Research Article

Advance in Environmental Waste Management & Recycling

What can be impact of civil authorities' faulty mortality registration on COVID-19 mortality count in the state of Bihar, India- Evidence from NFHS (National Family Health Survey -5)

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Abstract
Several local / global / national / international agencies have been estimating the impact of COVID-19 pandemic on mortality count in different regions. On 30 January 2020 the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC). Death toll was only 171 on 30-01-2020 and by 31 -12- 2020, this figure increased to 1 813 188. The estimates of global deaths attributable to the COVID-19 pandemic in 2020 as published by WHO is at least 3 million, which is 1.2 million more than officially reported. Objective of this research study is to find out number of deaths in the household in the three years preceding the survey registered with the civil authorities' with another objective of this research study is to estimate the excess mortality due to COVID-19 in a simple way to be understood by most of the readers. The total sample size was 35,834 households, 42,483 women of age 15-49 (including 6,350 women interviewed in PSUs in the state module), and 4,897 men of age 15-54 for the state of Bihar. This sample size was based on the size needed to produce reliable indicator estimates for each district. Household questionnaire regarding number of deaths in the household in the three years preceding the survey were collected and utilized to produce information in 19 languages using CAPI (Computer Assisted Personal Interviewing). This cross sectional survey study revealed that only 37.1 percent of deaths of households members due to any cause were registered with the civil authorities in the three years preceding the survey, of which 28 percent of deaths are at age 0-4, 45 percent of deaths occurred at age 25-34, and 41 percent of deaths occurred at age 35 and above (see table-1 and 2 for more details).

Introduction
Background/rationale
Several local / global / national / international agencies have been estimating the impact of COVID-19 pandemic on mortality count in different regions [1]. On 30 January 2020 the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC) [1]. Death toll was only 171 on 30-01-2020 and by 31 -12- 2020, this figure increased to 1 813 188. The estimates of global deaths attributable to the COVID-19 pandemic in 2020 as published by WHO is at least 3 million, which is 1.2 million more than officially reported [2]. The reported death numbers registered with the civil authorities' under-estimate the actual number of lives lost is found by NFHS-5 (National Family Health Survey) [3]. COVID-19 cases may have died without testing, without correctly defining COVID as the cause-of-death. Bihar may have experienced lower than expected total deaths due to poor surveillance and reduced mobility, as well as the state is also struggling with corruption, scams , poor governance and failure of public health management due to posting and several scams [4]. The low mortality reported COVID-19 deaths in the state of Bihar may be due to faulty coverage of routine death surveillance as well as reduced real death registration and medical certification errors of cause of death. In Bihar, only 37 percent of all deaths from any cause of usual household's members in the three years preceding the survey were registered with the civil authorities. Another fact is that COVID-19 death is focused mostly among reported cases and the case detection ratio is very low.

Objectives
In light of the questions raised on reported data of COVID-19 cas-

es and deaths, it is most needed to find out excess mortality due to impacts of the pandemic. Objective of this research study is to find out number of deaths in the household in the three years preceding the survey registered with the civil authorities' with another objective of this research study is to estimate the excess mortality due to COVID-19 in a simple way to be understood by most of the readers.

Methods
Study design
The total sample size was 35,834 households, 42,483 women of age 15-49 (including 6,350 women interviewed in PSUs in the state module), and 4,897 men of age 15-54 for the state of Bihar. This sample size was based on the size needed to produce reliable indicator estimates for each district. The rural sampling was done through a two-stage sampling design with keeping villages as the Primary Sampling Units (PSUs) in the first stage (selected with probability proportional to size), followed by randomly selecting twenty-two (22) households in each PSU at the second stage. In the urban areas of survey two-stage sampling design was done with Census Enumeration Blocks (CEB) selection during first stage while random selection of twenty-two (22) households in each CEB during second stage. The second stage sampling selection of households in both urban and rural areas, were done after performing a complete mapping and listing operation for household in the selected samples of first-stage units. This study was a cross-sectional large-scale, several round survey done in a representative sample of households in all 38 districts of the state of Bihar from 9 July, 2019 to 2 February, 2020.

Setting
Household questionnaire regarding number of deaths in the household in the three years preceding the survey were collected and utilized to produce information in 19 languages using CAPI (Computer Assisted Personal Interviewing). The fieldwork was conducted in all 38 districts of the state of Bihar starting from 9 July, 2019 to 2 February, 2020. Data were collected from selected 35,834 households, 42,483 women of age 15-49 (including 6,350 women interviewed in PSUs in the state module), and 4,897 men of age 15-54.

Participants
Participants were from 38 districts of the state of Bihar from selected 35,834 households, which includes 42,483 women of age 15-49 (including 6,350 women interviewed in PSUs in the state module), and 4,897 men of age 15-54.

Variables
Death registrations with the civil authorities were the key variable. Data sources/measurement

National Family Health Survey, India – available at - http://rchiips.org/nfhs/bihar.shtml
Bias
The utilization of secondary data from NFHS-5 is a kind of bias as felt by researcher and to address this potential source of bias the researcher is looking for grants or financial aid to conduct a survey to estimate the COVID-19 mortality in Bihar, India.

Study size
38 districts of the state of Bihar from selected 35,834 households, which includes 42,483 women of age 15-49 (including 6,350 women interviewed in PSUs in the state module), and 4,897 men of age 15-54.
Quantitative variables
Kindly see table 1 and 2.

Statistical methods
Suppose Z persons died from COVID-19 and Y % of death have been reported / registered while X% is not reported. The real count will be X%+Y%=100%. Now in the case of state of Bihar we found that 37% of Z= 12256 then Z= 12256 *100/37= 33,124.32. Hence the total COVID-19 death estimate will be 33124 and unreported death X% will be 33124- 12256= 20868. This method will be employed to estimate the COVID-19 mortality in next version with other analysis.

Results
This cross sectional survey study revealed that only 37.1 percent of deaths of households members due to any cause were registered with the civil authorities in the three years preceding the survey, of which 28 percent of deaths are at age 0-4, 45 percent of deaths occurred at age 25-34, and 41 percent of deaths occurred at age 35 and above (see table-1 and 2 for more details). This cross sectional survey study revealed that the death registrations religion wise shows that 38 percent of Hindus deaths were registered and 32 percent of Muslims death had been registered while remaining were not registered. This cross sectional survey study revealed that among scheduled castes death registrations were 31% and scheduled tribes registered 33%, while other backward classes registered 38% deaths and those who do not belong to a scheduled caste, or scheduled tribe, or other backward class 43% death registrations were found with civil authorities. This cross sectional survey study revealed that in Bihar, death registration is higher (48%) in urban compared to rural areas (36%) and among males (43%) than females (31%).

This finding will be applied in version-2 of this research study for estimating death due to COVID-19 with the statistical method discussed above. The researcher will also try to find some more data for better estimate of COVID-19 deaths.

Descriptive Data

Table 1: Death registration

Among deaths of usual residents during the 3 years preceding the survey, percentage of deaths registered with civil authority by selected background characteristics, according to residence and sex, Bihar, 2019-21

Background characteristic	Male	Female	Total	Urban Male	Urban Female	Urban Total	Rural Male	Rural Female	Rural Total
Age at death 0-4	(47.8)	(29.3)	41.0	27.5	24.3	26.1	30.0	24.8	27.6
5-9	*	*	*	*	*	(22.9)	*	*	(19.0)
10-14	*	*	*	(16.2)	(26.5)	20.3	(16.2)	(24.8)	19.9
15-24	*	*	*	41.3	30.3	36.2	44.8	34.1	40.0
15-19	*	*	*	42.3	(32.6)	38.3	46.5	(38.2)	42.9
20-24	*	*	*	(39.6)	(27.9)	33.7	(42.6)	(29.4)	36.4
25-34	*	*	*	44.9	41.3	42.9	45.5	44.5	45.0
35 and over	60.5	36.5	49.1	46.0	31.5	39.3	48.0	32.2	40.6
Religion of household head Hindu	58.1	40.7	50.5	41.3	30.3	36.1	43.4	31.5	37.8
Muslim	(50.6)	(20.9)	35.4	36.2	26.6	31.7	38.6	25.5	32.4
Caste/tribe of household head- Scheduled caste	(42.8)	(38.7)	41.1	32.9	27.3	30.3	33.9	28.3	31.3
Scheduled tribe	*	*	*	37.7	24.4	32.6	39.2	24.0	33.2
Other backward class	59.8	27.4	45.7	42.6	30.2	36.6	45.1	29.9	37.8
Other	(60.7)	51.9	56.3	45.3	33.6	40.2	47.8	37.3	43.1
Don't know	*	*	*	*	*	(36.8)	*	*	(36.8)
Total	57.1	36.2	47.6	40.6	29.8	35.5	42.7	30.6	37.1

Note: Figures in parentheses are based on 25-49 un-weighted cases. An asterisk indicates that a figure is based on fewer than 25 un-weighted cases and has been suppressed. Total includes deaths of persons in households with household head belonging to Christian or other religions, which are not shown separately.

Table 2: Death Registration by District

Among deaths of usual residents during the 3 years preceding the survey, percentage of deaths registered with civil authority by district, according to residence and sex, Bihar, 2019-21

District	Urban Male	Urban Female	Urban Total	Rural Male	Rural Female	Rural Total	Total Male	Total Female	Total Total
Arwal	*	*	*	43.1	21.0	33.4	44.7	20.2	34.2
Aurangabad	*	*	*	35.7	(26.3)	32.3	34.4	(33.1)	33.9
Banka	*	*	*	45.8	19.2	33.3	44.5	18.9	32.8
Begusarai	*	*	*	(30.1)	(19.6)	24.6	46.4	28.1	37.4
Bhagalpur	*	*	(25.3)	(31.9)	(22.1)	26.8	32.8	19.3	26.3
Bhojpur	*	*	*	40.4	(37.3)	39.1	51.2	36.0	44.6
Buxer	*	*	*	40.6	(30.7)	36.4	45.4	33.7	40.5
Darbhanga	*	*	*	34.1	(21.5)	29.2	33.4	(18.6)	27.5
Gaya	*	*	*	43.3	(33.9)	39.2	44.2	32.0	38.2
Gopalganj	*	*	*	46.8	36.2	41.7	48.6	32.9	40.8
Jamui	*	*	*	45.1	(27.1)	37.4	44.2	(28.1)	37.4
Jehanabad	*	*	*	45.3	(23.4)	35.5	46.1	(21.3)	35.3

Kaimur (Bhabua)	*	*	*	42.0	(34.9)	39.1	48.3	(31.8)	41.3
Katihar	*	*	*	36.6	30.4	33.7	38.4	34.7	36.6
Khagaria	*	*	*	39.5	24.1	32.7	39.5	22.7	31.8
Kishanganj	*	*	*	27.2	(39.2)	32.0	29.1	(39.0)	33.5
Lakhisarai	*	*	*	36.8	37.4	37.1	38.7	35.9	37.4
Madhepura	*	*	*	40.8	20.3	30.6	42.0	20.3	31.4
Madhubani	*	*	*	30.9	(10.2)	21.4	33.7	(9.7)	22.8
Munger	*	*	(64.7)	(52.1)	(37.5)	44.7	57.2	43.7	50.7
Muzaffarpur	*	*	*	31.5	37.7	34.2	36.9	40.2	38.2
Nalanda	*	*	*	41.4	37.5	39.3	42.1	39.3	40.6
Nawada	*	*	*	30.0	33.8	31.8	41.0	35.5	38.6
Pashchim Champaran	*	*	*	41.3	21.4	31.4	39.8	20.0	29.4
Patna	*	*	(38.9)	(52.3)	(28.6)	40.6	(47.9)	(32.5)	39.9
Purbi Champaran	*	*	*	36.7	27.0	32.2	40.5	27.2	34.4
Purnia	*	*	*	39.7	35.0	37.1	44.4	34.1	39.1
Rohtas	*	*	*	57.5	(45.7)	51.8	54.0	39.8	47.2
Saharsa	*	*	*	42.7	22.4	32.4	45.0	20.0	32.3
Samastipur	*	*	*	48.3	30.5	39.9	46.7	30.5	39.2
Saran	*	*	*	46.4	(42.6)	44.7	46.6	39.7	43.8
Sheikhpura	*	*	*	(50.6)	41.7	45.9	55.5	40.1	47.8
Sheohar	*	*	*	(50.7)	(39.2)	45.2	(54.8)	(42.7)	49.1
Sitamarhi	*	*	*	38.8	31.6	35.0	40.1	31.6	35.6
Siwan	*	*	*	62.8	47.7	56.8	63.3	60.1	61.9
Supaul	*	*	*	36.0	19.7	27.8	36.0	21.6	28.7
Vaishali	*	*	*	44.3	40.7	42.7	46.3	41.4	44.1
Bihar	57.1	36.2	47.6	40.6	29.8	35.5	42.7	30.6	37.1

Note: Figures in parentheses are based on 25-49 unweighted cases. An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed

Other analyses

The estimates of this cross sectional sample survey may be affected by non-sampling errors, and sampling errors. Non-sampling errors are due to failure to locate and interview the correct sample household, misunderstanding of the survey questions by interviewer or the respondent, and data entry errors. Non-sampling errors are very difficult to avoid and also difficult to evaluate and correct statistically. The NFHS-5 sample is a multi-stage stratified design, Jackknife repeated replication method derives estimates of complex rates from each of several replications of the parent sample, and calculates standard errors for these estimates using simple formulae. Each replication considers all but one cluster in the calculation of the estimates. Pseudo independent replications are thus created. In the NFHS-5 sample for Bihar, there were 1710 clusters. Hence, 1710 replications were created.

Discussion

Civil registration systems differ greatly across different states/UT as well as districts with respect to timelines and quality for compiling record for cause-of-death, numbers and period of death. In addition, in remote areas the absence of electronic surveillance systems and limited resources has resulted in failure to provide good quality routine data, even before the ongoing COVID-19 pandemic. This lack of data required to capture mortality information may be exacerbated during the pandemic resulting in underestimation of real numbers of death due to COVID-19.

Limitations

This is a novel study which is trying to find out estimate of excess COVID-19 mortality in a new way but the key limitation is poor data resources as well as lack of funds for field investigation by the researcher.

Interpretation

For a number of reasons, these pre-existing survey data cannot provide a complete picture of the mortality attributable to COVID-19.

Other important factors such as COVID-19 deaths have not been certified because tests are not available or had not been conducted before death. Guidance for appropriate recording of COVID-19 related deaths in India was also not available timely [5, 6, 7, 8, and 9].

Other information
This is the first version of this work and more versions will evolve in future with more information and analysis of estimates on mortality due to COVID-19.

Abbreviation
COVID-19- coronavirus disease 2019; World Health Organization (WHO); Public Health Emergency of International Concern (PHEIC); CAPI (Computer Assisted Personal Interviewing); Primary Sampling Units (PSUs); Census Enumeration Blocks (CEB) ; CAPI (Computer Assisted Personal Interviewing);

Declarations
This version of paper has not been previously published in any peer reviewed journal and is not currently under consideration by any journal.

Ethics approval and consent to participate
Not applicable. This study has not involved any human or animals in real or for experiments. The submitted work does not contain any identifiable patient/participant information.

Consent for publication
The author provides consent for publication.

Availability of data and materials
Electronic records from National Family Health Survey, India, HMIS (health management information system) of MoHFW (ministry of health and family welfare), Government of India, NITI Aayog, NHSRC etc.

Conflicts of Interest/ Competing Interest
There are no conflicts / competing of interest

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