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What is the impact of the COVID-19 on Inpatient Department (IPD) hospital admissions in India? - A 41months Cross-Sectional Study

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Abstract

The inpatient department or IPD is the dedicated unit of a hospital/healthcare facility for admitting patients from the OPD (outpatient department), ED (emergency department), or a referred patient usually from lower facilities for a planned care/procedure, for special medical problems that necessitate hospital admission for suitable care and consideration. The index case of SARS-CoV-2 virus infection in India was first suspected (based on clinical grounds) on 27th January 2020, an assumed case of covid-19 in Kerala with a that time recent voyage history of Wuhan, china was affirmed as SARS-CoV-2 virus infection positive case by the NIV (National Institute of Virology) situated at Pune in Maharashtra, on January 30th, 2020 as positive for COVID-19. As per the constitution of India Health is a subject matter of state, hence different states had reserved different percentages of beds in pre-existing health facilities for COVID-19 IPD patients, for example, the Delhi government had reserved 50% of pre-existing ICU (intensive care unit) and ward beds for COVID-19 IPD patient's. Besides the other factors such as fear etc, this new arrangement of hospital care delivery and prioritization of needs of COVID-19 patients may have resulted in the general cancellations of other IPD patients elective procedures leading to a reduced IPD number of patients with diseases other than COVID-19, as priority was shifted to COVID-19 admitted patient's and cases. The first author researcher of this study has found unusual prevalence in the figure of IPD (Inpatient Department) hospital admissions during his normal course of duties at health centres throughout the current ongoing COVID-19 (coronavirus disease-2019) era. To know about the real scenario this epidemiological deductive study was done to confirm that, does the COVID-19 era have affected the number of IPD hospital admissions (positively or negatively) in India? The aim of this 41months comparative, quantitative, deductive, Cross-Sectional Research Study is to assess the impacts of COVID-19 on the prevalence of IPD hospital admissions in India (other than COVID-19), across all public/private/rural/urban health facilities of 36 states and union territories registered on HMIS (Health Management Information System) of Ministry of Health and Family Welfare (MoHFW), Government of India. The total mean number of IPD admissions for the 17 months (2020-2021) COVID-19 pandemic epoch, was 5387311 compared to 7435770 of IPD admission for the pre-pandemic 2 years (2018-2019). The total mean number of IPD admission decreased by 2048459 during the COVID-19 pandemic epoch i.e. 27.55% decrease is observed during COVID-19. This research study revealed that there is a significant decrease in IPD hospital admissions for various medical conditions other than COVID-19 during the COVID-19 pandemic epoch which is a matter of concern for policy and decision-makers.

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Impact of COVID-19 on the IPD hospital admissions in India

Introduction

Background/Rationale

The inpatient department or IPD is the dedicated unit of a hospital/healthcare facility for admitting patients from the**OPD (outpatient department), ED (emergency department),** or a referred patient usually from lower facilities for a planned care/procedure, for special medical problems that necessitate hospital admission for suitable care and consideration [1]. This Inpatient Department is usually equipped-operational with medical beds, medical equipment, and anytime 24x7 availability of a medical team [2].

On a global basis, the index case of**SARS-CoV-2(severe acute respiratory syndrome-coronavirus-2)** virus infection was first confirmed and reported from the Wuhan City of Hubei province in China in the month **December, the year 2019,** which has spread hastily worldwide to more than 200 countries [3]. The **(World Health Organization) WHO** as per recommendation and strategy of the **IHR (International Health Regulations (2005))** affirmed the **COVID-19 (CORONAVIRUS DISEASE-2019)** outburst as a Public Health Crisis of International trepidation on **30th January 2020** and initiated issuing various protocols, strategies, advisories-guidelines to global nations in order to contain the outbreak [4]. The **index case** of SARS-CoV-2 virus infection in India was first suspected (based on clinical grounds) on **27th January 2020**, an assumed case of COVID-19 in**Kerala with a current voyage history of Wuhan, china** which was subsequently affirmed as SARS-CoV-2 virus infection positive case by the**NIV (National Institute of Virology)** situated at Pune in Maharashtra, on**January 30th, 2020** as COVID-19 case [5].

The **Government of India**, in order to contain the COVID-19 outbreak announced and enforced an obligatory**nationwide lockdown from 25th march 2020 to 31st may 2020** to trim down the Incidence of new cases as well as prevalence of COVID-19 by putting lockdown a novel intervention as a fence in further community spread [6]. This lockdown intervention with other factors such as fear, and apprehension of contracting COVID-19 disease had disrupted the scheduled - normal functioning of the health system delivery of various essential health services utilization in India [7]. The stipulation of health services delivery is of major trepidation in India due to elevated as well as dense population with scanty resources, old twisted poor infrastructure amidst massive demand on the healthcare system [8]. Newborn children, older citizens, and pregnant women are especially susceptible to the ongoing crisis impacted due to COVID-19 because of their extraordinary requirements of health needs [9].

The ongoing SARS-CoV-2 infection pandemic challenged the healthcare systems globally and India is not an exception[10]. The majority of resources of healthcare facilities including infrastructure, ambulance services, etc. medical personnel's, have been predominantly deployed to deal with the COVID-19 pandemic which has negatively affected various essential health services utilization [11]. Added to this there are wide variations in healthcare delivery services among different states and union territories of India which is quite evident from the NITI **(National Institution for Transforming India)** AAYOG annual state health index [12]. The lack of dedicated and exclusive **PUBLIC HEALTH MANAGEMENT CADRE (PHMC)** in several states of India with poor governance especially in poor states like Bihar aggravated the crisis that erupted due to COVID-19 [13]. The WHO had also raised a question on the COVID-19 mortality count provided by the Government of India [14].

The Government of India response to the COVID-19 pandemic essentially followed procedures adopted by other global nations that included shutting down borders, restraining social interaction, and creating new COVID-19 segregation wards within mostly pre-existing hospitals wards as it is practically impossible to construct new dedicated COVID-19 healthcare facilities overnight to cater the needs of about 140 crores population of India [15]. The total COVID-19 cases Prevalence in INDIA as on 09th September 2022, 03:29 GMT were 44,482,411, with mortality count 528,090 [16]. As per the constitution of India Health is a subject matter of state, hence different states had reserved different percentages of beds in pre-existing health facilities for COVID-19 IPD patients, for example, the Delhi government had reserved 50% of pre-existing **ICU (intensive care unit)** and ward beds for COVID-19 IPD patients [17]. Besides the other factors such as fear etc, mentioned above this new arrangement of hospital care delivery and prioritization of needs of COVID-19 patients may have resulted in the general cancellations of other IPD patients elective procedures leading to reduced IPD number of patients of diseases other than COVID-19, as priority was shifted to COVID-19 admitted patients and cases.

The first author researcher of this study has found unusual prevalence in the figure of IPD (Inpatient Department) hospital admissions during his normal course of duties at health centres throughout the current ongoing COVID-19(coronavirus disease-2019) era. To know about the real scenario this epidemiological deductive study was started to confirm that, **does the COVID-19 era has affected the number of IPD hospital admissions (positively or negatively) ?.** This study was started and designed to get an answer to the above question. Through the presentation of the whole story and figures, the researcher hopes that it will facilitate depicting a real scenario of the situation with the **purpose to draw the consideration of policy and decision makers to contemplate measures of alleviation and providing relief in form of standard health services delivery to IPD patients in the situation of distress like COVID-19.** This research study especially highlights the COVID-19 impacts on IPD health service utilization and access of people to IPD healthcare services during the COVID-19 era.

Aim & Objectives

The aim of this 41months comparative, quantitative, deductive, Cross-Sectional Research Study is to assess the indirect impacts of COVID-19 on the number of IPD hospital admissions in India (other than COVID-19), across **all public/private/rural/urban health facilities of 36 states and union territories** registered on **HMIS (Health Management Information System)** of **Ministry of Health and Family Welfare (MoHFW),** Government of India on a cumulative basis. This unique study will also do **a brief analysis of COVID-19 impact on IPD health service** utilization of some important and more prevalent diseases in India.

The key objectives are to assess the count i.e. increase/decrease in the number of IPD patients in India during the covid-19 pandemic years in comparison to the pre-pandemic period. The **Mean number of IPD patients will be considered for**

comparison of the same variable with a dissimilar duration of surveillance.

Methods & Materials

This is a unique research study done for highlighting COVID-19 impact on IPD health service utilization.**Any alterations in the health outcomes like the numbers of IPD patients after the commencement of the COVID-19 epoch are assumed in this novel study to be special effects of this pandemic.** The period of COVID-19 era will be compared to previous pre-pandemic years. The index case of SARS-CoV-2 virus infection in India was first reported in January 2020, hence for this study epoch **before 1st January 2020 is measured as the pre-pandemic era** and **from 1st January 2020 the period is understood as the pandemic years** on the foundation of the first covid-19 case in India as discussed above.

Since **this study was not a sample survey and all IPs (indoor patients) from 36 states and union territories were included** for this deductive study hence we feel that the descriptive analysis is enough for this version of research paper. **There is no scope for any statistical test like t-test or ANOVA as there is no question of generalisability from data as the data covers the entire population of IP admissions** hence we do not feel need for applying any inferential statistical methods here.

Study design & Period

This is a unique, novel, comparative, cross-sectional, retrospective, deductive observational research study premeditated at describing the panorama, dimensions, and extent of the unforeseen health impacts of the COVID-19 pandemic. A purposive sampled health facility-based retrospective cross-sectional research was conducted for IPD hospital admissions in India, across all public/private/rural/urban health facilities of 36 states and union territories registered on HMIS **from 1st January 2018 to 31st May 2021**. The first recognized COVID-19 case in India was found in January 2020; hence the period before 1st January 2020 i.e. years 2018 and 2019 are marked pre-pandemic period which is utilized for assessment with the continuing COVID-19 pandemic phase i.e.2020 and 2021 (up to May as data is available till this month only). **The mean number of IPD patients per month is considered for comparison of the pandemic epoch with the pre-pandemic epoch to uncover the influence of COVID-19 on IPD services utilization.**

Study Setting

This research study was carried out by **uninterrupted surveillance of health facilities IPD data**, of all public/private/rural/urban health facilities of 36 states and union territories registered on HMIS of the Ministry of Health and Family Welfare (MoHFW) from **1st January 2018 to 31st May 2021**. The populations enclosed are residents of 36 states and union territories of India. As per the data obtained from HMIS, the total IPD registered during this period is shown in **Table-1and Figure-1.** Exclusive information sources for the investigation are publicly accessible data from the Indian Health Management Information System (HMIS) of MoHFW, Government of India. The HMIS is an entrenched reporting arrangement used by all 36 states and **union territories (UT)** of India [18]. The information on HMIS is periodically uploaded on a scheduled basis from the entire HMIS registered health facilities across the nation.

Location

This investigation study includes all the **Public-private-rural-urban health amenities** situated in 36 **states and union territories of India, whose information are obtainable on HMIS.**

Period of study

This study started on **1st January 2018 and ended on 31st May 2021**.

Exposure (Study Variables and Operational Definition)

The outcome variable of this study was IPD services utilization (number of IPD patients). IPD services utilization for this study was defined as number of:

1. **Inpatient (Male)- Children<18yrs**
2. **Inpatient (Male)- Adults**
3. **Inpatient (Female)- Children<18yrs**
4. **Inpatient (Female)- Adults**
5. **Inpatient - Malaria**
6. **Inpatient - Dengue**
7. **Inpatient - Typhoid**
8. **Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections**
9. **Inpatient - Tuberculosis**
10. **Inpatient - Pyrexia of unknown origin (PUO)**
11. **Inpatient - Diarrhoea with dehydration**
12. **Inpatient - Hepatitis**

Any person in India who has been registered on HMIS for use of IPD services related to above mentioned purpose during study period were included in this study.

Follow up and Data collection

The data was constantly collected, observed and checked for **SMART (specificity, measurability, accuracy, reproducibility and timeliness)** objective. The **Microsoft office and stata15.1 software** were utilized for this data collection and analysis.

Participants

Inclusion criteria - Any person in India who has been registered on HMIS for utilization of IPD services related to Operational Definition given above.

Exclusion criteria - Any person in India who has not been registered on HMIS for utilization of IPD services related to Operational Definition given above. All other diseases not related to Operational Definition were also excluded from this research study.

Sources and methods of selection of participants - The investigator has done purposive sampling for assortment of participants and the resource of data is HMIS of MoHFW.

Variables

Variables for this research study are mentioned above under **Exposure section**.

Data sources / measurement

The Source of Data is - HMIS-MoHFW and link is given below.

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

For the evaluation of impact of COVID-19 induced situation on number of IPD patients in India the pandemic epoch is compared to pre-pandemic epoch, **Data investigation were done with Microsoft office and stata 15.1 software.**

Bias

To reduce the bias the **mean were compared** for calculating prevalence of IPD patients in India for different variables.

Study size (Sample Size and Sampling Technique)

The **total numbers of IPD registered** on HMIS for operational definition mentioned above were included in this study with a **purposive sampling technique**, see table-1. The data essential for this study was collected from HMIS of the MoHFW, which is the most endorsed and certified data source in India. The total quantity of indicators included for this research study was 12. The data composed and analyzed with Microsoft office and stata 15.1.

The size of different variables for study period is given in **Table-1** below:

Ethical Consideration

This study **did not require any informed consent or ethical endorsement** since the data used were absolutely and publicly obtainable from HMIS and in compliance with Indian data protection policy.

Quantitative variables

The quantitative variables for this research study are mentioned below in **Table-1 and Figure-1.**

Data and Statistical Analysis

Stata 15.1 and Microsoft office software were utilized for statistical analysis. As the foremost step of the data investigation we calculated changes in IPD hospital admissions and compared the **mean number of IPD cases** over a 2-year pre-pandemic epoch (2018-2019) with the mean number of IPD cases over a 17-month pandemic epoch in 2020-2021**, see Table-2 and Figure -2**. We utilized HMIS data with the intention of determining the extent to which, IPD cases altered after the onset of the pandemic compared to the pre-COVID-19 pandemic across the hospital network in India. In the subsequent step of the investigation we calculated the **changes to mean IPD hospital admissions for 12 variables** mentioned above**; see Table-3 and Figure-3**. For both time periods (2018-2019 and 2020-2021) the **period prevalence (mean)** was calculated for IPD hospital admissions as a

number of events (inpatient admissions) during specified period divided by the whole population during the two individual time epochs (population estimate based on the World Bank Estimate for India 2018-2021[19]).

Table-1. Total IPD registered during study period (study size of variables)

variable	Inpatient (Male)-Children<18yrs	Inpatient (Male)-Adults	Inpatient (Female)-Children<18yrs	Inpatient (Female)-Adults	Inpatient - Malaria	Inpatient - Dengue	Inpatient - Typhoid	Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections	Inpatient - Tuberculosis	Inpatient - Pyrexia of unknown origin (PUO)	Inpatient - Diarrhoea with dehydration	Inpatient - Hepatitis
Jan-18	684699	1574918	563919	2678916	20456	6728	36655	144382	17726	167898	149561	11965
Feb-18	681371	1628263	597415	2759214	21223	2874	39239	148166	19116	172680	171802	17066
Mar-18	726858	1791078	632809	2957897	28899	2278	44393	139901	19216	191845	211370	12607
Apr-18	681470	1752082	632745	2853456	36400	3274	38096	158459	21490	178071	256333	11851
May-18	742325	1963800	667019	3150982	24301	5311	39988	131532	21387	181025	299387	13284
Jun-18	701940	1875796	650402	3077431	30100	10274	44392	132608	24224	184425	297469	12927
Jul-18	740319	1943982	683178	3229387	33824	10717	47647	142359	20632	222390	313703	13836
Aug-18	799787	2186194	727566	3473204	31856	13138	52114	149881	20207	240156	280927	17606
Sep-18	853391	2290216	754869	3440361	38323	22720	63007	171255	20665	291630	245127	17506
Oct-18	803515	2254968	740055	3374097	38738	27996	66121	166784	20154	316880	200439	13327
Nov-18	718558	2069608	648514	3076557	33515	19838	50157	150142	20954	256961	173187	12603
Dec-18	648337	1907330	611454	2883320	24911	8217	37597	154418	19332	182316	161920	13027
Jan-19	686179	1639004	575306	2895626	21813	4268	30305	149579	27353	158822	162888	12470
Feb-19	640078	1645341	569909	3813163	20334	2382	36250	153516	20996	169448	172174	11351
Mar-19	701015	1786303	629191	3131875	21502	2919	40836	164308	20010	192519	214957	27057
Apr-19	700426	1866593	640817	3141545	15868	2203	38331	140434	20551	174534	263588	11684
May-19	752464	2087793	694781	3471198	18779	3360	41083	143818	22421	200440	319861	13575
Jun-19	755337	2124433	721481	3464597	24376	6732	41580	141213	22849	210881	326535	11930
Jul-19	845104	2177848	767206	3724697	28194	12126	51768	158915	20660	249832	335329	13279
Aug-19	903031	2232026	810121	3744344	34913	18951	65049	166547	20730	307207	315993	13869
Sep-19	943497	2293607	838354	3866960	31140	31487	74914	174504	22310	380334	267409	19041
Oct-19	878571	2134394	786222	3555016	31156	46730	67030	167454	21175	403146	216945	15102
Nov-19	869053	2090392	782772	3443596	26179	41206	56135	164036	21808	284287	188179	10614
Dec-19	855819	1931149	795053	3311131	22759	18546	42296	155979	20977	194387	154212	13558
Jan-20	840458	1916716	761127	3193577	17540	7782	35078	152303	20390	155433	155688	10966
Feb-20	719106	1778147	613589	3046363	17097	6670	38487	165303	22438	171027	180727	10775
Mar-20	643595	1601093	572698	2761780	13527	2826	32485	137689	23819	156460	176884	11288
Apr-20	389987	920123	351525	1849306	6821	1349	11343	56325	9294	61620	79227	5313
May-20	436795	1113843	406811	2046145	7076	2779	13489	57399	10656	68789	98533	10212
Jun-20	481895	1292371	451571	2252284	10509	4955	15582	63435	10661	65750	106061	6234
Jul-20	497378	1352235	450734	2361914	22605	4768	15089	72126	14188	78590	104179	7758
Aug-20	508227	1403440	468758	2425176	18978	2756	16253	80182	9224	83778	89278	8434

Sep-20	552825	1531763	519696	2584574	11357	3602	19960	86221	10257	90296	89258	9986
Oct-20	559988	1437472	526542	2578263	14669	6422	20497	85493	11685	99700	84429	8980
Nov-20	566007	1428260	516503	2530869	12853	5261	21419	90168	10931	88579	82289	9271
Dec-20	533973	1384966	491615	2600425	11926	3394	18576	88000	13493	74787	84294	14467
Jan-21	508088	1385723	480950	2505200	8969	2708	20724	91694	14746	80713	96094	10292
Feb-21	504279	1518640	460082	2534441	11049	2881	21182	95191	14801	87639	113497	10389
Mar-21	607158	1774289	540008	2860296	13821	3835	25576	119992	16906	105348	161084	12997
Apr-21	534535	1631732	457325	2404670	8388	4118	23880	139756	12412	101448	134668	9568
May-21	416723	1456718	354881	2037041	6111	3026	14949	164378	9817	91453	68375	7741
Total	27614161	72174649	24945573	121090894	872855	393407	1509552	5415845	742661	7173524	7603860	505806
Mean	673516.1	1760357	608428.6	2953436.4	21289.1	9595.2	36818.3	132093.8	18113.6	174964	185460	12336.7
No. of Obs.	41	41	41	41	41	41	41	41	41	41	41	41
Max.	943497	2293607	838354	3866960	38738	46730	74914	174504	27353	403146	335329	27057
Min.	389987	920123	351525	1849306	6111	1349	11343	56325	9224	61620	68375	5313

Results

The total numbers of different IPD during the 41 months study period is elaborated in table -1 and figure-1 with a little emphasis on lockdown in the figure-1. The GoI (Government of India) responded to this novel COVID-19 by enforcing nationwide lockdown from 25th March 2020 ending on 31st May 2020 and figure-1 shows a sharp decline in IPD admissions during this period specially shown with an arrow [3]. The total registered IPD during the 41 months study period on HMIS at any public-private-rural-urban health facilities were 27614161number of Inpatient (Male)- Children<18yrs; 72174649 number of Inpatient (Male)- Adults; 24945573number of Inpatient (Female)- Children<18yrs; 121090894 number of Inpatient (Female)- Adults; 872855, 393407, 1509552, 5415845, 742661,7173524,7603860,505806 respectively for Inpatient – Malaria, Inpatient – Dengue, Inpatient – Typhoid, Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections, Inpatient – Tuberculosis, Inpatient - Pyrexia of unknown origin (PUO), Inpatient - Diarrhoea with dehydration, Inpatient – Hepatitis **See table-1**.

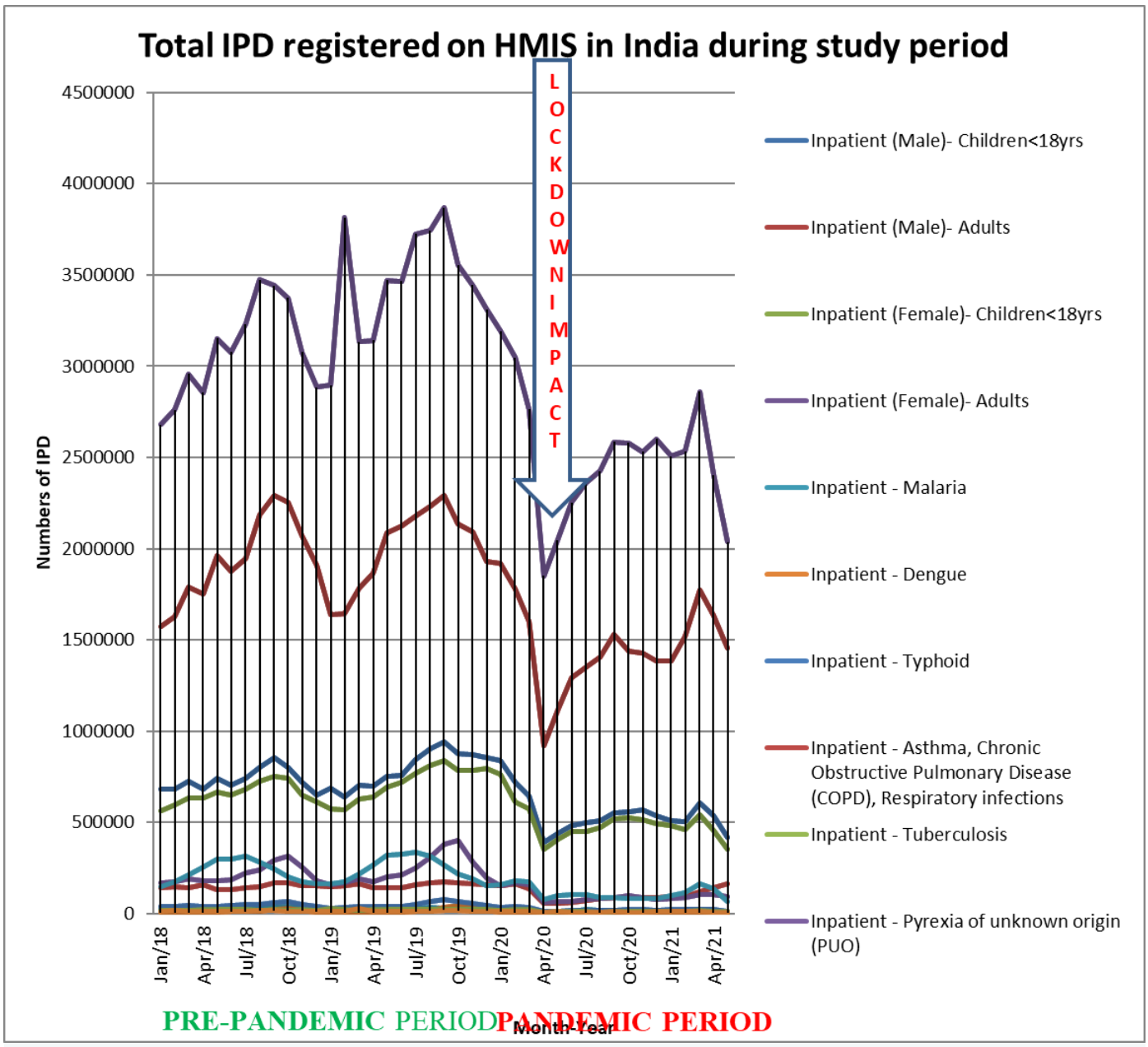

Figure-1. Total different IPD registered on HMIS in India during study period

This research study revealed that there is a significant decrease in IPD hospital admissions for various medical conditions other than COVID-19 during the COVID-19 pandemic epoch which is a matter of concern for policy and decision makers.

Outcome data

The outcome data of this exploration study are presented as table-2, 3, 4 and figure-2, 3, 4. For the 17 months (2020-2021) COVID-19 pandemic epoch, the total mean numbers of IPD admissions were 5387311 compared to total mean7435770 numbers of IPD admission for the previous pre-pandemic 2 years (2018-2019). The total mean numbers of IPD admission decreased by 2048459 numbers **during COVID-19 pandemic epoch i.e.27.55% decrease in IPD hospital admission were observed**during

COVID-19 as compared to pre-pandemic epoch; see table-2 and figure-2.

Table-2. Mean number of IPD cases during Pre-pandemic and Pandemic epoch

		Pre-pandemic Epoch – January 2018 to December 2019					Pandemic Epoch – January 2020 to May 2021				
S.No.	**Variable**	**No. of Obs.**	**Mean**	**Std. Err.**	**95 % conf. Interval**		**No. of Obs.**	**Mean**	**Std. Err.**	**95 % conf. Interval**	
1	Inpatient (Male)- Children<18yrs	24	763047.7	17692.6	726447.6	799647.7	17	547118.6	26767.6	490373.7	603863.6
2	Inpatient (Male)- Adults	24	1968630	45900.5	1873677	2063582	17	1466325	58560.2	1342183	1590467
3	Inpatient (Female)- Children<18yrs	24	688381.6	16763.4	653703.7	723059.5	17	495553.8	23513.8	445706.7	545400.9
4	Inpatient (Female)- Adults	24	3271607	69318.7	3128210	3415004	17	2504254	84495.9	2325131	2683378
5	Inpatient - Malaria	24	27481.6	1332.0	24725.9	30237.2	17	12546.8	1114.3	10184.4	14909.1
6	Inpatient - Dengue	24	13511.4	2584.5	8164.8	18858.0	17	4066.5	412.1	3192.9	4940.2
7	Inpatient - Typhoid	24	47707.6	2426.5	42687.8	52727.4	17	21445.2	1861.3	17499.3	25391.1
8	Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections	24	152924.6	2472.1	147810.6	158038.6	17	102685.6	8866.8	83888.7	121482.4
9	Inpatient - Tuberculosis	24	21122.6	384.9	20326.1	21919.0	17	13865.7	1108.4	11516.0	16215.4
10	Inpatient - Pyrexia of unknown origin (PUO)	24	229671.4	13979.7	200752.2	258590.7	17	97730	7916.9	80946.8	114513.2
11	Inpatient - Diarrhoea with dehydration	24	237470.6	12884.5	210816.9	264124.3	17	112033.2	8727.7	93531.2	130535.3
12	Inpatient - Hepatitis	24	14213.9	709.4	12746.3	15681.5	17	9686.5	546.4	8528.0	10845.0

Mean number of various IPD hospital admissions during Pre-pandemic and Pandemic period

1. Inpatient (Male) - Children<18yrs- During the Pre-pandemic Epoch – January 2018 to December 2019 the**mean number of IPD** hospital admissions in India for Inpatient (Male) - Children<18yrs was**763047.7** (Std. Err.-17692.6; 95 % conf. Interval-726447.6 -799647.7) whereas during Pandemic Epoch – January 2020 to May 2021it was **547118.6** (Std. Err.-26767.6; 95 % conf. Interval - 490373.7-603863.6), **see table-2 and figure2.**

2. Inpatient (Male) – Adults - During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient (Male) – Adults was1968630 (Std. Err. - 45900.5; 95 % conf. Interval-1873677-2063582) whereas during Pandemic Epoch – January 2020 to May 2021it was1466325, (Std. Err. - 58560.2; 95 % conf. Interval -1342183-1590467), **see table-2 and figure2.**

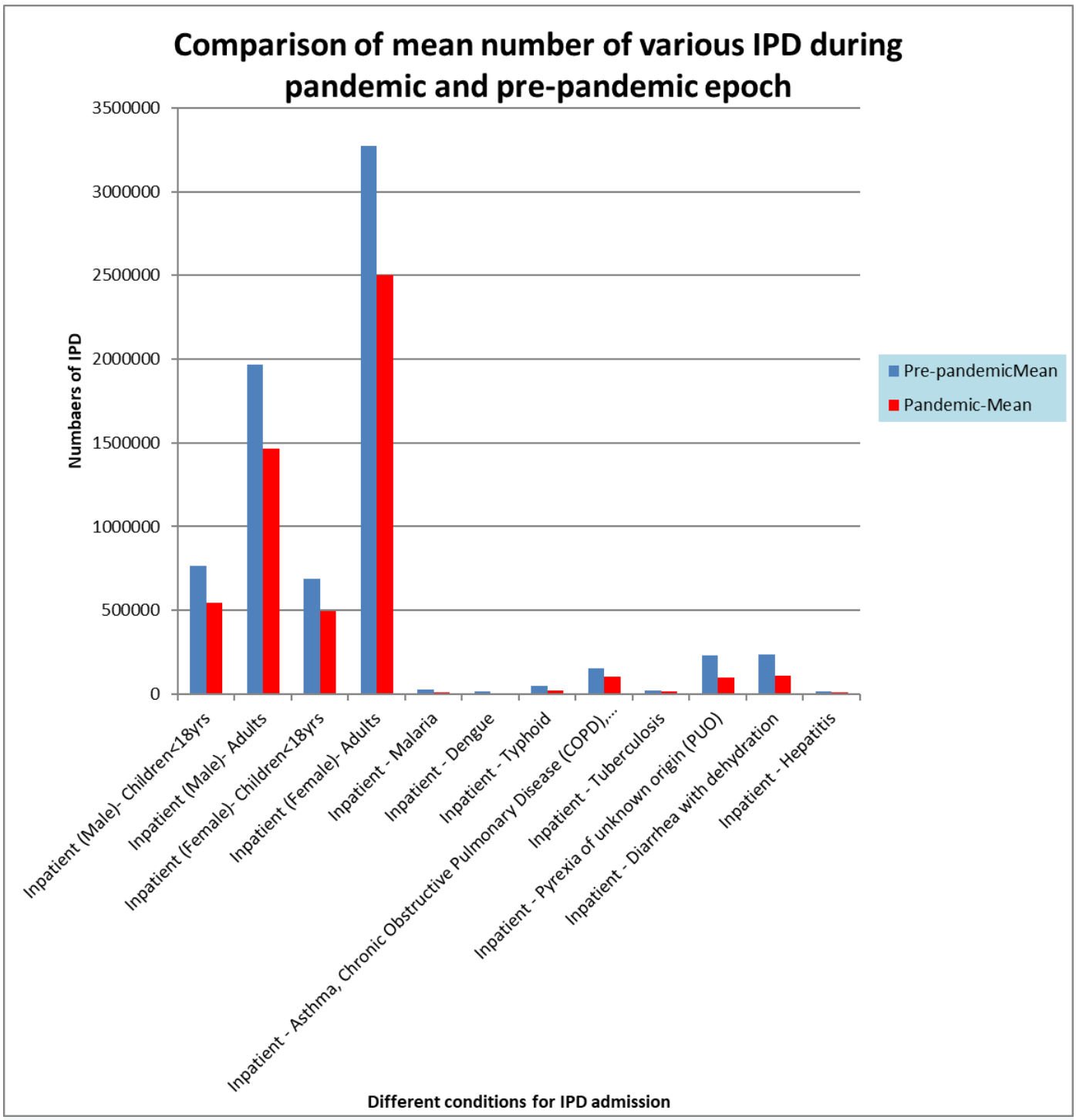

Figure-2. Comparison of mean number of various IPD hospital admissions during study period

3. Inpatient (Female) - Children<18yrs - During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient (Female) - Children<18yrs was688381.6, (Std. Err. - 16763.4; 95 % conf. Interval-653703.7-723059.5) whereas during Pandemic Epoch – January 2020 to May 2021it was495553.8, (Std. Err. - 23513.8; 95 % conf. Interval -445706.7-545400.9), **see table-2 and figure-2**.

4. Inpatient (Female) – Adults- During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient (Male) – Adults was3271607, (Std. Err. - 69318.7; 95 % conf. Interval-3128210-3415004)

whereas during Pandemic Epoch – January 2020 to May 2021it was2504254, (Std. Err. -84495.9; 95 % conf. Interval -2325131-2683378), **see table-2 and figure-2**.

5. Inpatient – Malaria- During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Malaria was27481.6, (Std. Err. - 1332.0; 95 % conf. Interval-24725.9-30237.2) whereas during Pandemic Epoch – January 2020 to May 2021it was12546.8, (Std. Err. -1114.3; 95 % conf. Interval -10184.4-14909.1), **see table-2 and figure-2.**

6. Inpatient – Dengue- During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Dengue was 13511.4, (Std. Err. - 2584.5; 95 % conf. Interval-8164.8 -18858.0) whereas during Pandemic Epoch – January 2020 to May 2021it was 4066.5, (Std. Err. -412.1; 95 % conf. Interval -3192.9-4940.2), **see table-2 and figure-2.**

7. Inpatient – Typhoid - During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Typhoid was 47707.6, (Std. Err. - 2426.5; 95 % conf. Interval-42687.8-52727.4) whereas during Pandemic Epoch – January 2020 to May 2021it was 21445.2, (Std. Err. -1861.3; 95 % conf. Interval -17499.3-25391.1), **see table-2 and figure-2.**

8. Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections-During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections was 152924.6, (Std. Err. - 2472.1; 95 % conf. Interval-147810.6-158038.6) whereas during Pandemic Epoch – January 2020 to May 2021it was 102685.6, (Std. Err. -8866.8; 95 % conf. Interval -83888.7-121482.4), **see table-2 and figure-2.**

9. Inpatient – Tuberculosis- During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Tuberculosis was 21122.6, (Std. Err. - 384.9; 95 % conf. Interval-20326.1-21919.0) whereas during Pandemic Epoch – January 2020 to May 2021it was 13865.7, (Std. Err. -1108.4; 95 % conf. Interval -11516.0-16215.4), **see table-2 and figure-2.**

10. Inpatient - Pyrexia of unknown origin (PUO) -During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Pyrexia of unknown origin (PUO) was 229671.4, (Std. Err. - 13979.7; 95 % conf. Interval-200752.2-258590.7) whereas during Pandemic Epoch – January 2020 to May 2021it was 97730, (Std. Err. -7916.9; 95 % conf. Interval -80946.8 -114513.2), **see table-2 and figure2.**

11. Inpatient - Diarrhoea with dehydration- During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Diarrhoea with dehydration was 237470.6, (Std. Err. - 12884.5; 95 % conf. Interval-210816.9-264124.3) whereas during Pandemic Epoch – January 2020 to May 2021it was 112033.2, (Std. Err. -8727.7; 95 % conf. Interval -93531.2-130535.3), **see table-2 and figure2.**

12. Inpatient – Hepatitis - During the Pre-pandemic Epoch – January 2018 to December 2019 the mean number of IPD hospital admissions in India for Inpatient – Hepatitis was 14213.9, (Std. Err. - 709.4; 95 % conf. Interval-12746.3-15681.5) whereas during Pandemic Epoch – January 2020 to May 2021it was 9686.5, (Std. Err. -546.4; 95 % conf. Interval -8528.0-10845.0), **see table-2 and figure-2**.

Decrease in mean number and Percent reduction in IPD hospital admissions during COVID-19

1. Inpatient (Male) - Children<18yrs –The mean IPD hospital admissions for Inpatient (Male) - Children<18yrs decreased by 215929.1 numbers or 28.29 % during covid-19 period as compared to Pre-pandemic period, **see table-3 and figure-3.**

2. Inpatient (Male) - Adults -mean IPD hospital admissions decreased by 502305numbers or 25.51 % during covid-19 period as compared to Pre-pandemic period, **see table-3 and figure-3.**

Table-3. Changes to mean IPD hospital admissions for 12 variables

Variable	Pre-pandemic Mean	Pandemic-Mean	Decrease in mean IPD during covid-19 period	Percent reduction during covid-19 period
Inpatient (Male)- Children<18yrs	763047.7	547119	215929.1	28.29
Inpatient (Male)- Adults	1968630	1466325	502305	25.51
Inpatient (Female)- Children<18yrs	688381.6	495554	192827.8	28.01
Inpatient (Female)- Adults	3271607	2504254	767353	**23.45**
Inpatient - Malaria	27481.6	12546.8	14934.8	54.34
Inpatient - Dengue	13511.4	4066.5	9444.9	**69.90**
Inpatient - Typhoid	47707.6	21445.2	26262.4	55.04
Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections	152924.6	102686	50239	32.85
Inpatient - Tuberculosis	21122.6	13865.7	7256.9	34.35
Inpatient - Pyrexia of unknown origin (PUO)	229671.4	97730	131941.4	57.44
Inpatient - Diarrhoea with dehydration	237470.6	112033	125437.4	52.82
Inpatient - Hepatitis	14213.9	9686.5	4527.4	31.85

3. Inpatient (Female) - Children<18yrs- mean IPD hospital admissions decreased by 192827.8numbers or 28.01 % during covid-19 period compared to Pre-pandemic period, **see table-3 and figure-3.**

4. Inpatient (Female) - Adults- mean IPD hospital admissions decreased by 767353 numbers or 23.45 % during covid-19 period compared to Pre-pandemic period, **see table-3 and figure-3. This is the least reduction seen among all variables.**

5. Inpatient – Malaria- mean IPD hospital admissions decreased by 14934.8 numbers or 54.34 % during covid-19 period compared to Pre-pandemic period**, see table-3 and figure-3.**

6. Inpatient – Dengue- mean IPD hospital admissions decreased by 9444.9 numbers or 69.90 % during covid-19 period compared to Pre-pandemic period, **see table-3 and figure-3. This is the largest reduction seen among all variables.**

7. Inpatient - Typhoid - mean IPD hospital admissions decreased by 26262.4 numbers or 55.04 % during covid-19 period compared to Pre-pandemic period **see table-3 and figure-3.**

8. Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections-mean IPD hospital admissions **decreased by 50239 numbers or 32.85 % during covid-19 periodcompared to Pre-pandemic period see table-3 and figure-3.**

9. Inpatient – Tuberculosis- mean IPD hospital admissions decreased by 7256.9 numbers or 34.35 % during covid-19 period compared to Pre-pandemic period, **see table-3 and figure-3.**

10. Inpatient - Pyrexia of unknown origin (PUO) -mean IPD hospital admissions decreased by 131941.4 numbers or 57.44 % during covid-19 period compared to Pre-pandemic period **see table-3 and figure-3.**

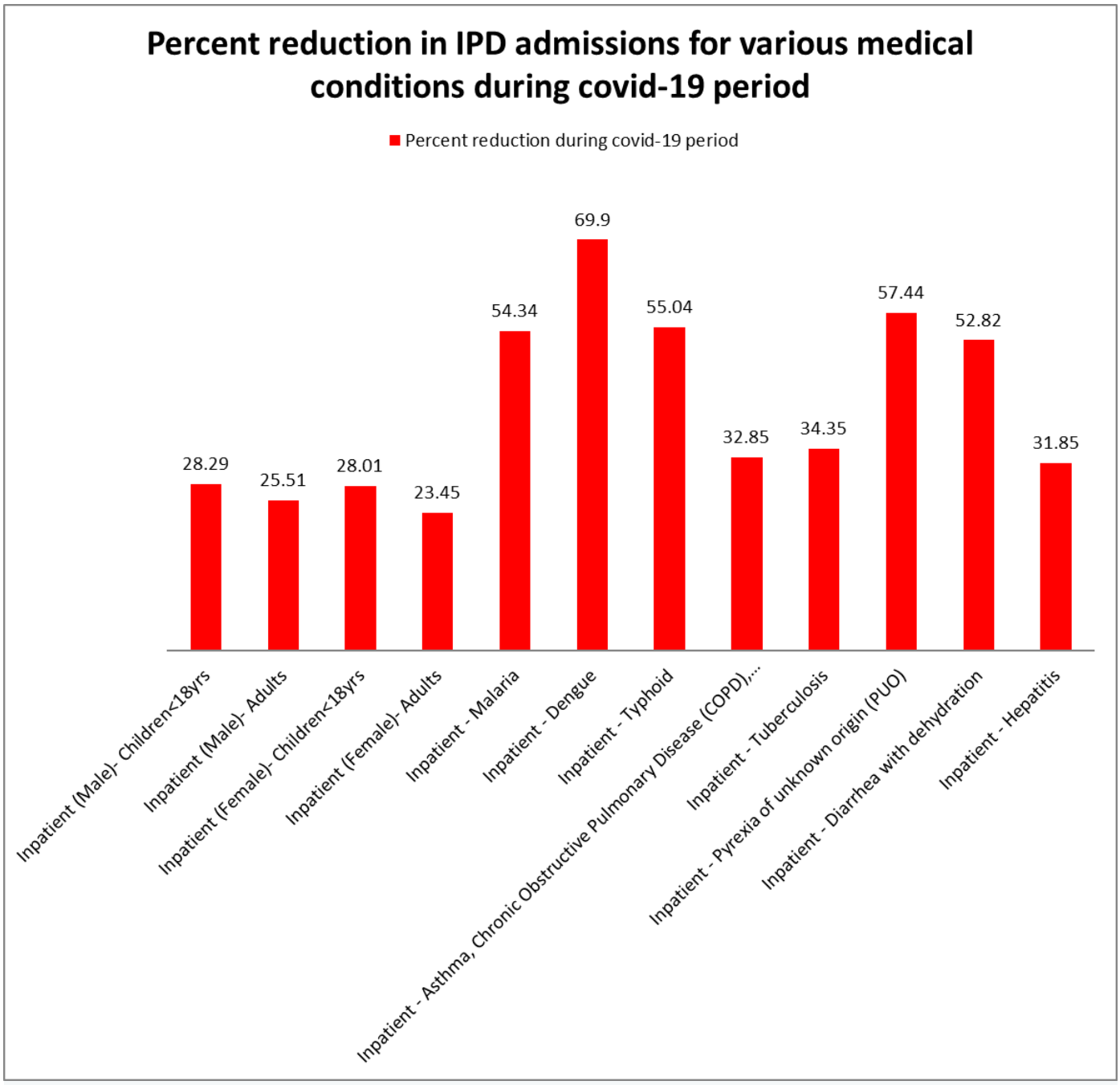

Figure-3. Percent reduction in IPD admissions for various medical conditions during COVID-19

11. Inpatient - Diarrhoea with dehydration- mean IPD hospital admissions decreased by 125437.4 numbers or 52.82 % during covid-19 period compared to Pre-pandemic period, **see table-3 and figure-3.**

12. Inpatient – Hepatitis- mean IPD hospital admissions **decreased by 4527.4 numbers or 31.85 % during covid-19 period compared to Pre-pandemic period, see table-3 and figure-3.**

Comparison of Period prevalence (mean) of IPD admission in India for different variables

The period prevalence is calculated utilizing The World Bank Data (see-Table-4, 5 and figure-4). This novel research study revealed that the Period prevalence (mean) of IPD admission in India is significantly reduced during COVID-19 pandemic period as compared to pre-pandemic period which is a matter of concern for policy and decision makers.

1. **Inpatient (Male) - Children<18yrs** – The pre-pandemic period prevalence per 10000 population was 5.6 whereas during COVID-19 period it was reduced to 3.9 (see-Table-4, 5 and figure-4).

2**. Inpatient (Male) – Adults** - The pre-pandemic period prevalence per 10000 population was 14.4 whereas during COVID-19 period it was reduced to 10.5 (see-Table-4, 5 and figure-4).

3. **Inpatient (Female**) - Children<18yrs - The pre-pandemic period prevalence per 10000 population was 5.1 whereas during COVID-19 period it was reduced to 3.6 (see-Table-4, 5 and figure-4).

4. **Inpatient (Female)** – Adults- The pre-pandemic period prevalence per 10000 population was 24.1 whereas during COVID-19 period it was reduced to 18.0 (see-Table-4, 5 and figure-4).

5**. Inpatient – Malaria** - The pre-pandemic period prevalence per 10000 population was 0.20 whereas during COVID-19 period it was reduced to 0.09 (see-Table-4, 5 and figure-4).

6. **Inpatient – Dengue** - The pre-pandemic period prevalence per 10000 population was 0.09 whereas during COVID-19 period it was reduced to 0.02 (see-Table-4, 5 and figure-4).

Table-4. Period prevalence (mean) of IPD admission in India for different variables

Variable	Pre-pandemic-Mean	pre-pandemic period prevalence per 10000 population	pandemic period prevalence per 10000 population	Pandemic-Mean
Inpatient (Male)- Children<18yrs	763047.7	5.6	3.9	547119
Inpatient (Male)- Adults	1968630	14.4	10.5	1466325
Inpatient (Female)- Children<18yrs	688381.6	5.1	3.6	495554
Inpatient (Female)- Adults	3271607	24.1	18.0	2504254
Inpatient - Malaria	27481.6	0.20	0.09	12546.8
Inpatient - Dengue	13511.4	0.09	0.02	4066.5
Inpatient - Typhoid	47707.6	0.4	0.15	21445.2
Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections	152924.6	1.1	0.7	102686
Inpatient - Tuberculosis	21122.6	0.2	0.09	13865.7
Inpatient - Pyrexia of unknown origin (PUO)	229671.4	1.7	0.7	97730
Inpatient - Diarrhoea with dehydration	237470.6	1.7	0.8	112033
Inpatient – Hepatitis	14213.9	0.10	0.06	9686.5

7. **Inpatient – Typhoid** - The pre-pandemic period prevalence per 10000 population was 0.4 whereas during COVID-19 period it was reduced to 0.15 (see-Table-4, 5 and figure-4).

8. **Inpatient - Asthma**, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections - The pre-pandemic period prevalence per 10000 population was 1.1 whereas during COVID-19 period it was reduced to 0.7 (see-Table-4, 5 and figure-4).

9. **Inpatient – Tuberculosis** - The pre-pandemic period prevalence per 10000 population was 0.2 whereas during COVID-19 period it was reduced to 0.09 (see-Table-4, 5 and figure-4).

10. **Inpatient - Pyrexia of unknown origin (PUO)**- The pre-pandemic period prevalence per 10000 population was 1.7 whereas during COVID-19 period it was reduced to 0.7 (see-Table-4, 5 and figure-4).

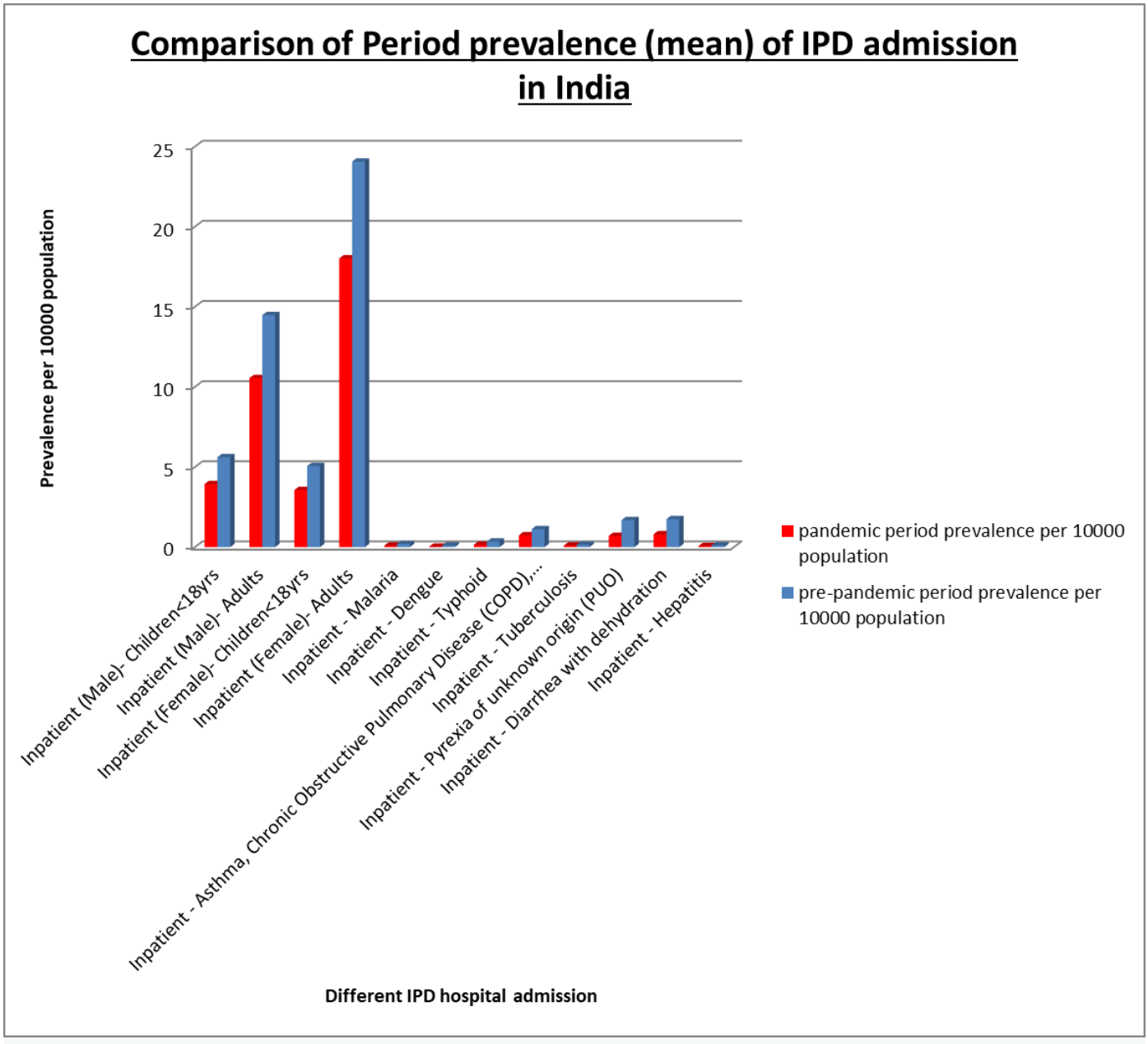

Figure 4. Comparison of Period prevalence (mean) of IPD admission in India for different variables

Figure-4. Comparison of Period prevalence (mean) of IPD admission in India for different variables

11. Inpatient - Diarrhoea with dehydration - The pre-pandemic period prevalence per 10000 population was 1.7 whereas during COVID-19 period it was reduced to 0.8 (see-Table-4, 5 and figure-4).

12. Inpatient – Hepatitis - The pre-pandemic period prevalence per 10000 population was 0.10 whereas during COVID-19 period it was reduced to 0.06 (see-Table-4, 5 and figure-4).

Table-5. THE WORLD BANK POPULATION DATA FOR INDIA

THE WORLD BANK POPULATION DATA FOR INDIA		
2018	1352642283	
2019	1366417756	
2020	1380004385	
2021	1399335837	projected
Pre-pandemic mean population		1359530020
pandemic mean population		1389670111

Other analyses

This deductive research study revealed that the entirety IPD of all medical admissions in indoor have shown a radical reduction in numbers and percentages of IPD during COVID-19 period as shown in various tables and figures above. It's a well acknowledged fact that population and diseases is mounting by leaps and bounds in India. Hence it is apparent from this research study that the novel COVID-19 induced state of affairs in India tends to have a disadvantageous and deleterious impact on other medical conditions IPD health services delivery and utilization.

Discussion

An initial massive drop down in IPD hospital admissions were observed in April 2020, soon after imposition of lockdown in India as well as after declaration of COVID-19 as a pandemic by the WHO. The total mean numbers of IPD admission decreased by 2048459 numbers during COVID-19 pandemic epoch i.e.27.55% decrease in IPD hospital admission were observed during COVID-19 as compared to pre-pandemic epoch. The general IPD admissions of medical conditions other than COVID-19 in Indian hospitals fell by 27.55% over the investigation period despite the fact that COVID-19 has been found to aggravate pre-existing medical as well as social morbidities like domestic violence had been reported to be increased too as indirect effect of COVID-19 [20][21]. Certainly there are wide geographical variations in prevalence of COVID-19 among different states and union territories of India but all the states and UTs were affected by this pandemic [22]. Added to this the mortality count at emergency ward of hospital in India had also increased significantly, inducing a sense of panic and fear among the population [23]. The prevalence of

certain sexually transmitted disease (STD) had also been altered during COVID-19 epoch [24][25][26]. The IPD admissions are also critical for several NCD (non-communicable diseases) such as cancer and the incidence of NCDs are also increasing every year such as cancer [27]. Despite above mentioned facts it is very difficult to think that the IPD hospital admissions decreased during COVID-19 epoch as compared to pre-pandemic epoch. How? Why? Naturally such question mark is coming to researcher mind. Few factors which may be responsible for this significant reduction in IPD admissions may be:-

1. Lockdown leading to reduced mobility.
2. Fear of contracting COVID-19 if admitted at hospital. The reluctance of public with healthcare requirements to seek hospital IPD care due to perceived hazard of acquiring a COVID-19 disease in a hospital setting
3. Reduced OOPE (out of pocket expenditure) capacity due to loss of jobs as indirect COVID-19 impact.
4. Lack of bed for IPD general admissions as a large portion was reserved for COVID-19 cases.
5. Self-Ignorance as well as family and social ignorance or negligence.
6. Lack of medical doctors and staff for medical conditions other than COVID-19 cases.
7. The Hospital medical staff shortages due to COVID-19 illness and mortality among the healthcare workforce.
8. Commotion within the hospital system in order to tackle the perceived obligations of the pandemic.
9. Decrease in the IPD admission referral rate as a result of the reduction in (OPD) outpatient hours.

This research study revealed that India experienced a decrease in inpatient hospital admissions for conditions which prevalence or incidence is not related to the COVID-19 pandemic, which can pose a grave health risk if left untreated. For an explanation consider the case of Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections, we calculated a 32.85% diminution in IPD admissions for such medical condition over the study period. The question arises what happened to these patients?

This novel research study also revealed a distraction in number of male-female IPD of all ages, malaria, dengue, typhoid, Inpatient - Asthma, Chronic Obstructive Pulmonary Disease (COPD), Respiratory infections, Inpatient - Pyrexia of unknown origin (PUO), Inpatient - Diarrhoea with dehydration and hepatitis care during the COVID-19 study period.

In brief, like other nations, the natural response of healthcare authorities in India to the unexpected onset of COVID-19 was to tackle and mitigate the perceived priority requirements of COVID-19 patients. Investigation of HMIS data revealed that, as the pandemic outspread, this response resulted in a universal reduction of hospital IPD services, for the treatment of non COVID-19 precedence needs. The prospective consequences of this crash in IPD services in India may result in augmented mortality rates over the approaching years for diseases other than COVID-19. Added to this several other very significant essential health services other than IPD were also affected negatively as direct/indirect impact of COVID-19 [28][29][30].

Future VERSION of this research study using HMIS data can reveal to what magnitude IPD activity recovers over the upcoming years from the COVID-19 epoch.

The influence on patients of chronic medical conditions such as NCDs who require regular IPD care for improved health and good quality of life may be of grave consequences. India being a LMICs, it is predictable that the majority of the population underneath poverty line could not manage to pay for private hospitals IPD or received public hospitals IPD care during the COVID-19 epoch. Patients with recently diagnosed NCDs may not be capable to get the IPD treatment, while the previous chronic NCDs patients

may have not received their regular therapy. It is quite obvious from this research study that majority of patients with medical conditions other than COVID-19 faced an amplified risk of complications, morbidity and mortality owing to reduced access to IPD healthcare. It's also a well recognized fact that deferred initiations and interruption of treatment may augment disease progression, reappearance, stress, concern, and premature mortality with morbidity.

This negative impact of COVID-19 epoch on IPD is due to countless factors, such as health workers being shifted for scheming the COVID-19 pandemic, etc [31]. The number of IPD decline may be explained by a prospect that prior information of COVID-19 through media and channels may have prejudiced prior health-seeking behaviour.

Strength and Limitations of this study

The fundamental strength of this research study is the utilization of a data set on IPD activity for all HMIS (MoHFW) registered hospitals in India. It is furthermore the first systematic endeavour to describe the bearing of SARS-CoV-2 pandemic on IPD hospital admissions in India. The prime limitations of this study are lack of data availability from any other source as well as lack of discrete data for several other significant medical conditions.

Conclusions and recommendations

The more regular and frequent publication of HMIS data can provide opportunities for judicious decision making in responding to unfolding emergencies such as COVID-19. Moreover, an in-depth study of the HMIS data set can make available insights into epidemiology, utilization patterns, and burden outcomes, including mortality rates. Though it appears India has responded reasonably well to the COVID-19 emergency, there is room for further improvement. The lesson India can learn from this incident is the need to advance strategies and processes whereby the reaction to pandemics is not unavoidably at the expense of other and similarly important other community health care needs. One area for upgrading is that while the reaction should be timely, health authorities need to respond proportionally, taking into description the population-wide health needs, health equity as the pandemic evolves and notify the public accordingly [32]. The strategy should take account of an evaluation of the consequences to population health needs if existing resources are enthused from one care need to another. For hospitals, it would denote that their pandemic reaction is phased-in as well as likely in line with definite clinical need and prearranged around specialist task force with the aim of reducing disruption to the prerequisite of other medical services. This tactic however, would require the orderliness of hospitals to become more flexible in their ability to react to altering conditions, and to offer a safe patient environment at times of contagion/distress. In addition, better use of telemedicine would improve access to care at a time when estrangement measures are in place, and a well-targeted information drive would educate the community of the harmful consequences of not seeking care. The states of India who are at bottom ranks in the NITI AAYOG annual health index report should be focussed more by the centre for improving the health services delivery [33][34]. The Government of India have issued advisory to all the states for establishment of dedicated PHMC by the end of 2022 but not implemented by several states like the bottom ranking states Bihar in India and this PHMC establishment must be ensured by all the states for significant improvements in health services delivery [35]. The registration system of birth and death should be improved in India with transparency for citizen satisfaction as well as for satisfaction of the accredited Organizations on global basis like WHO [36].

In the light of conclusion of this research study we recommend the following:

- Governments of India should think of strategies on priority basis to trim down the burden of morbidity and mortality to reap the benefits of **Demographic Dividend**. The COVID-19 management should be prioritized, but not at the cost of other NCDs and CDs.
- Government need a more robust and flexible health framework to respond to COVID-19/distress with due considerations of rigorous restrictions which can interrupt routine essential other health services, leading to a **vicious cycle** and overwhelming effect on the health need of population.
- Government of India should give more focus on proper and timely data collection.
- The different states of India should comply with the central government guidelines[37][38]

Other information

Abbreviations: OPD- Outpatient Department; COVID-19- Coronavirus disease2019; SARS-CoV-2- severe acute respiratory syndrome coronavirus 2; (NIV) National Institute of Virology; (World Health Organization) WHO; Health Management Information System (HMIS); Ministry of Health and Family Welfare (MoHFW); IPD (Inpatient Department); ED (emergency department); IHR (International Health Regulations); NITI (National Institution for Transforming India); PUBLIC HEALTH MANAGEMENT CADRE (PHMC); ICU (intensive care unit).

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