Syphilis
20. Number of syphilis positive pregnant women treated for Syphilis,

Data Collection and Quality Assurance

Data were continuously collected, observed analysed using Microsoft office software from electronic records of HMIS from MoHFW. The whole data collection and analysis is solely done by the author. To assure data quality the researcher has taken the help of his wife to do cross-check as well. Furthermore, there was daily supervision of data collected in the data collection process. Finally, it was checked for accuracy, reliability, completeness, and consistency.

Data Management and Analysis

All data was checked for inconsistencies, any missing values, and for incompleteness, then entered into Microsoft office software and also exported to STATA for further analysis.

Data Availability

The data for study is available on HMIS of Ministry of Health and Family Welfare, Government of India. The link to the source is given below:-

https://hmis.nhp.gov.in/#!/standardReports

Ethical Consideration

Ethical clearance was not applicable as this research study have not utilized any human or animal for trials etc. or involved them in any way which requires ethical considerations. Furthermore, the data used is available for the public and the researcher have not disclosed any hidden or secret data. The purpose of this study is well explained above, and consent or approval is not required for such studies based on secondary data available in public domain. The researcher is a medical doctor and this research study is a part of author usual routine.

Results

Socio-Demographic Characteristics of Respondents

A facility-based retrospective mixed cross-sectional study was conducted from 1st January 2018 to 31st May 2021 for pregnant women attending all /public/private/rural/urban ANC services in 36 states and union territories of India. Thus, a total of 96990524 women registered for ANC were included in the study with a purposive sampling technique. See Table 1, 2, 3, 4, 5,(some extra data table is also attached at the end for researchers interest)

This research study is ongoing and more analysis and interpretation will be available in the next version of this research study with more data.

Impact of COVID-19 Pandemic on ANC Service Utilization

Table – 1- Comparison of ANC service utilization across India (all health facilities) before and after the covid-19 pandemic

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Indicator/ Variable	Average per month-Pandemic Era (2020-21)	Average per month-Pre-Pandemic Era (2018-2019)
Total number of pregnant women registered for ANC	**2309294.7**	**2414769**
Out of the total ANC registered, number registered within 1st trimester (within 12 weeks)	**1725702.3**	**1662208**
Number of PW given TT1/ Td1	**1650691.2**	**1734836**
Number of PW given TT2 / Td2	**1459628.4**	**1555820.5**
Number of PW given TT Booster/ Td Booster	**514934.24**	**497145.75**
Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets	**2080879.9**	**2072583.5**
Number of PW provided full Course 360 Calcium tablets	**1853213.6**	**1474173.5**
Number of PW given one Albendazole tablet after 1st trimester	**1143783**	**945783.85**
Number of PW received 4 or more ANC check ups	**1801079**	**1802186.5**
Number of PW given ANC Corticosteroids in Pre Term Labour	**38021.317**	**35867.25**
New cases of PW with hypertension detected	**46943.875**	**48617.71**
Out of the new cases of PW with hypertension detected, cases managed at institution	**33567.525**	**32482.96**
Number of Eclampsia cases managed during delivery	**5051.6167**	**5005.875**
Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs	**1803885.8**	**1927255.5**
Number of PW having Hb level<11 (out of total tested cases)(7.1 to 10.9)	**1508156**	**1706392.5**
Number of PW having Hb level<7 (out of total tested cases)	**72676.35**	**88738.625**
Number of PW having severe anaemia (Hb < 7) treated	**44108.592**	**49309.625**
Number of PW tested for Blood Sugar using OGTT(Oral Glucose Tolerance Test)	**368095.89**	**343927.75**
The number of PW tested positive for GDM	**10798.183**	**11486**
Number of PW given insulin out of total tested positive for GDM	**2990.3917**	**2328.4165**
Number of PW tested using POC test for Syphilis	**215142.48**	**32339.21**
Out of above, number of PW found sero-positive for Syphilis	**1499.9917**	**379.2083**
Number of pregnant women tested for Syphilis	**694791.53**	**732651.45**
Number of pregnant women tested found sero positive for Syphilis	**3670.8917**	**3673.542**
Number of syphilis positive pregnant women treated for Syphilis	**1573.55**	**1261.375**

The study revealed that there is decrease in ANC service utilization of following services as compared to pre-pandemic era on cumulative all India basis:-

- Total number of pregnant women registered for ANC-Number of PW given TT1/ Td1
- Number of PW given TT2 / Td2
- Number of PW received 4 or more ANC check-ups
- Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs
- Number of pregnant women tested for Syphilis

An important finding is an increase in following ANC service utilization during covid-19 pandemic Era:-

- Number of PW tested using POC test for Syphilis
- Out of above, number of PW found sero-positive for Syphilis
- Number of syphilis positive pregnant women treated for Syphilis

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Table – 2- Comparison of ANC service utilization at public health facilities across India before and after covid-19 pandemic

Indicator /	Public Average per month-Pandemic Era	Public Average per month-Pre-Pandemic Era
Total number of pregnant women registered for ANC	**2208203**	**2314360**
Out of the total ANC registered, number registered within 1st trimester (within 12 weeks)	**1662352.5**	**1605446.5**
Number of PW given TT1/ Td1	**1566090.5**	**1645625.5**
Number of PW given TT2 / Td2	**1392607.5**	**1481007**
Number of PW given TT Booster/ Td Booster	**491451.45**	**476094.6**
Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets	**2002525.5**	**2009726**
Number of PW provided full Course 360 Calcium tablets	**1782147**	**1420106.5**
Number of PW given one Albendazole tablet after 1st trimester	**1112063.5**	**927973.95**
Number of PW received 4 or more ANC check ups	**1730049.5**	**1739785.5**
Number of PW given ANC Corticosteroids in Pre Term Labour	**34949.625**	**32516.54**
New cases of PW with hypertension detected	**42436.215**	**43997.665**
Out of the new cases of PW with hypertension detected, cases managed at institution	**30312.55**	**29495.5**
Number of Eclampsia cases managed during delivery	**4629.0585**	**4606**
Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs	**1738688.5**	**1874225**
Number of PW having Hb level<11 (out of total tested cases)(7.1 to 10.9)	**1469851**	**1667481**
Number of PW having Hb level<7 (out of total tested cases)	**68486.65**	**83875.165**
Number of PW having severe anaemia (Hb < 7) treated	**40909.89**	**46005.125**
Number of PW tested for Blood Sugar using OGTT(Oral Glucose Tolerance Test)	**336444.35**	**320643.6**
Number of PW tested positive for GDM	**8575.35**	**9711.25**
Number of PW given insulin out of total tested positive for GDM	**2204.1915**	**1654.708**
Number of PW tested using POC test for Syphilis	**215122.4**	**32318.875**
Out of above, number of PW found sero positive for Syphilis	**1499.99165**	**379.2083**
Number of pregnant women tested for Syphilis	**648700.65**	**702290.65**
Number of pregnant women tested found sero positive for Syphilis	**3460.9585**	**3535.7085**
Number of syphilis positive pregnant women treated for Syphilis	**1436.3665**	**1217.208**

The study revealed that there is a decrease in ANC service utilization at **public health facilities** of the following services as compared to the pre-pandemic era on a cumulative all India basis:-

- The total number of pregnant women registered for ANC
- Number of PW given TT1/ Td1
- Number of PW given TT2 / Td2
- Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets
- Number of PW received 4 or more ANC check-ups
- Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs
- Number of PW having severe anaemia (Hb < 7) treated
- Number of pregnant women tested for Syphilis

An important finding is increase in following ANC service utilization at the public health facility during the covid-19 pandemic Era:-

- Number of PW tested using POC test for Syphilis
- Out of above, number of PW found sero-positive for Syphilis
- Number of syphilis positive pregnant women treated for Syphilis

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Table – 3- Comparison of ANC service utilization at private health facilities across India before and after the covid-19 pandemic

Indicator /	Private Average per month-Pandemic Era	Private Average per month-Pre-Pandemic Era
Total number of pregnant women registered for ANC	101091.14	100409.19
Out of the total ANC registered, number registered within 1st trimester (within 12 weeks)	63350.035	56761.17
Number of PW given TT1/ Td1	84600.925	89210.625
Number of PW given TT2 / Td2	67020.885	74813.5
Number of PW given TT Booster/ Td Booster	23482.815	21051.165
Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets	78354.375	62857.625
Number of PW provided full Course 360 Calcium tablets	71066.59	54066.875
Number of PW given one Albendazole tablet after 1st trimester	31719.815	17809.585
Number of PW received 4 or more ANC check ups	71029.54	62401.585
Number of PW given ANC Corticosteroids in Pre Term Labour	3071.6915	3350.7085
New cases of PW with hypertension detected	4507.6585	4620.042
Out of the new cases of PW with hypertension detected, cases managed at institution	3254.975	2987.4585
Number of Eclampsia cases managed during delivery	422.55835	399.875
Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs	65197.565	53030
Number of PW having Hb level<11 (out of total tested cases)(7.1 to 10.9)	38304.95	38911.625
Number of PW having Hb level<7 (out of total tested cases)	4189.7	4863.4585
Number of PW having severe anaemia (Hb < 7) treated	3198.7	3304.5
Number of PW tested for Blood Sugar using OGTT (Oral Glucose Tolerance Test)	31651.565	23284.125
Number of PW tested positive for GDM	2222.8335	1774.75
Number of PW given insulin out of total tested positive for GDM	786.2	673.70835
Number of PW tested using POC test for Syphilis	20.1	20.33333
Out of above, number of PW found sero positive for Syphilis	0	0
Number of pregnant women tested for Syphilis	46090.865	30360.79
Number of pregnant women tested found sero positive for Syphilis	209.93335	137.83335
Number of syphilis positive pregnant women treated for Syphilis	137.18335	44.166665

The study revealed that there is a decrease in ANC service utilization at private health facilities of the following services as compared to the pre-pandemic era on cumulative all India basis:-

- Number of PW given TT1/ Td1
- Number of PW given TT2 / Td2
- Number of PW given ANC Corticosteroids in Pre Term Labour
- Number of PW having severe anaemia (Hb < 7) treated
- Number of PW tested using POC test for Syphilis

An important finding is an increase in following ANC service utilization at private health facilities during covid-19 pandemic Era:-

- The total number of pregnant women registered for ANC
- Out of the total ANC registered, the number registered within 1st trimester (within 12 weeks)
- Number of PW given TT Booster/ Td Booster
- Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets
- Number of PW provided full Course 360 Calcium tablets
- Number of PW given one Albendazole tablet after 1st trimester

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- Number of PW received 4 or more ANC check-ups
- Out of the new cases of PW with hypertension detected, cases managed at the institution
- Number of Eclampsia cases managed during delivery
- Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs
- Number of PW tested for Blood Sugar using OGTT (Oral Glucose Tolerance Test)
- Number of pregnant women tested for Syphilis
- Number of syphilis positive pregnant women treated for Syphilis

Table – 4- Comparison of ANC service utilization at urban health facilities across India before and after the covid-19 pandemic.

Indicator /	Urban Average per month-Pandemic Era	Urban Average per month-Pre-Pandemic Era
Total number of pregnant women registered for ANC	518771.3	451593.7
Out of the total ANC registered, number registered within 1st trimester (within 12 weeks)	343403.05	279530.85
Number of PW given TT1/ Td1	349543.55	310719.25
Number of PW given TT2 / Td2	293695.65	269778.9
Number of PW given TT Booster/ Td Booster	102912.92	85386.455
Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets	483290.8	393306.2
Number of PW provided full Course 360 Calcium tablets	451589.65	312952.3
Number of PW given one Albendazole tablet after 1st trimester	227563.45	155192.5
Number of PW received 4 or more ANC check ups	371357.45	297172.6
Number of PW given ANC Corticosteroids in Pre Term Labour	15494.765	7497.875
New cases of PW with hypertension detected	17067.65	10140.295
Out of the new cases of PW with hypertension detected, cases managed at institution	12952.615	7149.417
Number of Eclampsia cases managed during delivery	2449.4415	900.41685
Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs	339487	291424.85
Number of PW having Hb level<11 (out of total tested cases)(7.1 to 10.9)	312497.4	298461
Number of PW having Hb level<7 (out of total tested cases)	21975.99	15978.585
Number of PW having severe anaemia (Hb < 7) treated	16918.35	9425
Number of PW tested for Blood Sugar using OGTT(Oral Glucose Tolerance Test)	125177.65	74461.67
Number of PW tested positive for GDM	5035.4085	2772.5835
Number of PW given insulin out of total tested positive for GDM	1637.3335	719.41665
Number of PW tested using POC test for Syphilis	734.15	328.125
Out of above, number of PW found sero positive for Syphilis	25.333335	12.666669
Number of pregnant women tested for Syphilis	255750.1	153349.8
Number of pregnant women tested found sero positive for Syphilis	1302.8334	1047.0419
Number of syphilis positive pregnant women treated for Syphilis	506.975	244.6667

- **The study revealed that there is a significant increase in ANC service utilization at urban health facilities of all the services as compared to the pre-pandemic era on cumulative all India basis.**

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Table – 5- Comparison of ANC service utilization at rural health facilities across India before and after the covid-19 pandemic

Indicator /	Rural Average per month-Pandemic Era	Rural Average per month-Pre-Pandemic Era
Total number of pregnant women registered for ANC	1790520	1963175.5
Out of the total ANC registered, number registered within 1st trimester (within 12 weeks)	1382296	1382677.5
Number of PW given TT1/ Td1	1301144.5	1424117
Number of PW given TT2 / Td2	1165928	1286041.5
Number of PW given TT Booster/ Td Booster	412021.3	411759.3
Number of PW provided full Course 180 Iron Folic Acid (IFA) tablets	1597586	1679277.5
Number of PW provided full Course 360 Calcium tablets	1401620.5	1161220.9
Number of PW given one Albendazole tablet after 1st trimester	916217.85	790591.3
Number of PW received 4 or more ANC check ups	1429718.5	1505014
Number of PW given ANC Corticosteroids in Pre Term Labour	22526.55	28369.375
New cases of PW with hypertension detected	29876.225	38477.415
Out of the new cases of PW with hypertension detected, cases managed at institution	20614.91	25333.54
Number of Eclampsia cases managed during delivery	2602.175	4105.4585
Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs	1464396	1635830.5
Number of PW having Hb level<11 (out of total tested cases)(7.1 to 10.9)	1195653	1407931.5
Number of PW having Hb level<7 (out of total tested cases)	50700.36	72760.04
Number of PW having severe anaemia (Hb < 7) treated	27190.24	39884.625
Number of PW tested for Blood Sugar using OGTT(Oral Glucose Tolerance Test)	242917.6	269466.1
Number of PW tested positive for GDM	5762.775	8713.417
Number of PW given insulin out of total tested positive for GDM	1353.0585	1609
Number of PW tested using POC test for Syphilis	214408.35	32011.08
Out of above, number of PW found sero positive for Syphilis	1474.6584	366.5417
Number of pregnant women tested for Syphilis	439041.45	579301.65
Number of pregnant women tested found sero positive for Syphilis	2368.0585	2626.5
Number of syphilis positive pregnant women treated for Syphilis	1066.575	1016.7084

The study revealed that there is a decrease in almost all ANC service utilization at rural health facilities except following services as compared to the pre-pandemic era on cumulative all India basis:-

- Number of PW given TT Booster/ Td Booster
- Number of PW provided full Course 360 Calcium tablets
- Number of PW given one Albendazole tablet after 1st trimester
- Number of PW tested using POC test for Syphilis
- Number of syphilis positive pregnant women treated for Syphilis

Discussion

The study revealed that there is a **decrease in ANC service utilization** of the following services as compared to the pre-pandemic era on cumulative all India basis:-

- The total number of pregnant women registered for ANC
- Number of PW given TT1/ Td1
- Number of PW given TT2 / Td2
- Number of PW received 4 or more ANC check-ups
- Number of PW tested for Haemoglobin (Hb) 4 or more than 4 times for respective ANCs
- Number of pregnant women tested for Syphilis

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An important finding is an **increase in** following ANC service utilization during covid-19 pandemic Era:-

- Number of PW tested using POC test for **Syphilis**
- Out of above, number of PW found sero-positive for Syphilis
- Number of syphilis positive pregnant women treated for Syphilis

This research study finding also revealed that urban health facility where maximum private health facilities are available was found to be associated with significantly increased utilization of antenatal care services in the pandemic era. This finding was supported by the accredited data source of HMIS –MoHFW-GoI. This might be related to the fact that pregnant women residing in urban areas may have better access as well as affordability-availability of different health facilities and better knowledge about the significance of ANC utilization.

This research study finding also revealed that rural health facility where mostly public health facilities are available was found to be associated with significantly decreased utilization of antenatal care services in the pandemic era. This finding was supported by the accredited data source of HMIS –MoHFW-GoI. This might be related to the fact that pregnant women residing in rural areas may have limited access as well as limited affordability-availability of different health facilities and lesser knowledge about the significance of ANC utilization added with lack of transport accessibility. This might be because of other reasons like fear of contracting disease stay-at-home orders leading to greater loss of income, reduced capability, or (OOPE) purchasing power, resulting in the inability to pay for services which in turn limit utilization of ANC services.

The situation is harsher in rural areas of developing countries like India due to the lack of proper infrastructure at public health facilities and limited resources. This might be due to public health system collapse or intentional individual choices made by the public in responding to the pandemic, workforce diversion-reduction at rural-public health facilities, access reduction, and also some health facility may have restricted number of regular ANC visits due to possible fear of the pregnant women contracting coronavirus.

Strength and Limitation of the study

The cross-sectional retrospective nature of this study was one of the main limitations of this research study. Another limitation is the availability of data from any other accredited and established source recognized worldwide. Furthermore, this study is not done with the primary method of data collection. The main strength is that the whole study is based on real-time based accredited government data sources which is also available 24x7 to the visitors.

Conclusion and Recommendation

This research study's findings showed that the covid-19 pandemic reduced the utilization of various antenatal health care services among pregnant women in India as compared to the pre-pandemic period. Hence author recommends more efforts in rural areas as well as improvement in public health facilities for enhancing ANC health services. Various types of IEC (Information, Education, and Communication) materials should be distributed to raise awareness regarding the protective ANC services for pregnant women during the COVID-19 pandemic. It is also useful to start telecommunication-consultation services to help pregnant women. In addition, virtual consultation with a gynaecologist-obstetricians can be provided via tele-consultation services, to women who need maternal health services.

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