The COVID-19 Impact on Accidental Deaths and Suicide Incidence in India- A Comparative Study (1967-2022)

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Article

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Abstract: Globally 703 000 people commit suicide (4th leading cause of mortality among 15-29 year-olds, 1.4% of all deaths globally) every year, which have a negative effect on families, colleagues, and societies. India accounts for 36.6 percent of global suicide in women and 24.3 percent among men, while having only 17.8 percent of the global population, also remarkable fact is that the suicide ratio for female is 14.7 per 100,000 compared to 21.2 per 100,000 of male which is 2.1 times the global average in female, while 1.4 times higher for men. COVID-19 (coronavirus disease-2019) pandemic has certainly affected the physical, mental, economical and social well being of global population directly or indirectly in different ways. Deteriorating physical, mental, economical and social health of an individual could increase the suicidal tendency, leading to accidents and suicide. This study tried to find out the COVID-19 pandemic situation impact on accidental death as well as suicide rates in India. The study period is from 1st January 1967 to 31st December 2021, to assess the effect of the COVID-19 pandemic situation on suicide and accidental death rates. This study revealed that the suicide deaths percentage among males increased significantly in comparison to females in COVID-19 era and actual count and incidence also increased. This study revealed that the mean accidental death and suicide both increased during COVID period of study as compared to pre-pandemic whole period from 1967 by 25.47 % and 30.61% respectively. Alternatively we can say that the accidental death and suicides increased significantly in India, which is largely preventable.

Keywords: COVID-19; suicide; accident; pandemic; impact

1. Background:

Globally 703 000 people commit suicide (4th leading cause of mortality among 15-29 year-olds, 1.4% of all deaths globally) every year, which have a negative effect on families, colleagues, and societies [1]. LMICs (low- and middle-income countries) account for 77% of global suicides most commonly by ingestion of pesticide (20% of global suicides) in rural agricultural areas in low- and middle-income countries; hanging and firearms [2]. Suicide is serious public health issue in India which can be prevented by low-cost interventions [3]. In 2016 the suicidal death rate in India per lakh population was 16.5, whereas the global average in 2016 was 10.5 per 100 000 [4]. India accounts for 36.6 percent of global suicide in women and 24.3 percent among men, while having only 17.8 percent of the global population, also remarkable fact is that the suicide ratio for female is 14.7 per 100,000 compared to 21.2 per 100,000 of male which is 2.1 times the global average in female, while 1.4 times higher for men [5].

COVID-19 (coronavirus disease-2019) pandemic has certainly affected the physical, mental, economical and social well being of global population directly or indirectly in different ways [6]. The COVID-19 distress is no more a PHEIC (public health emergency of international concern) as declared by WHO (World Health Organization) International Health Regulations (2005) (IHR) Emergency Committee 15th meeting, held on Thursday 4 May 2023 [7]. The global researcher community is yet calculating and analyzing the devastating impact of this pandemic on various

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aspect of life. Undoubtedly the situations have provoked mental health issues globally. Numerous factors originating due to the pandemic situation like fear, anxiety, reduced access-utilization of routine health services, forced social distancing, lockdowns, loss of job, hiked treatment costs, social boycott of infected individuals, an increase of domestic violence could deteriorate the physical, mental, economical and social health of an individual [8]. Deteriorating physical, mental, economical and social health of an individual could increase the suicidal tendency, leading to accidents and suicide [9]. Several Studies have reported that COVID-19 pandemic is associated with increased stress, depression, insomnia, and narcotics abuse [10]. Research on exploring association/impact of the pandemic with suicide and accident are abundant in developed countries, where there is narrow gap in different samples. In countries like India where there are extreme rich and extreme poor individuals such studies will provide a better insight about the impact of pandemic situation on such explorations [11]. Of course limited public data availability and lack of funds to eminent poor researchers of countries like India for carrying out field survey of situation might interfere with the output of such studies on the COVID-19 impact on suicide and accidental death in developing countries. One study done by, Pirikis et al. found that the suicidal death has not increased in twenty two high-income countries, whereas in LMICs, COVID-19 attributed as a prominent cause of suicidal death [12]. The impact of the pandemic on suicide and accidental death could be country- exclusive depending on individual country specific factors like the prevalence of physical, mental, economical and social co morbidities, and the country specific public health actions imposed by governments to contain the pandemic. Some studies found gender variation in suicide rates with a high rate for males, whereas some have reported mental health worsening related to the pandemic is higher in females [13–15].

The COVID-19 pandemic has had deleterious effects on the food system, economy and social life globally as well as it has disrupted transportation across the world [16]. Globally governments imposed travel restrictions (closed borders, restricted flights, and lockdowns) which may have reduced the risk of collisions and accidental deaths [17]. Two major waves of the COVID-19 pandemic distressed the world in 2020 and 2021, leading to the death of about 06 million (real count may be more) people worldwide by 2021end [18]. The first confirmed case of COVID-19 in India, was from southern state Kerala on 30th January 2020 [19], India imposed nationwide lockdown and stopped flights, Railways and roadways from 25thMarch disrupting several routine services except for essential services like food, health, etc [20–23]. The lockdown increased fear and feeling of isolation, which was more aggravated by the loss of relatives, and social stigma [24]. Added to this lockdown caused loss of employment, financial crisis, uncertain future to students who could not attend schools and colleges [25]. Females became more exposed to domestic violence at home while older ones feel neglected leading to depression [26].

This study tried to find out the COVID-19 pandemic situation impact on accidental death as well as suicide rates in India. This study may help policy and decision makers in devising appropriate programs for reducing the future pandemic or any similar disaster responses to minimize harm. This study also aims to create awareness among health professionals and readers in general by doing comparative study of suicidal deaths and accidents during the pre-COVID-19 and COVID-19 periods.

2. Aim and Objective

The aim of this study is to compare the accidental and suicidal deaths, (incidence, prevalence, rate, numbers, percentage, gender, etc.) in the pandemic (COVID-19 period) with non-pandemic periods (pre-COVID-19 period), in India. The key objective is to assess the COVID-19 impact on accidental and suicidal mortality in terms of epidemiological indicators like rate, proportions, etc.

Methodology

This is an observational, comparative and retrospective study for analyzing the COVID-19 impact on suicide and accidental death count in India. The study period is from 1st January 1967 to 31st December 2021, to assess the effect of the COVID-19 pandemic situation on suicide and accidental death rates. We define 1st January 1967 to 31st December 2019 as the pre-pandemic period and 1st

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January 2020 to 31st December 2021 as the pandemic period (based on identification of first COVID-19 confirmed case in India). Of course two similar periods is also compared to avoid bias i.e. 2018-2019 is compared to 2020-2021. A larger period is studied to know the longer trends in suicide and accidental death count in India.

Study setting and data

The annual suicide and accidental death counts by gender for India were obtained from NCRB (NATIONAL CRIME RECORDS BUREAU), Government of India [27]. The cause of death is investigated by the Indian Police department of 36 states and union territories of India as required by established law. The nature of death is usually based on the certified medical and autopsy reports. The population estimate by gender was obtained from World Bank, Population data [28]. Table 1 presents the data collected during the study period.

Statistical analysis

We calculated the suicide and accidental death rates for each year during the study period by dividing the number of suicide and accidental death by the population exposed (considering whole population exposed). Then incidence rate per lakh population is calculated for each year during the pandemic era by utilizing the data.

The data was collected from NCRB records. The same period was also taken to address any bias due to seasonal factors as well as the whole data collected was also analyzed to present the previous background. The data is presented as tables, graph, etc. with appropriate statistical analysis. The incidence rate ratio (IRR) is calculated as the ratio of incidence of suicide and accidental death out of total deaths during the study period and two period separately (NOT AVAILABLE IN PREPRINT). Table 2 presents the statistical analysis of the data collected during the study period.

Table 1. Gender-wise suicide and accidental death in India from 1967 to 2021*.

Year	Accidental Deaths-Male	Accidental Deaths-Female	Accidental Deaths-Bisexual	Total - Accidental Deaths	Suicides-Male	Suicides-Female	Suicides-Bisexual	Suicides-Total
1967	79131	47631	N/A**	126762	22637	16192	N/A	38829
1968	79159	47073	N/A	126232	24464	16224	N/A	40688
1969	82105	48650	N/A	130755	25947	17686	N/A	43633
1970	89210	50542	N/A	139752	28846	19582	N/A	48428
1971	68344	37257	N/A	105601	26326	17349	N/A	43675
1972	69838	36346	N/A	106184	26923	16678	N/A	43601
1973	69613	36741	N/A	130654	25231	15576	N/A	40807
1974	73580	37044	N/A	110624	27791	18217	N/A	46008
1975	74987	38029	N/A	113016	26074	16816	N/A	42890
1976	73098	38513	N/A	111611	24042	17373	N/A	41415
1977	76013	41325	N/A	117338	23453	16265	N/A	39718
1978	78352	40242	N/A	118594	24137	16070	N/A	40207
1979	72448	36539	N/A	108987	22980	15237	N/A	38217
1980	76293	40619	N/A	116912	24188	17475	N/A	41663
1981	82328	39893	N/A	122221	23864	16381	N/A	40245
1982	82977	43016	N/A	125993	26520	18212	N/A	44732
1983	85577	42999	N/A	128576	27260	19319	N/A	46579

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1984	90636	43992	N/A	134628	29296	21275	N/A	50571
1985	93568	46089	N/A	139657	30460	22351	N/A	52811
1986	98480	48543	N/A	147023	31271	23086	N/A	54357
1987	103727	48587	N/A	152314	34292	24276	N/A	58568
1988	110235	53287	N/A	163522	37755	26515	N/A	64270
1989	114953	54113	N/A	169066	40212	28532	N/A	68744
1990	117932	56469	N/A	174401	43451	30460	N/A	73911
1991	129142	58861	N/A	188003	46324	32126	N/A	78450
1992	133977	60933	N/A	194910	47481	32668	N/A	80149
1993	130499	61858	N/A	192357	49851	34393	N/A	84244
1994	132241	58194	N/A	190435	52752	36443	N/A	89195
1995	157219	65268	N/A	222487	52357	36821	N/A	89178
1996	156106	63988	N/A	220094	51206	37035	N/A	88241
1997	164876	69027	N/A	233903	56281	39548	N/A	95829
1998	185520	72889	N/A	258409	61686	43027	N/A	104713
1999	193652	78266	N/A	271918	65488	45099	N/A	110587
2000	186324	69559	N/A	255883	66032	42561	N/A	108593
2001	196129	74890	N/A	271019	66314	42192	N/A	108506
2002	194850	65272	N/A	260122	69332	41085	N/A	110417
2003	197285	62340	N/A	259625	70221	40630	N/A	110851
2004	210190	67073	N/A	277263	72651	41046	N/A	113697
2005	224806	69369	N/A	294175	72916	40998	N/A	113914
2006	241210	73494	N/A	314704	75702	42410	N/A	118112
2007	262918	77876	N/A	340794	79295	43342	N/A	122637
2008	263809	78500	N/A	342309	80544	44473	N/A	125017
2009	276333	80688	N/A	357021	81471	45680	N/A	127151
2010	298262	86387	N/A	384649	87180	47419	N/A	134599
2011	302420	88464	N/A	390884	87839	47746	N/A	135585
2012	306061	88921	N/A	394982	88453	46992	N/A	135445
2013	312670	87847	N/A	400517	90543	44256	N/A	134799
2014	354573	97078	106	451757	89129	42521	16	131666
2015	328241	85169	47	413457	91528	42088	7	133623
2016	333804	84372	45	418221	88997	41997	14	131008
2017	318316	78234	34	396584	89019	40852	16	129887
2018	330925	80864	35	411824	92114	42391	11	134516
2019	340267	80800	37	421104	97613	41493	17	139123
2020	301405	72975	17	374397	108532	44498	22	153052
2021	324151	73306	33	397530	118979	45026	28	164033
Total	9530765	3366301	354	12921760	3025250	1756003	131	4781384

*Source of data – NCRB, Government of India- Available at - https://ncrb.gov.in/en/ADSI-2021 ** N/A – Not Available.

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Table 2. Statistical analysis of the data collected during the study period.

A-Gender-wise statistical analysis of suicide and accidental death in India from 1st January-1967 to 31st December 2021								
Variable	Obs	Mean	Std. Dev.	[95% Conf. Interval]	Std. Err.	Total	Min	Max
Accidental Deaths-Male	55	173286.6	96397.1	147226.9 - 199346.4	12998.2	9530765	68344	354573
Accidental Deaths-Female	55	61205.5	17561.7	56457.9 - 65953.1	2368.0	3366301	36346	97078
Accidental Deaths-Bisexual	8	44.3	26.5	22.1 -66.4	9.4	354	17	106
Total -Accidental Deaths	55	234941.1	112658.5	204485.2 - 265397	15190.9	12921760	105601	451757
Suicides-Male	55	55004.6	27692.1	47518.3 - 62490.7	3734.0	3025250	22637	118979
Suicides-Female	55	31927.3	11789.9	28740.1- 35114.6	1589.8	1756003	15237	47746
Suicides-Bisexual	8	16.4	6.4	10.9 -21.8	2.3	131	7	28
Suicides-Total	55	86934.3	38879.9	76423.5 - 97444.9	5242.6	4781384	38217	164033
B-Gender-wise statistical analysis of suicide and accidental death in India during pre-COVID-19 period from 1st January 1967 to 31st December 2019								
Variable	Obs	Mean	Std. Dev.	[95% Conf. Interval]	Std. Err.	Total	Min	Max
Accidental Deaths-Male	53	168022.8	94171.1	142066 - 193979.6	12935.4	8905209	68344	354573
Accidental Deaths-Female	53	60755.1	17736.6	55866.3 - 65643.9	2436.3	3220020	36346	97078
Accidental Deaths-Bisexual	6	50.7	27.6	21.7 -79.7	11.3	304	34	106
Total -Accidental Deaths	53	229242.1	110745.8	198716.8 - 259767.4	15212.1	12149833	105601	451757
Suicides-Male	53	52787.5	25642.4	45719.6 - 59855.4	3522.3	2797739	22637	97613
Suicides-Female	53	31443	11737.6	28207.7- 34678.3	1612.3	1666479	15237	47746
Suicides-Bisexual	6	13.5	3.8	9.5- 17.5	1.6	81	7	17
Suicides-Total	53	84232.1	36931.9	74052.4- 94411.8	5072.9	4464299	38217	139123
C-Gender-wise statistical analysis of suicide and accidental death in India during COVID-19 period from 1st January 2020 to 31st December 2021								

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Variable	Obs	Mean	Std. Dev.	[95% Conf. Interval]	Std. Err.	Total	Min	Max
Accidental Deaths-Male	2	312778	16083.9	168270.3 - 457285.7	11373	625556	301405	324151
Accidental Deaths-Female	2	73140.5	234.1	71037.6 - 75243.4	165.5	146281	72975	73306
Accidental Deaths-Bisexual	2	25	11.3	-76.6- 126.6	8	50	17	33
Total -Accidental Deaths	2	385963.5	16357.5	238997.2-532929.8	11566.5	771927	374397	397530
Suicides-Male	2	113755.5	7387.1	47384.6 - 180126.4	5223.5	227511	108532	118979
Suicides-Female	2	44762	373.4	41407.6-48116.4	264	89524	44498	45026
Suicides-Bisexual	2	25	4.2	-13.1- 63.1	3	50	22	28
Suicides-Total	2	158542.5	7764.7	88779.1 - 228305.9	5490.5	317085	153052	164033
D-Gender-wise statistical analysis of suicide and accidental death in India during Pre-COVID-19 period from 1st January 2018 to 31st December 2019 – NOT AVAILABLE IN PREPRINT								

3. Results

Suicidal deaths - accidental deaths – 2018-2019-2020-2021

Table 3-A shows that during the pre-COVID-19 era of this study, 1106567 suicidal and accidental deaths were reported, of which 83298 (75.27 %) were accidental deaths and 273639 (24.73 %) were suicidal death. During the COVID-19 epoch of this study, 1089012 suicidal and accidental deaths were reported of which 771927 (70.88 %) were accidental and 317085 (29.12 %) were suicidal.

This research study revealed that out of two study period the accidental death were reduced by 4.39 % during the COVID-19 epoch of this study whereas the suicidal death increased by 4.39% during the COVID-19 epoch. This study also revealed that the total suicidal and accidental deaths reduced during COVID-19 epoch by 1.59%.

Table 3-B shows that out of total 1604855 accidental death during above study period 832928 (51.90%) accidental deaths were reported during the pre-COVID-19 era of this study, whereas 771927 (48.10 %) were reported during COVID-19 epoch. During the pre-COVID-19 epoch of this study, 273639 (46.32%) suicidal deaths whereas 317085 (53.68%) were reported during the COVID-19 epoch out of total 590724 suicide during above study period.

This research study revealed that out of individual category of total suicide and accidental death, the accidental death were reduced by 3.80 % during the COVID-19 epoch of this study whereas the suicidal death increased by 7.35% during the COVID-19 epoch.

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Table 3. Cause of death during COVID-19 and pre-COVID-19 periods.

Table 3A: Cause of death during COVID and pre-COVID periods Manner of death (same period percent of accidents and deaths)	Pre-COVID period 2018-2019	COVID period 2020-2021	Total 2018-2021
Total Accidental Death	832928(75.27%)	771927(70.88 %)	1604855
Total Suicide	273639(24.73%)	317085(29.12 %)	590724
Total	1106567(100%)	1089012(100%)	2195579
Table 3B: Cause of death during COVID and pre-COVID periods Manner of death(Two study period percent of accidents and deaths)	Pre-COVID period 2018-2019	COVID period 2020-2021	Total 2018-2021
Total Accidental Death	832928 (51.90%)	771927(48.10 %)	1604855(100%)
Total Suicide	273639(46.32%)	317085(53.68 %)	590724(1 00%)
Total	1106567	1089012	2195579
Table 3C: Cause of death during COVID and pre-COVID periods Manner of death (Two study period percent of accidents and deaths)	Mean Pre-COVID period 1967-2019	Mean COVID period 2020-2021	Mean Total 1967-2021
Mean Accidental Death	229242.1(37.26 %)	385964(62.74 %)	615206.1(100%)
Mean Suicide	84232.06(34.70 %)	158543(65.30 %)	242775.1(100%)
Mean Total	313474.2	544507	857981.2
Table 3D: Cause of death during COVID and pre-COVID periods Manner of death (same period percent of accidents and deaths)	Mean Pre-COVID period 1967-2019	Mean COVID period 2020-2021	Mean Total 1967-2021
Mean Accidental Death	229242.1(73.13 %)	385964(70.88 %)	615206.1
Mean Suicide	84232.06(26.87 %)	158543(29.12 %)	242775.1
Mean Total	313474.2(100%)	544507(100%)	857981.2

Mean Suicidal deaths vs. accidental deaths – 1967-2021

The whole study period i.e. from 1967 to 2021 mean comparison of two periods is presented in Table 3-C and D. The mean accidental death and suicides increased to a great extent during the COVID period as compared to pre- COVID period of study. This study revealed that the mean accidental death and suicide both increased during COVID period of study as compared to pre-pandemic whole period from 1967 by 25.47 % and 30.61% respectively. Alternatively we can say that the accidental death and suicides increased significantly in India, which is largely preventable.

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To reduce the bias a similar previous period of pre- COVID period is compared in Table3-A and B.

Test of independence is not applied here between cause of death during pre-COVID-19 and COVID-19 era as this is not a sample survey, instead the whole population is taken into account for this study.

Gender-Wise Yearly variation in suicides and accidental death

Tables 1, 2, 4 and Figures 1 and 2 presents the Gender-Wise Yearly variation in suicides and accidental death during the study period.

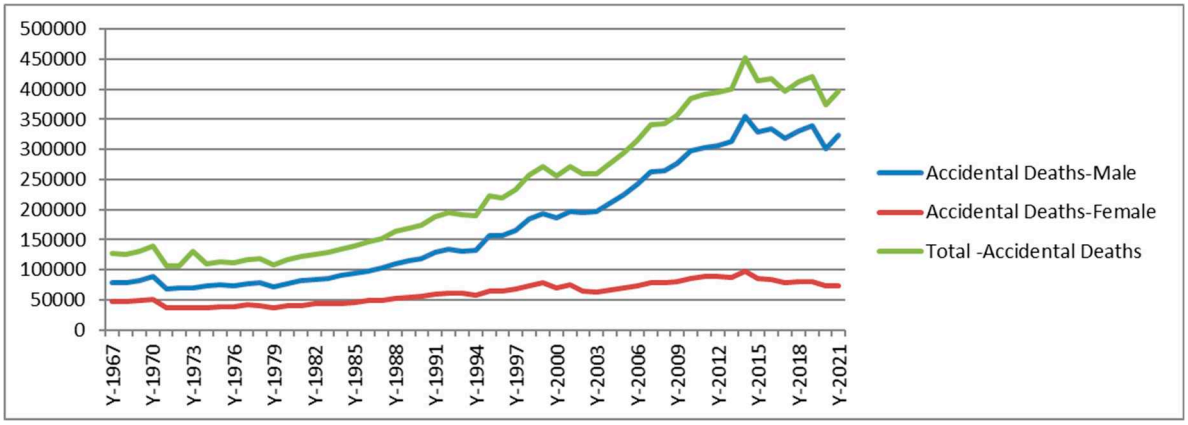

Figure 1. Gender-wise comparison of annual accidental death in India from 1st January-1967 to 31st December 2021.

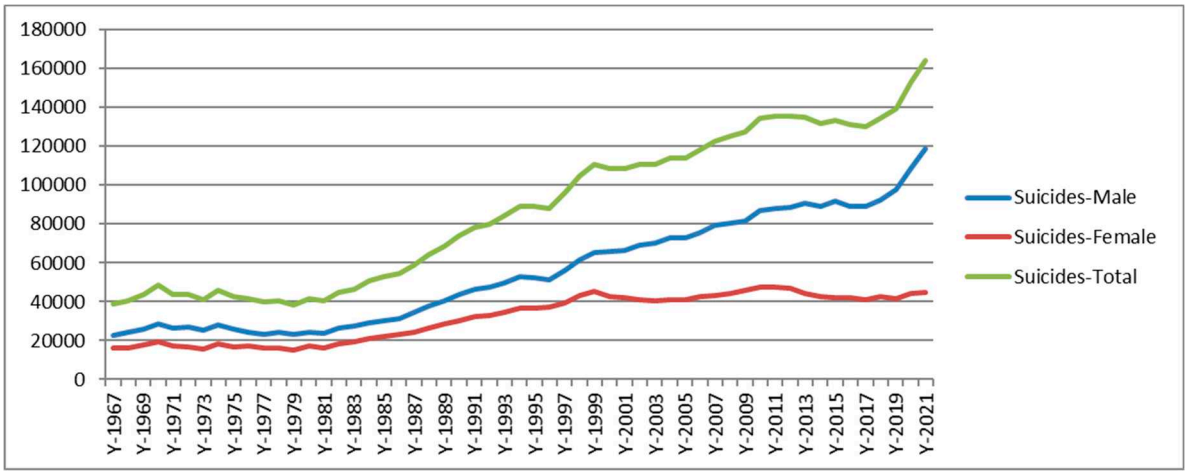

Figure 2. Gender-wise comparison of annual suicide in India from 1st January-1967 to 31st December 2021.

A monthly data of suicides will provide a better insight in suicides and accidental deaths during the COVID period, particularly to assess the impact of the lockdown period on, the number of accidental and Suicidal deaths. The data is not available to us but we are trying to get data from an accredited source.

Gender Variation- accidental deaths

Tables 1, 2, 4-A and Figure 1 shows that during the total pre-COVID-19 period (1967-2019), there were 12149833 [95% C.I. - 198716.8 -259767.4] total accidental deaths, out of which 8905209 were male[95% C.I. - 142066 -193979.6], and 3220020 female[95% C.I. - 55866.3 -65643.9], whereas, for the COVID-19 period, there were total 771927 accidental deaths [95% C.I. - 238997.2- 532929.8] out of which 625556 were males[95% C.I. -168270.3 -457285.7], and 146281 were females[95% C.I. -71037.6 -

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75243.4]. This study revealed that compared to immediate previous i.e. 2018-2019 pre-pandemic era a decrease in percentage and annual incidence of accidental deaths is observed in both the genders with male preponderance during the COVID-19 period (2020-2021) of the study.

Male

Table 1, 2, 4-A and Figure 1 shows that for the pre-COVID period 2018-2019, accidental deaths percentage among males out of total accidental deaths (411824-421104) were 80.4%-80.8% respectively for 2018-2019 whereas for the COVID period 2020-2021(374397-397530), accidental deaths among males as a percentage of total accidental deaths was 80.5%-81.5% respectively for 2018-2019. The accidental deaths among males percentage increased slight in comparison to females in COVID-19 era but actual count and incidence decreased.

Female

Table 1, 2, 4-A and Figure 1 shows that for the pre-COVID period 2018-2019, accidental deaths percentage among females out of total accidental deaths (411824-421104) were 19.6%-19.2% respectively for 2018-2019 whereas for the COVID period 2020-2021(374397-397530), accidental deaths among females as a percentage of total accidental deaths was 19.5%-18.4% respectively for 2018-2019. The accidental deaths among females percentage decreased slight in comparison to males in COVID-19 era but actual count and incidence decreased.

Table 4. A- Gender-wise comparison of accidental death in India from 1st January-1967 to 31st December 2021.

Year	Accidental Deaths-Male	Population male	Male-Annual Incidence per 100000	Accidental Deaths-Female	Population female	Female-Annual Incidence per 100000	Total - Accidental Deaths	Male-% of Total	Female-%of total	Accidental Deaths-Bisexual*
Y-1967	79131	269770979	29.3	47631	252216091	18.9	126762	62.4	37.6	N/A**
Y-1968	79159	275736482	28.7	47073	257695427	18.3	126232	62.7	37.3	N/A
Y-1969	82105	281934206	29.1	48650	263380464	18.5	130755	62.8	37.2	N/A
Y-1970	89210	288292405	30.9	50542	269208897	18.8	139752	63.8	36.2	N/A
Y-1971	68344	294818942	23.2	37257	275180236	13.5	105601	64.7	35.3	N/A
Y-1972	69838	301529376	23.2	36346	281308597	12.9	106184	65.8	34.2	N/A
Y-1973	69613	308465459	22.6	36741	287642024	12.8	130654	53.3	28.1	N/A
Y-1974	73580	315584063	23.3	37044	294137889	12.6	110624	66.5	33.5	N/A

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Y-1975	74987	322800952	23.2	38029	300723268	12.6	113016	66.4	33.6	N/A
Y-1976	73098	330077580	22.1	38513	307373867	12.5	111611	65.5	34.5	N/A
Y-1977	76013	337496325	22.5	41325	314189303	13.2	117338	64.8	35.2	N/A
Y-1978	78352	345069608	22.7	40242	321198151	12.5	118594	66.1	33.9	N/A
Y-1979	72448	352826329	20.5	36539	328422054	11.1	108987	66.5	33.5	N/A
Y-1980	76293	360875327	21.1	40619	335953058	12.1	116912	65.3	34.7	N/A
Y-1981	82328	369149846	22.3	39893	343719452	11.6	122221	67.4	32.6	N/A
Y-1982	82977	377542519	22.0	43016	351626946	12.2	125993	65.9	34.1	N/A
Y-1983	85577	386102269	22.2	42999	359724278	12.0	128576	66.6	33.4	N/A
Y-1984	90636	394865497	23.0	43992	368029660	12.0	134628	67.3	32.7	N/A
Y-1985	93568	403766421	23.2	46089	376475662	12.2	139657	67.0	33.0	N/A
Y-1986	98480	412811682	23.9	48543	385067312	12.6	147023	67.0	33.0	N/A
Y-1987	103727	421960524	24.6	48587	393755601	12.3	152314	68.1	31.9	N/A
Y-1988	110235	431194389	25.6	53287	402535292	13.2	163522	67.4	32.6	N/A
Y-1989	114953	440551295	26.1	54113	411461378	13.2	169066	68.0	32.0	N/A
Y-1990	117932	449984059	26.2	56469	420468106	13.4	174401	67.6	32.4	N/A
Y-1991	129142	459463492	28.1	58861	429478264	13.7	188003	68.7	31.3	N/A
Y-1992	133977	469046096	28.6	60933	438527953	13.9	194910	68.7	31.3	N/A
Y-1993	130499	478735976	27.3	61858	447615320	13.8	192357	67.8	32.2	N/A
Y-1994	132241	488535405	27.1	58194	456726553	12.7	190435	69.4	30.6	N/A
Y-1995	157219	498432465	31.5	65268	465846665	14.0	222487	70.7	29.3	N/A

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Y-1996	156106	508349160	30.7	63988	474932057	13.5	220094	70.9	29.1	N/A
Y-1997	164876	518303618	31.8	69027	484031612	14.3	233903	70.5	29.5	N/A
Y-1998	185520	528287413	35.1	72889	493147162	14.8	258409	71.8	28.2	N/A
Y-1999	193652	538244360	36.0	78266	502255693	15.6	271918	71.2	28.8	N/A
Y-2000	186324	548223581	34.0	69559	511410095	13.6	255883	72.8	27.2	N/A
Y-2001	196129	558291332	35.1	74890	520679574	14.4	271019	72.4	27.6	N/A
Y-2002	194850	568334873	34.3	65272	529978166	12.3	260122	74.9	25.1	N/A
Y-2003	197285	578236241	34.1	62340	539178882	11.6	259625	76.0	24.0	N/A
Y-2004	210190	587990365	35.7	67073	548274218	12.2	277263	75.8	24.2	N/A
Y-2005	224806	597477666	37.6	69369	557161047	12.5	294175	76.4	23.6	N/A
Y-2006	241210	606611392	39.8	73494	565762395	13.0	314704	76.6	23.4	N/A
Y-2007	262918	615506279	42.7	77876	574185530	13.6	340794	77.1	22.9	N/A
Y-2008	263809	624242020	42.3	78500	582492785	13.5	342309	77.1	22.9	N/A
Y-2009	276333	632892402	43.7	80688	590747758	13.7	357021	77.4	22.6	N/A
Y-2010	298262	641566029	46.5	86387	599047591	14.4	384649	77.5	22.5	N/A
Y-2011	302420	650244390	46.5	88464	607376801	14.6	390884	77.4	22.6	N/A
Y-2012	306061	658839435	46.5	88921	615647779	14.4	394982	77.5	22.5	N/A
Y-2013	312670	667322883	46.9	87847	623809180	14.1	400517	78.1	21.9	N/A
Y-2014	354573	675549357	52.5	97078	631697152	15.4	451757	78.5	21.5	106
Y-2015	328241	683543213	48.0	85169	639323292	13.3	413457	79.4	20.6	47
Y-2016	333804	691623419	48.3	84372	647012921	13.0	418221	79.8	20.2	45

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Y-2017	318316	699587889	45.5	78234	654607791	12.0	396584	80.3	19.7	34
Y-2018	330925	707149230	46.8	80864	661854076	12.2	411824	80.4	19.6	35
Y-2019	340267	714325057	47.6	80800	668786993	12.1	421104	80.8	19.2	37
Y-2020	301405	720997448	41.8	72975	675389679	10.8	374397	80.5	19.5	17
Y-2021	324151	726503429	44.6	73306	681060412	10.8	397530	81.5	18.4	33
Mean	173286.6	493012045	32.7	61205.5	460355243.8	13.4	234941.091	71.0	28.6	44.3

*Due to less available data further analysis of this category is not done but it is included in total count. ** N/A – Not Available

Gender Variation- Suicide

Table 1, 2, 4-B and Figure 2 shows that during the total pre-COVID-19 period (1967-2019), there were 4464299 [95% C.I. - 74052.4- 94411.8] total suicide deaths, out of which 2797739 were male[95% C.I. - 45719.6 -59855.4], and 1666479 female[95% C.I. - 28207.7- 34678.3], whereas, for the COVID-19 period, there were total 317085 suicide deaths [95% C.I. - 88779.1 -228305.9] out of which 227511 were males[95% C.I. -47384.6 -180126.4], and 89524 were females[95% C.I. -41407.6- 48116.4]. This study revealed that compared to immediate previous i.e. 2018-2019 pre-pandemic era, an increase in percentage and annual incidence of suicide deaths is observed in both the genders with male preponderance during the COVID-19 period (2020-2021) of the study.

Male

Table 1, 2, 4-B and Figure 2 shows that for the pre-COVID period 2018-2019, suicide deaths percentage among males out of total suicide deaths (134516-139123) were 68.5%-70.2% respectively for 2018-2019 whereas for the COVID period 2020-2021(153052-164033), suicide deaths among males as a percentage of total suicide deaths was 70.9%-72.5% respectively for 2018-2019. This study revealed that the suicide deaths percentage among males increased significantly in comparison to females in COVID-19 era and actual count and incidence also increased.

Female

Table 1, 2, 4-B and Figure 2 shows that for the pre-COVID period 2018-2019, suicide deaths percentage among females out of total suicide deaths (134516-139123) were 31.5%-29.8% respectively for 2018-2019 whereas for the COVID period 2020-2021(153052-164033), suicide deaths among females as a percentage of total suicide deaths was 29.1%-27.4% respectively for 2018-2019. This study revealed that the suicide deaths among females percentage increased in COVID-19 era and actual count and incidence also increased.

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Table 4. B- Gender-wise comparison of suicide in India from 1st January-1967 to 31st December 2021.

Year	No. of Suicides-Male	Population of male	Male-Annual Incidence of suicide in male per 100000	No. of Suicides-Female	Population of female	Female-Annual Incidence of suicide in female per 100000	Total No. of Suicides-	Male-% of Total suicide	Female-%of total suicide	Suicides-Bisexual*
Y-1967	22637	269770979	8.4	16192	252216091	6.4	38829	58.3	41.7	N/A**
Y-1968	24464	275736482	8.9	16224	257695427	6.3	40688	60.1	39.9	N/A
Y-1969	25947	281934206	9.2	17686	263380464	6.7	43633	59.5	40.5	N/A
Y-1970	28846	288292405	10.0	19582	269208897	7.3	48428	59.6	40.4	N/A
Y-1971	26326	294818942	8.9	17349	275180236	6.3	43675	60.3	39.7	N/A
Y-1972	26923	301529376	8.9	16678	281308597	5.9	43601	61.7	38.3	N/A
Y-1973	25231	308465459	8.2	15576	287642024	5.4	40807	61.8	38.2	N/A
Y-1974	27791	315584063	8.8	18217	294137889	6.2	46008	60.4	39.6	N/A
Y-1975	26074	322800952	8.1	16816	300723268	5.6	42890	60.8	39.2	N/A
Y-1976	24042	330077580	7.3	17373	307373867	5.7	41415	58.1	41.9	N/A
Y-1977	23453	337496325	6.9	16265	314189303	5.2	39718	59.0	41.0	N/A
Y-1978	24137	345069608	7.0	16070	321198151	5.0	40207	60.0	40.0	N/A
Y-1979	22980	352826329	6.5	15237	328422054	4.6	38217	60.1	39.9	N/A
Y-1980	24188	360875327	6.7	17475	335953058	5.2	41663	58.1	41.9	N/A
Y-1981	23864	369149846	6.5	16381	343719452	4.8	40245	59.3	40.7	N/A

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Y-1982	26520	377542519	7.0	18212	351626946	5.2	44732	59.3	40.7	N/A
Y-1983	27260	386102269	7.1	19319	359724278	5.4	46579	58.5	41.5	N/A
Y-1984	29296	394865497	7.4	21275	368029660	5.8	50571	57.9	42.1	N/A
Y-1985	30460	403766421	7.5	22351	376475662	5.9	52811	57.7	42.3	N/A
Y-1986	31271	412811682	7.6	23086	385067312	6.0	54357	57.5	42.5	N/A
Y-1987	34292	421960524	8.1	24276	393755601	6.2	58568	58.6	41.4	N/A
Y-1988	37755	431194389	8.8	26515	402535292	6.6	64270	58.7	41.3	N/A
Y-1989	40212	440551295	9.1	28532	411461378	6.9	68744	58.5	41.5	N/A
Y-1990	43451	449984059	9.7	30460	420468106	7.2	73911	58.8	41.2	N/A
Y-1991	46324	459463492	10.1	32126	429478264	7.5	78450	59.0	41.0	N/A
Y-1992	47481	469046096	10.1	32668	438527953	7.4	80149	59.2	40.8	N/A
Y-1993	49851	478735976	10.4	34393	447615320	7.7	84244	59.2	40.8	N/A
Y-1994	52752	488535405	10.8	36443	456726553	8.0	89195	59.1	40.9	N/A
Y-1995	52357	498432465	10.5	36821	465846665	7.9	89178	58.7	41.3	N/A
Y-1996	51206	508349160	10.1	37035	474932057	7.8	88241	58.0	42.0	N/A
Y-1997	56281	518303618	10.9	39548	484031612	8.2	95829	58.7	41.3	N/A
Y-1998	61686	528287413	11.7	43027	493147162	8.7	104713	58.9	41.1	N/A
Y-1999	65488	538244360	12.2	45099	502255693	9.0	110587	59.2	40.8	N/A
Y-2000	66032	548223581	12.0	42561	511410095	8.3	108593	60.8	39.2	N/A
Y-2001	66314	558291332	11.9	42192	520679574	8.1	108506	61.1	38.9	N/A
Y-2002	69332	568334873	12.2	41085	529978166	7.8	110417	62.8	37.2	N/A

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Y-2003	70221	578236241	12.1	40630	539178882	7.5	110851	63.3	36.7	N/A
Y-2004	72651	587990365	12.4	41046	548274218	7.5	113697	63.9	36.1	N/A
Y-2005	72916	597477666	12.2	40998	557161047	7.4	113914	64.0	36.0	N/A
Y-2006	75702	606611392	12.5	42410	565762395	7.5	118112	64.1	35.9	N/A
Y-2007	79295	615506279	12.9	43342	574185530	7.5	122637	64.7	35.3	N/A
Y-2008	80544	624242020	12.9	44473	582492785	7.6	125017	64.4	35.6	N/A
Y-2009	81471	632892402	12.9	45680	590747758	7.7	127151	64.1	35.9	N/A
Y-2010	87180	641566029	13.6	47419	599047591	7.9	134599	64.8	35.2	N/A
Y-2011	87839	650244390	13.5	47746	607376801	7.9	135585	64.8	35.2	N/A
Y-2012	88453	658839435	13.4	46992	615647779	7.6	135445	65.3	34.7	N/A
Y-2013	90543	667322883	13.6	44256	623809180	7.1	134799	67.2	32.8	N/A
Y-2014	89129	675549357	13.2	42521	631697152	6.7	131666	67.7	32.3	16
Y-2015	91528	683543213	13.4	42088	639323292	6.6	133623	68.5	31.5	7
Y-2016	88997	691623419	12.9	41997	647012921	6.5	131008	67.9	32.1	14
Y-2017	89019	699587889	12.7	40852	654607791	6.2	129887	68.5	31.5	16
Y-2018	92114	707149230	13.0	42391	661854076	6.4	134516	68.5	31.5	11
Y-2019	97613	714325057	13.7	41493	668786993	6.2	139123	70.2	29.8	17
Y-2020	108532	720997448	15.1	44498	675389679	6.6	153052	70.9	29.1	22
Y-2021	118979	726503429	16.4	45026	681060412	6.6	164033	72.5	27.4	28
Mean	55004.545	493012045	10.5	31927.3	460355243.8	6.8	86934.3	61.9	38.1	16.4

*Due to less available data further analysis of this category is not done but it is included in total count. ** N/A – Not Available.

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Table 1, 2, 3 and 4 shows that during this 55 year observational retrospective study between 1st January 1967 and 31st December 2021, 1, 29, 21,760 accidental deaths occurred of which 71.0% were male and 28.6% were female and 47, 81,384 people committed suicide in India, of which 61.9% were male and 38.1% were female. The annual average accidental death and suicide incidence (including both gender) during 55 years of the study is 24.6 and 9.1 per 100,000 respectively. This study revealed that males had a significantly higher mean annual incidence of accidental deaths of 32.7 per 100,000 compared to female of 13.4 per 100,000. Furthermore males had a significantly higher mean annual incidence of suicidal deaths of 10.5 per 100,000 compared to female of 06.8 per 100,000. Furthermore mean male and female suicide percent out of total suicides during whole period of study is 61.9% and 38.1%, whereas for accidental deaths it is 71.0 and 28.6 respectively.

The statistical analysis of suicide in India from 1st January-1967 to 31st December 2021 showed a substantial variation with annual suicide numbers ranging from 38217 to 164033 [Min, Max],(Obs, Mean, Std. Dev., [95% Conf. Interval], Std. Err., Total, - 55,86934.3, 38879.9, 76423.5 -97444.9, 5242.6, 4781384,) respectively.

The statistical analysis of accidental deaths in India from 1st January-1967 to 31st December 2021 showed a substantial variation with annual accidental deaths ranging from 105601 to 451757, [Min, Max],(Obs, Mean, Std. Dev., [95% Conf. Interval], Std. Err., Total, - 55, 234941.1, 112658.5, 204485.2 - 265397, 15190.9, 12921760,) respectively.

Gender-wise statistical analysis is presented in Table 2-A-B-C-D. The lowest suicides were recorded in 1979 in all 55 years, whereas the highest suicides were recorded in 2021 of the COVID-19 era. In the accidental death category lowest count were recorded in 1971 in all 55 years, whereas the highest count were recorded in 2014 of the pre-COVID-19 era. During the whole study period, the highest suicides incidence/lakh population were observed in males during the COVID-19 era 2021 while in 1999 highest suicides incidence/lakh population were observed in females.

Table 4 presents the gender-wise annual suicide and accidental death counts with annual incidence rates in different years at the country level. The annual increase/decrease in suicide and accidental death can be seen in this table.

Over the entire pandemic period, this study found an overall increase in annual suicide rates of males compared to female population. The increase in suicide rate is significant among males.

4. Discussion

Suicide and accidents are significant preventable public health problem especially in LMICs like India due to several factors like population density, illiteracy and a multitude of socio-economic as well as political-administrative issues [29]. Majority of these can be prevented with specific, timely, research-based low-cost interventions. A comprehensive multisectoral co-ordination for suicide and accident prevention is needed to reduce the mortality. Suicides are absolutely preventable cause of death by creating awareness in individual, community and national levels [30]. The prevention of accidents and suicide can be addressed by creating awareness in the societies to openly discuss it. A novel robust but flexible national suicide and accident prevention framework needs to be drafted for countrywide implementation in order to improve the data and situation.

Globally, the data of suicides and accidents availability and quality is poor [31,32]. This problem of poor-quality data is likely due to under-reporting and lack of proper classification. Improved surveillance and monitoring is needed for making accident and suicide prevention strategies. Faulty registration of accidental death and suicide in hospital- register and nationally-representative surveys may occur like COVID-19 death registration [33]. Furthermore a large percentage of mortality is not medically certified in India; hence the mortality counts may represent only the iceberg of deaths from accidents and suicides [34].

Risk assessment should be done at national level. Several research found well established link between suicide, accidental death and psychiatric illness (mostly depression and substance use dependency) [35,36]. Furthermore situations of crisis like COVID-19 leading to a breakdown in the normal ability to deal with life stresses, like financial crisis, fear, conflict, violence, abuse,

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discrimination, sense of isolation, relationship break-up, and illness can increase the vulnerability for suicides and accidental death [37].

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Limitations and strength

There are several studies done on the title mentioned research question but this study is very unique study as we have also explored the pandemic impact on accidents together with suicide (considering the fact that the COVID-19 led mental issues may have increased the accidents due to poor concentration while driving etc). One of the major limitations is the data which is obtained solely from the NCRB in our study. In India there is lack of any accredited other public health agencies, to collect and report these data. The NCRB is dependent on the 36 states and union territories for this data which lacks robust data collection systems hence prone to error due to utilizing methods like paper- recording and document transfer of data. Hence there could be data quality issues. Despite this limitation, the data utilized for this study is the most accredited available data and most of the studies have utilized this data source. The data we utilized was yearly aggregated data hence we were cannot explore finer variation in less time intervals (e.g. days or weeks) or age standardized variations like age or cause of accident and suicide. Furthermore, the study can only adjust for seasonality (by comparing equal annual periods), but the geographical-temporal trends could not be calculated specific to pandemic periods or pre- COVID-19 era. This is the first study in our knowledge analyzing the accidental death and suicide together in India in the context of the COVID-19 in the whole population, and by gender.

5. Conclusion

COVID-19 is having an indirect impact on accidental death and suicide, positive impact on accidental death while negative impact on suicide. The present quantitative data study on the accidental and suicidal deaths in both genders is intended to present a brief answer to the title mentioned query. The accident rate decreased while the suicide rates significantly increased in males of India during the COVID-19 pandemic, whereas in females the suicide rates increased slightly with significant decrease in accident rate. Epidemiological studies with better data input and more analysis is needed to better understand and control the drivers of accident and suicide with more exploration related to gender and other differences like existing co-morbidities. Future version of this research will try to explore these differential impacts of the COVID-19 pandemic in different states and union territories of India.

Prevention and control of suicides (accident already reduced hence not emphasized here)

Suicides are largely preventable. Measures should be taken at national, state/UTs and individual levels to reduce suicide and suicide attempts. WHO's approach and recommendation for suicide prevention is given below which is based on evidence-based interventions [38]:

1. Stop the access to instrument of suicide (e.g. firearms, pesticides, certain medications);
2. Improve the media for appropriate-responsible reporting of suicide events;
3. Encourage socio-emotional life skills;
4. Early identification, assessment, management and follow up of individuals with suicidal behaviours.,

These interventions need situation analysis with multisectoral collaboration, financing, awareness raising, surveillance and monitoring, capacity building, and evaluation. Suicide prevention require multisectoral coordination with collaboration among individuals of society, including the health and other sectors like agriculture, business, education, politics, labour, justice, law, defence, and the media. These efforts need to be comprehensive and integrated as individual approach for an issue as complex as suicide is not sufficient.

Recommendations for reducing suicides in distress like COVID-19 (accident already reduced)

1. A national robust, flexible and scientifically-technically sound, multisectoral primordial preventive strategy is needed to mitigate the suicidal morbidity and mortality.
2. Creating mass awareness by government bodies, national/local media, NGO-social organizations, health care facilities-providers, and increasing budgetary allocation for mental health.
3. More investment on research and analysis to better understand the COVID-19 impact on suicides in different regions.
4. Financial stability programs to decreased suicide in times of poverty.
5. Promoting BCC through online portals with community approach.

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Abbreviations

COVID-19- Coronavirus Disease 2019; UTs- union territories; World Health Organization (WHO); LMICs (lower-middle-income countries); GoI (Government of India)

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