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Integrated Disease Surveillance Program (IDSP) implementation in Bihar since inception in 2009 : A critical review

Summary

The burden of communicable diseases is still a sizeable and pressing problem in India. The best way to tackle is through an efficient integrated surveillance system, especially in less-developed states. Bihar, one of the poorest states in the country, continues to experience frequent disease outbreaks related to acute diarrhoeal diseases, vector-borne diseases, acute respiratory infections and acute encephalopathy syndrome. The Integrated Disease Surveillance Programme (IDSP) was implemented in 2009 as a comprehensive strategy to improve disease surveillance and response in the state. This paper is based on available IDSP-related documents published in the public domain and in-depth interviews with stakeholders to assess the performance of the IDSP in Bihar over 10 years since its inception in 2009. Findings revealed an increase in reporting of priority diseases in the state. In absolute number under presumptive surveillance, the reporting of the following disease/conditions increased over time- acute respiratory infections, fever of unknown origin and acute diarhhoeal diseases. Among the vaccine-prevetable diseases, measles and chicken pox were mostly reported. Lab-confirmed Dengue cases appeared to be high in 2019 (approximately 3232 cases). However, there is lot of discrepancies observed in data captured under presumptive and laboratory surveillance over the years. The completeness of all the three ('S' syndromic; 'P' probable; & 'L' laboratory) reporting formats showed improvement over the last 10 years (S reporting improved from 0 to 40%, P from 58% to 77% and L from 32% to 75%. The outbreak detection improved significantly since the launch of the programme in the state (increased from 3 in 2009 to 589 in 2019). The major outbreaks reported were related to vector-borne diseases (dengue), vaccine preventable disease (measles and chicken pox) and acute diarrhoeal cases. Adequate financial and human resources had been a challenge. The involvement of private sector unit improved from 0 in 2009 to 103 in 2019. Dissemination of data was a mixed bag of hits and misses. Training component was missing in early years of IDSP implementation due to severe shortage of fund. In conclusion, the IDSP performance in Bihar showed marked improvements but significant challenges still remained. A number of challenges related to IDSP implementation have been identified in the state. These included insufficient data

management platform, absence of dedicated human resources at the district level, limited use of digital platform, poor monitoring and evaluation using core indicators. Given a well-functioning disease surveillance system is instrumental for priority setting and resource allocation, addressing the identified gaps through focused approach in alignment with local context may improve IDSP performance in Bihar.

Keywords: IDSP, Review, Bihar, India

Introduction

With rapidly evolving climate, globalization, urbanization and population growth, the risk of infectious diseases continues to be a major public health concern worldwide, largely in low-to-middle-income countries (1). Apart from predictable burden of endemic diseases, the growing threats of emerging and re-emerging diseases further deepened the situation. Despite many specific disease control programs in place, the fragile health systems are becoming overwhelmed with large-scale unpredictable outbreaks and global pandemics. These have often resulted in high morbidity and mortality leading to significant negative economic and health impacts (2). However, majority of these health-related adversities may be reduced with appropriate epidemic preparedness (3). Apart from traditional endemic diseases, old diseases with new traits such as multidrug-resistant and extensively drug-resistant tuberculosis, malaria resistant to artemisinin-combination therapy or entirely new disease or conditions like avian influenza and severe acute respiratory syndrome, represent potential threats that needs immediate attention(3). Furthermore, the risk of the neglected tropical diseases continued to be high among low-to-middle-income countries (4, 5). Several factors were attributable to the epidemics of infectious diseases, including rapid urbanization, human encroachment into wildlife habitat, international trade, demographic transition, risky human behaviors, irrational antibiotic use and climate change (6, 7).

India with 17.7% share of the world's population (8) is still grappling with a high burden of traditional infectious diseases and emerging threats of non-communicable diseases (9). India has probably the largest burden of several communicable diseases including half of the world's burden of visceral leishmaniasis, dengue and leprosy (10, 11). An estimated one-third or more of the global cases of leprosy, lymphatic filariasis, cysticercosis, and rabies are arguably reported from India along with approximately one-quarter of the world's ascariasis and hookworm cases (4).

Historically, the Government of India has implemented several vertical programs for the control of priority diseases including Polio or Acute Flaccid Paralysis (AFP), Tuberculosis, Hepatitis, HIV, Neonatal Tetanus, Guinea worm because of quick and tangible benefits of their investments (12-15). However, empirical evidence showed that such programs without having horizontal synergies were likely to suffer from serious limitations which included unnecessary consumption of scare resources, duplication of efforts and faulty program evaluation and poor sustainability performance. The need was felt for the

integration of different vertical infectious disease control programs into a standardized platform for ensuring public health action to be more sustainable and efficient (16). With the growing threat of global pandemics, the need for better-quality disease surveillance systems for the control of infections was highlighted during the International Conference on Emerging Infectious Diseases in 1998 (17). Due to growing threats of emerging and re-emerging diseases with pandemic potential, the concept of integrated surveillance appeared to be the most cost-effective response strategy in resource-limited settings instead of implementation of these vertical surveillance programs with overlapping objectives, often using the same infrastructure, staff and other resources (18). The concept of multi-disease or integrated approach was established by the World Health Organization (WHO) for effective synergies between core and support surveillance functions optimizing existing resource utilization to achieve program's objectives (15). This approach allows poor countries to effectively share expertise for data collection, analysis, interpretation and timely dissemination in a co-ordinated way (15).

Based on learnings from African and other countries, the WHO conceived and establised the Integrated Disease Surveillance and Response Strategy (IDSR) in the last decade of the 20th century (19, 20). Experiencing the similar infectious disease threats, the Government of India launched the Integrated Disease Surveillance Project (IDSP) in 101 districts of the country in 2004. Information related to surveillance activities and outbreak responses disseminated across three levels which included the district surveillance unit (DSU), state surveillance unit (SSU) and the central surveillance unit (CSU) (21). Initially, the World Bank provided funds for the CSU at the national level and in 9 states (Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttarakhand and West Bengal) while remaining states received fund from domestic budget. The IDSP was implemented in three phases covering states in phases: Phase I (2004-05)- 9 states, Phase II (2005-06)- 14 states and Phase III (2006-07)- 12 states (21).

Following the World Bank funding, the IDSP continued to be funded under the 12th Five Year Plan with a domestic budgetary support and presently function as a centrally sponsored scheme of the National Health Mission under Flexi-pool for communicable diseases. The program has evolved over the years and is being currently implemented in all states. For immediate notification of outbreaks, a rapid response team (RRT) was formed in each district of every state. To strengthen the laboratory support, 50 district public health laboratories and a network of referral laboratories were established in the country. The support and cooperation of private health facilities in reporting of suspected

cases of epidemic-prone diseases are also an integral component of IDSP (22). The IDSP monitors both communicable and few non-communicable diseases and function in both rural and urban health systems (23).

Though Bihar adopted the IDSP strategy in 2007 and started to implement it in 2009, to the best of our knowledge no previous study had explored the progress of the programme in Bihar since its inception. Previous studies related to IDSP in different parts of the country showed that the program was underutilized (24, 25). Evidence also indicated important implementation barriers which included lack of resources, inadequate training, underutilization of data, limited supervision and feedback, weak laboratory support, trained health workforce and weak integration of the private health sector (18, 26, 27). Therefore, a thorough understanding of the IDSP performance in terms of its core and support functions since its inception in Bihar appeared critical to guide necessary amendments and to further strengthen the program.

Methods

Surveillance of infectious diseases in Bihar is done through mandatory case reporting from government facilities including sub-centers, primary health centers, public health laboratories, district hospitals and other private health providers in all 38 districts of Bihar under the IDSP. Beginning in 2009, the program was implemented in the state and involved case-reporting in both paper and online mode. At present, the IDSP collects information on acute diarrheal disease (including acute gastroenteritis), bacillary dysentery, viral hepatitis, enteric fever, malaria, dengue/dengue hemorrhagic fever(DHF)/ dengue shock syndrome (DSS), chikungunya, acute encephalitis syndrome(AES), meningitis, measles, diphtheria, pertussis, chicken pox, fever of unknown origin(PUO), acute respiratory infection (ARI)/influenza-like illness(ILI), pneumonia, leptospirosis, acute flaccid paralysis among children below 15, dog bite, snake bite, up to five state-specific diseases and unusual syndrome (not being captured by any of the above). The operational structure for IDSP data capture is divided into three levels, the syndromic cases done by the ANM at the subcenter, the presumptive surveillance at the primary health center and other secondary and tertiary health facilities by physicians and the laboratory-confirmed disease reporting by personnel in public health laboratories. For each disease under surveillance, the ANMs fill out a standardized S (syndromic)-form reporting syndromic information and the doctors report on presumptive diagnosis via the P-Form. Finally, according to the national guidelines, laboratories report to the IDSP through the L-Form on confirmed cases of diseases under surveillance. Information from district and sub-district units is reported weekly to the state surveillance unit until it reaches the National Center for Disease Control, where all compiled surveillance data are stored in an electronic database. The surveillance data is collated and analyzed at the national and state levels and is made available in the form of weekly, monthly and annual reports both by the state and national surveillance units. Microsoft excel was used to analyze and present the results in this study obtained from the available IDSP-related documents published by the State Health Society, Bihar in public domain and from qualitative interviews of stakeholders in the state.

The implementation of IDSP at the state level for the current paper was evaluated through analysis of the core IDSP indicators and funding for functioning of IDSP. Analysis of IDSP core indicators revolved on completeness and timeliness of weekly epidemiological data, morbidity and mortality data for few infectious diseases as a proxy of IDSP performance from 2009 to 2019. Completeness was computed based on proportion of districts and

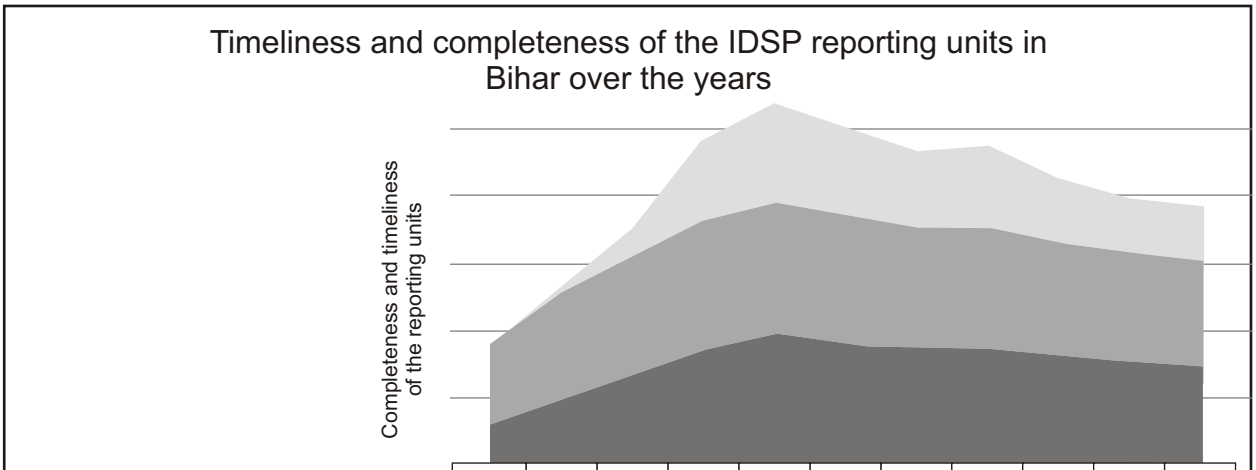
health units per district which submitted completely filled in weekly and monthly reports in a calendar year. Timeliness was computed based on proportion of districts that submitted timely reports in a calendar year. Timely submission of reports was at district level and was done by Thursday following the end of the previous epidemiological week. Attack rates (AR) could not be calculated as population at risk could not be determined from the IDSP reports and case fatality rates (CFR) were reported as available in the IDSP documents, Bihar. In addition, proportion of probable cases under presumptive and laboratory surveillance was also included in the report. Descriptive analyses were conducted using SAS version 9.4.

Findings

Timeliness and completeness

Currently in the public health system, 664 units report P Form (presumptive surveillance), 597 units report L Form (laboratory surveillance) and 9792 units report S Form (syndromic surveillance) to the IDSP in all 38 districts of Bihar. At the sub-center (HSC), Auxiliary Nurse Midwives (ANM) with the aid of multi purpose health workers (MPHW) and Accredited Social Health Activists (ASHA) undertake data collection and notify through Form-S (based on syndromic approach) on a weekly basis. The paper-based syndromic surveillance report thus generated at the HSC is then digitized and uploaded to the IDSP portal from the Primary Health Center (PHC). Provisional diagnosis of reportable diseases is notified by the clinicians at the PHC/Additional Primary Health Center (APHC)/Sub-divisional Hospital (SDH)/District hospital (DH)/Referral Hospital/Medical College and Hospital (MCH) via Form-P (presumptive cases) and for the lab-confirmed cases laboratory personnel under the supervision of Medical Officer-in charge report through the Form-L (laboratory cases). The timeliness of weekly data reporting has to be maintained at all levels as the IDSP portal freezes after the weekly deadline and no further entries can be made. Therefore, weekly reporting remains incomplete if timeliness is not maintained. The completeness of weekly Syndromic surveillance increased gradually from 2009 (when the IDSP was launched) till 2013 when it peaked to 74%. Thereafter, the completeness and timeliness of reporting declined over the years to 60% in 2016, 47% in 2017 and 41% in 2018. A similar pattern was observed for weekly presumptive surveillance; completeness increased from 80% in 2010 to 95% in 2012 and 97% in 2013 followed by a dip to 88% in 2015-2016, 83% in 2017 and 78% in 2018. With regard to laboratory reporting, as with S and P Forms, there was a gradual increase in reporting from 2009 (32%) to 2013 (97%) thereafter this momentum declined and reporting fell to 88% in 2015-2016 and 79% in 2018. Though the low reporting observed in 2018 might be due to the closure of the IDSP portal from July to October 2018 for upgradation at the Central Unit. In 2019, the average reporting was 36% for S-Form, 71% for P-Form and 69% for L-Form. (Figure 1).

Figure 1 : The reporting performance of S-Form, P-Form and L-Form of IDSP in Bihar from 2009 till 2019



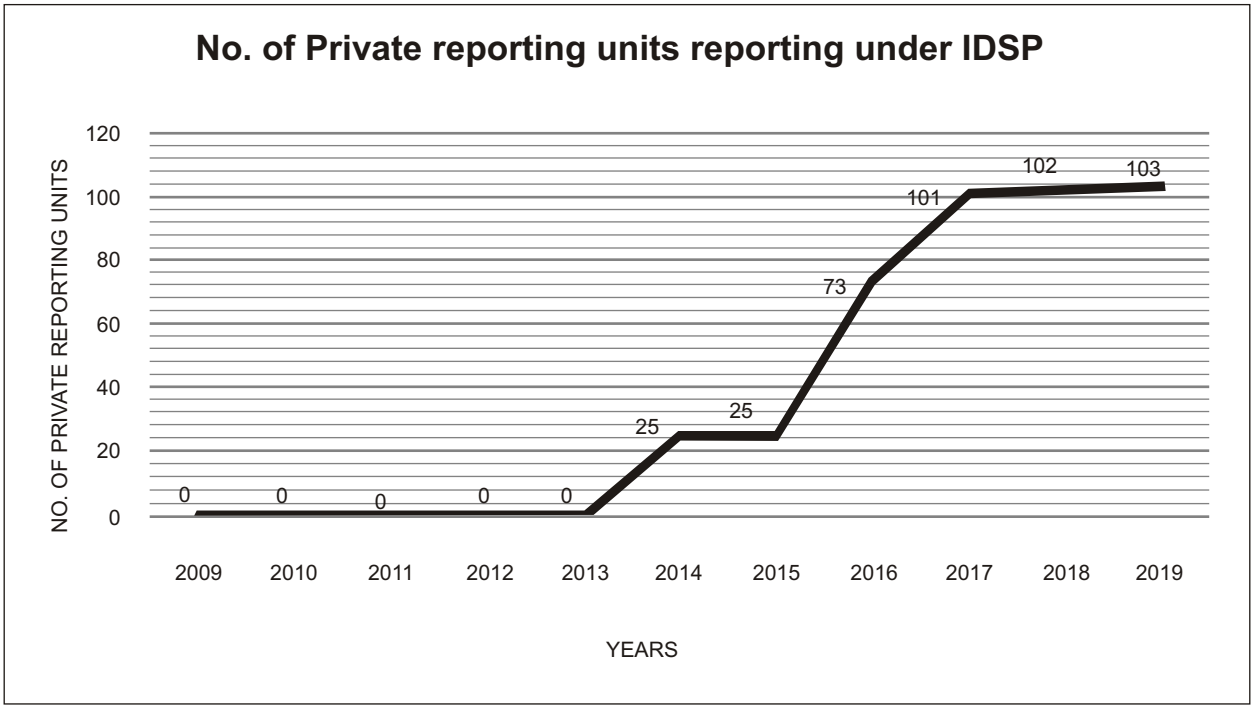
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Syndromin Surveillance Form (S)	0	3	22	60	74	65	57	60	47	41	40
Presumptive Surveillance Form (P)	58	80	85	95	97	93	88	88	83	78	77
Laboratory Surveillance Form (L)	32	50	69	87	97	91	88	88	82	79	75

Source: *State Health Society, Bihar*

Private sector

A key area of the IDSP has been to incorporate the private sector into one of its components as large portion of the country's population seek treatment from them. However, underreporting of infectious diseases by private practitioners remained a persistent challenge in this country. Engagement with the private health providers and sustained reporting from the sector has picked up from 2014 onwards. A growing trend has since been observed with 103 units reporting to the IDSP in 2019. (Figure 2)

Figure 2 : The reporting of private sector to the IDSP in Bihar from 2009 till 2019



Source: *State Health Society, Bihar*

Reported diseases

The IDSP reporting commenced from mid-2009 in Bihar. Initially, reporting was infrequent and incomplete in the districts, but this changed as the program matured and evolved. At present, all the districts have been reporting to the IDSP state and national units. Though any attempt in comparing reported disease patterns over the years needs to be made with caution, given that the reporting was not uniform throughout the program's existence, a fair idea about the performance and delivery of the IDSP can still be gained by delving into the pattern of the diseases reported since 2009. The diseases IDSP reported can be broadly categorized into: 1. Food and Waterborne Diseases (Acute Diarrhoeal Disease, Bacillary Dysentery, Typhoid fever, Cholera, Shigellosis), 2. Diseases Preventable by Routine Vaccination (Measles, Chicken Pox, Pertussis, Diphtheria, Tetanus), 3. Diseases Transmitted by Direct Contact and Respiratory Routes (Pneumonia, ARI/ILI), 4. Vector-borne and Zoonotic Diseases (Malaria, Acute Encephalitis Syndrome, Japanese Encephalitis, Kala-azar, Chikungunya, Dengue), and 5. Other Conditions/Disease Reported: Dog Bite, Snake Bite, Leptospirosis.

Reported disease-specific cases under P and L forms

Viral hepatitis

The number of new cases of viral hepatitis in presumptive surveillance increased from 13271 in 2011 to 18413 in 2012 followed by further increase of 25225 cases in 2015. Compared to 2016, the number of viral hepatitis increased in 2017 but the proportion of the respective cases out of total reported cases (reporting fraction) remained the same.

Lab confirmation and reporting of Hepatitis A also saw an increase with 142 cases in 2011 and 239 cases in 2012 being detected. Viral Hepatitis A constituted 3% of the total reported cases in 2016 while it increased to 4% in 2017. The low number of Hepatitis E reporting via the laboratory surveillance in spite of the district-wise variance in seasonality maybe due to poor lab facility to confirm it rather than low incidence of the disease. In 2012, 22 cases of lab-confirmed Hepatitis E were reported in Bihar, higher compared to 2011 when only 5 cases were reported. A total of 711 lab-confirmed Viral Hepatitis A and 158 cases of Viral Hepatitis E were reported in 2015 while it was 232 and 173 cases, respectively, in 2014. Viral Hepatitis E constituted 0.9% of the total reported cases in 2016 while it constituted 1.5% respectively in 2017.

Acute Diarrheal Disease

Diarrheal Diseases constituted 12% of the total reported cases in 2013 while it was 13% in 2012. Acute diarrhoea continued this pattern and constituted 12% of the total reported cases in 2013 and 14% in 2014. In 2015, out of total 512843 annual cases of Acute diarrhoea, which peaked during July. Acute diarrhea lately has shown a marginal decline in 2017 from 13% of the total reported cases in 2016 to 12%. Bacillary dysentery cases have been on the rise over the years. It constituted 8% of the total cases reported at the IDSP in 2014, 1% more than that in 2013. While 385316 cases of Bacillary dysentery were reported in 2014 and 275217 cases were reported in 2015. A minor decline from 7% of the total reported cases in 2016 to 6% in 2017 was observed.

Lab-confirmed Shigella cases were 278 in 2018 versus 52 in 2019. No cholera-positive diarrhoea was reported after 2014.

Enteric Fever

Cases showed gradual increase from 3% in 2012 to 5% of the total cases reported under

IDSP in 2013 and 6% in 2014. A gradual increase in number of cases was observed between 2010 and 2016, followed by a slow decline since 2017.

Laboratory-confirmed cases constituted 20% of the total cases of all diseases captured under IDSP in 2012, which increased to 35% in 2013. Typhoid cases constituted 40% of the total reported cases in 2016 and 41% in 2017.

Measles

For vaccine-preventable diseases, the number of Measles cases reported from Bihar in 2010 was 2519, which has slightly decreased since 2010 when 2153 cases were reported annually in 2011. While the number of Measles cases reported in 2012 (5990) again increased when compared to 2011 figures. In 2017, 340 cases were reported under the presumptive surveillance.

No laboratory confirmation was observed in annual or monthly reports published by the State Health Society, Bihar.

Chicken pox

The number of chicken pox cases under presumptive surveillance over the years (2010 and 2019) varied between 1200 and 5000 with a sudden dip (931) in 2018. In 2019, the number observed was 2294.

No laboratory confirmation was noted in the data set or annual reports.

Diphtheria

From 2014 onwards, there was a gradual decline in the number of Diphtheria cases in Bihar while in 2010, 582 cases were reported annually.

However, as per the lab surveillance, 23 confirmed cases of Diphtheria were reported in 2012, which was only 2 in 2011. No confirmed Diphtheria case was captured after 2014.

Pertussis

The number of Pertussis presumptive cases reported in 2012 was 1342. However, a marked discrepancy in the number of reported cases was observed.

Acute Respiratory Infection or Pneumonia

Respiratory diseases such as pneumonia under presumptive surveillance had been on a steady rise with 54927 cases in 2010, 70076 cases in 2011, 104556 cases in 2012 followed by a marginal decline in 2013. It constituted 1% of the total reported cases in 2016 and <1% in 2017.

Acute Respiratory Infection or Influenza like Illness

The number of Influenza-like illness captured in P forms had substantially increased, amounting to 1157977 cases in 2017; while it was 837456 in 2010, 1590227 in 2011, and 3512752 in 2012. ARI cases constituted 38% of the total reported cases in 2013 and 35% of the total cases reported in 2016, while it was 36% in 2017.

Malaria

Approximately, 67282 cases of Malaria were reported under presumptive surveillance which had drastically increased over the last two years i.e. in 2011 when 34692 cases were reported and 21294 cases in 2010. In 2012, total malaria cases [Plasmodium vivax, (Pv) & Plasmodium falciparum (Pf)] were 3402, which were 2624 in 2011.

The lab-confirmed Malaria (Pv) and (Pf) constituted 10% & 3% of the total reported in 2013, 11% & 5% respectively in 2012, 7% & 3% in 2014, 10% & 4% in 2016, and 9% & 3% respectively in 2017.

Dengue

There had been a sporadic rise and fall of cases over the years as captured in IDSP surveillance. Dengue cases constituted 9% of the total reported cases in 2013 while it constituted 2% in 2012. In 2017, 1651 cases of Dengue were reported, while in 2016 it was 2166.

Under Lab Surveillance, 350 cases of Dengue were reported in 2012, which was only 46 in 2011; while 1201 and 640 cases were detected in 2016 and 2017, respectively.

Acute Encephalitis Syndrome (AES)

In 2010, 1794 cases of AES were reported which increased to 2065 in 2011. From 2015 to 2017, 495, 396 and 383 cases of AES were reported, respectively, which show a relatively slight decline. In 2019, about 971 cases were captured in IDSP, relatively higher compared to previous years.

Under Lab Surveillance, 63 cases of JE were reported in 2012, which was 159 in 2011. JE cases showed a confusing trend with 30, 55, 39 cases in 2015, 2016 and 2017, respectively.

Acute Flaccid Paralysis (AFP)

In 2010, 3280 cases of AFP were reported in Bihar. In 2012, 3615 cases were captured. However, the proportion of cases of AFP out of 20 reportable diseases under presumptive surveillance accounted for less than 1% of total cases reported between 2014 and 2019. Although the number of new cases of AFP increased in 2017 than reported in 2016, the proportion of the cases out of total reported cases remained the same.

Dog bite

Out of 20 reportable diseases under IDSP, Dog bite cases contributed to 703925 (6%) of all the reported cases in 2012. Dog bite cases showed a slight decrease in 2013. Dog bite cases constituted 10% of the total cases reported in 2016 and 11% in 2017.

Snake bite

In 2011, 5981 cases of Snake bite were reported in Bihar; while in 2010, 3329 cases were reported. When compared to 2016, the number of cases in 2017 increased but the proportion of the cases out of total reported cases remained the same as in 2016.

(Table 1a & 1b and Table 2)

Table 1a: Probable cases of priority disease over the years (2009-2019) as per annual, monthly and weekly reports of IDSP, Bihar

Cases of Priority disease over the years as per IDSP annual, monthly and weekly reports, Bihar												
Surveillance type	Disease	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Viral Hepatitis		4083	9904	13271	18413	13015	22084	25225	25837	26258	23068	18632
	Acute Diarrhoeal Disease	70464	263583	518333	1124108	661067	697593	512843	416444	376739	269993	287180
	Bacillary Dysentery	54460	184396	273221	646531	378567	385316	275217	222701	196683	139992	148398
	Enteric fever	35440	116083	143085	304768	287066	308831	264646	216592	199591	113750	130476
	Measles	921	2519	2153	5990	737	260	446	577	340	467	943
	Chickenpox	1345	4868	3630	12546	3244	1218	1443	4842	2215	931	2294
	Pertussis	2911	3329	3295	1342	577	1615	466	491	1042	22	193
	Diphtheria	293	582	384	961	89	172	75	43	25	7	19
	Tetanus	477	387	387	403	303	373	393	310	592	NA	NA
Presumptive	Meningitis	250	1770	2553	943	1939	1940	1940	1282	1013	342	1048
Surveillance	Pneumonia	20678	54927	70076	104556	72055	52063	41543	34497	29874	16375	14816
	ARI/ILI	223100	837456	1590227	3512752	2132525	1821698	1353975	1149492	1157977	854864	959453
	Malaria	10202	21294	34692	67282	33676	29277	28535	25781	24574	13327	20004
	Acute Encephalitis Syndrome	234	1794	2065	1912	957	976	495	396	383	115	971
	Chikungunya	105	109	232	146	84	12	46	739	600	88	1009
	Dengue	42	2963	255	332	4018	990	2963	2166	1651	306	2429
	Dog Bite	38912	156442	268953	703925	419503	401291	262776	341065	364204	222069	343259
	Snake Bite	1908	3329	5981	1342	10556	8250	7995	6911	8660	3491	3651
	Leptospirosis	549	673	490	3318	481	201	45	24	13	0	40
	Acute Flaccid Paralysis < 15 years	1013	3280	2906	3615	1096	718	626	581	873	426	856
	Fever of Unknown Origin (PUO)	225353	757740	1192277	2384936	1589956	1385610	1036710	847706	841509	661052	868115

NA Not Available; Source: IDSP, Bihar

Table 1b: Laboratory-confirmed cases of priority disease over the years (2009-2019) as per annual, monthly and weekly reports of IDSP, Bihar

Cases of Priority disease over the years as per IDSP annual, monthly and weekly reports, Bihar												
Surveillance type	Disease	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Laboratory Surveillance	Hepatitis A	27	91	149	239	389	232	711	566	520	155	321
	Hepatitis E	6	0	5	22	152	173	158	153	211	3	20
	Cholera	0	20	0	0	0	4	0	0	0	0	0
	Shigella Dysentery	36	59	122	93/89	220	129	447	450	376	278	52
	Typhoid	279	857	2398	4571	9088	8239	9499	6790	5596	4811	8857
	Chikungunya	0	0	80	10	4	2	3	378	186	21	238
	Diphtheria	0	0	2	23	17	8	0	0	0	0	0
	Meningococcal Meningitis	10	59	122	63	219	126	306	319	229	253	1
	Malaria Pv	311	566	1567	2373	2505	1258	1610	1618	1286	620	937
	Malaria Pf	1025	528	1079	1029	888	524	781	596	423	252	196
	Kala-azar	21318	23084	25009	16056	9929	7615	6905	4773	4127	NA	NA
	Japanese Encephalitis	1	0	159	63	37	15	30	55	39	12	3
	Dengue	16	1125	46	350	2206	284	1296	1201	640	807	3232
	Leptospirosis	0	0	2	6	7	4	1	0	0	0	1

NA Not Available; Source: IDSP, Bihar

Table 2: Year-wise proportional distribution of individual diseases among all reported suspected cases under IDSP, Bihar (2009-2019)

Proportion* of cases for all reportable diseases in Bihar as per IDSP Reports											
Surveillance type	Disease under surveillance	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Presumptive surveillance	Viral Hepatitis	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
	Acute Diarrhoeal Disease	10	12	13	12	14	13	13	12	12	10
	Bacillary Dysentery	8	7	7	7	8	7	7	6	6	5
	Enteric fever	5	3	3	5	6	7	7	6	5	5
	Measles	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chickenpox	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Pertussis	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Diphtheria	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Meningitis	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Pneumonia	2	2	1	1	1	1	1	<1	<1	1
	ARI/ILI	34	38	39	38	36	35	35	36	37	34
	Malaria	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
	Acute Encephalitis Syndrome	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dengue	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dog Bite	6	6	8	7	8	7	10	11	10	12
	Snake Bite	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Leptospirosis	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Acute Flaccid Paralysis < 15 years	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Fever of Unknown Origin (PUO)	31	29	27	28	27	27	26	26	28	31
Lab surveillance	Hepatitis A	<1	<1	1	2	1	3	3	4	2	3
	Hepatitis E	0	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Cholera	<1	0	0	0	<1	0	0	0	0	<1
	Shigella Dysentery	<1	<1	<1	<1	<1	2	3	3	4	<1
	Typhoid	3	8	20	35	44	44	40	41	67	70
	Diphtheria	0	<1	<1	<1	<1	0	0	0	0	2
	Meningococcal Meningitis	<1	<1	<1	<1	<1	1.5	2	2	3.5	0
	Malaria Pv	2	5	10	10	7	7	10	9	9	<1
	Malaria Pf	2	4	5	3	3	4	4	3	3	0
	Japanese Encephalitis	0	<1	<1	<1	<1	<1	<1	<1	<1	0
	Kala-azar	87	81	61	39	41	32	28	30	NA	NA
	Chikungunya	0	<1	<1	<1	<1	<1	2	1	<1	<1
	Dengue	4	<1	2	9	2	6	7	5	11	25
	Leptospirosis	0	<1	<1	<1	<1	<1	0	0	0	<1

*Numerator=Symptom positive or laboratory confirmed cases of a particular disease condition

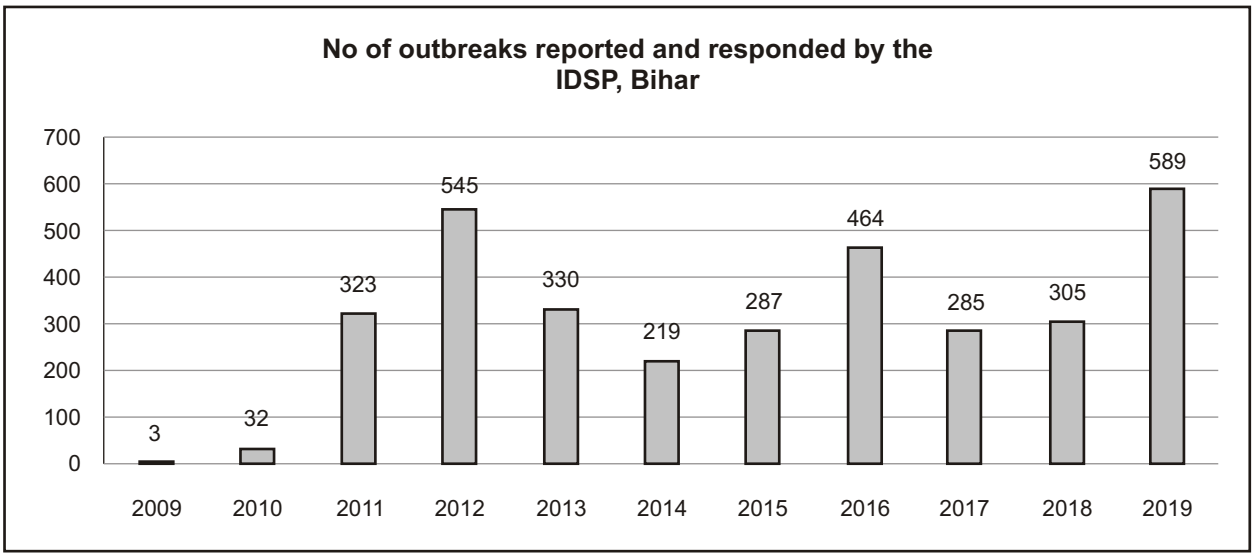
Denominator=Cumulative aggregate of all potential cases reported at OPD or sent for testing in that particular year

Detection of epidemics and outbreaks

Outbreaks are initially recorded at the local Primary Health Units (PHU) on a standardized Outbreak Report Form as an interim report (Early Warning Signal Form) with a provision of updating further data when it becomes available. Outbreak reports are available both at the IDSP Portal as well as the State Surveillance Unit, but the data source is primarily at the sub-district and district units. The likelihood of outbreak reporting increases if they involve a large number of cases, unusual pathogens, notifiable diseases or have a well-defined setting. Also, the resource disparity between the reporting units also have an impact on outbreak reporting at the local level. In mid-2009, when the IDSP was launched in Bihar, only 3 outbreaks were reported with 0 deaths. A year later, 32 outbreaks involving 2564 cases and 30 deaths were reported with another 6676 cases and 370 deaths attributed to different outbreaks in 2011. In 2013, 335 outbreaks involving 6653 cases resulted in 170 deaths, which was less than the 2012 figures where 542 outbreaks involved 9033 cases and 138 deaths. Similar pattern was observed in 2015 where 287 outbreaks involved 3978 cases and 51 deaths, much less compared to 2014 (4241 cases and 260 deaths). In 2016, 464 outbreaks involving 10048 cases and 62 deaths were reported and responded by the State, followed by 285 outbreaks involving 5945 cases and 61 deaths in 2017. In 2018, 305 outbreaks had been reported, while another 589 outbreaks were reported in 2019 involving 6417 cases. (Figure 3)

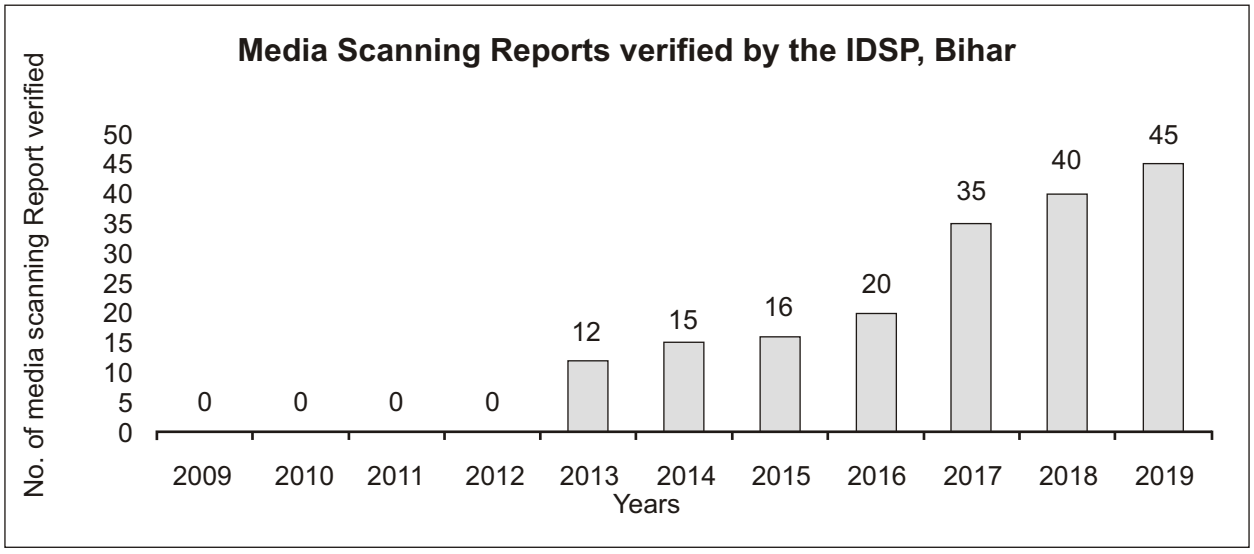
The media scanning and verification cell was established under IDSP in July 2008 at the National level. It detects and shares media alert with concerned State/Districts for verification and response. The Media scanning and verification cell of the IDSP, Bihar started collecting and investigating media reports of outbreaks from 2013, and between 2013 and 2019 a growing number of media reports were captured and investigated by the unit. Majority of the alerts were related to diarrhoeal diseases and vector-borne diseases. (Figure 4)

Figure 3: Total disease outbreaks detected by the IDSP, Bihar over the years (2009-2019)



Source :IDSP, Bihar

Figure 4: Total number of media reports on disease outbreaks identified and investigated by the IDSP, Bihar over the years (2009-2019)



Reported death

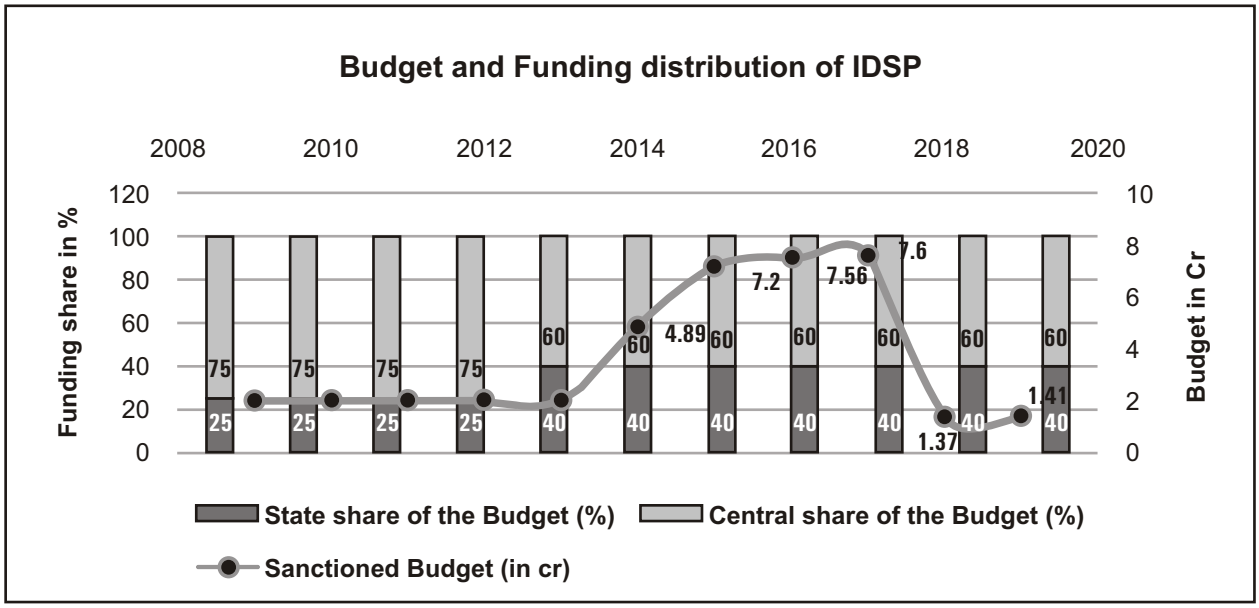
Vertical programs have an advantage in this regard as programmes such as the National Vector-borne Disease Control Program (NVBDCP) have an inbuilt system that captures fatality. Therefore, the case fatality of only those diseases under vertical control programs get reflected in the IDSP reports. Of the major diseases under surveillance in the IDSP, the reported case fatality of AES clinically-diagnosed (reported under IDSP) over the years in Bihar was 20 in 2011, 36 in 2012, 35.33 in 2013, 36.47 in 2014, 25.64 in 2015, 25.35 in 2016, 21 in 2017, 26.17 in 2018 and 22.58 in 2019.

While for Dengue, the case fatality could not be determined due to discrepancies in data captured under IDSP and NVBDCP. Hence, only absolute numbers are captured over the study period– 4141 cases and 6 deaths were reported in 2013, 342 cases and 1 death in 2014, 1648 cases with no deaths in 2015, 2479 cases and 4 deaths in 2016, 2854 cases with 3 deaths in 2017, 2203 cases with 1 death in 2018, and 8554 cases with 1 death in 2019.

Budget

IDSP was launched during 2004-05 with the World Bank assistance (loan of USD 68.00 million) and financial allocation of Rs. 408.36 crore. World Bank Loan amounting to 306.27 crore provided 75% of the total budget, while the Government of India provided funding for the rest 25% to the tune of 102.09 crore. When the programme was implemented in 2009, 75% of the annual budget earmarked for IDSP in Bihar was provided by the Centre, with the rest 25% of funds falling on the State's shoulders. This ratio of fund sharing carried on till 2013-14, following which the central share of the total budget decreased to 60%. For Bihar, 75% of the sanctioned budget of approx. 2 crores (2007-2008 to 2011-2012) was approved for human resources and the rest 25% was earmarked for operational activities of the programme. Till 2012-2013, the central share of the yearly funds was usually released by the Government of India after receiving utilization certificate at the end of last quarter. This led to a delay in the entire process of implementing the program. The budget for 2015-2016 was Rs. 756 lakhs (includes committed figures), while for 2016-2017 it was Rs. 760 lakhs (includes committed figures) and the funds for these years were received by the state IDSP unit in 2018-19. Commenting on the delays of receiving funds, a state-level stakeholder of the program stated (Figure 5)

Figure 5 : Budget and the funding distribution of IDSP, Bihar since 2009



Source :IDSP, Bihar

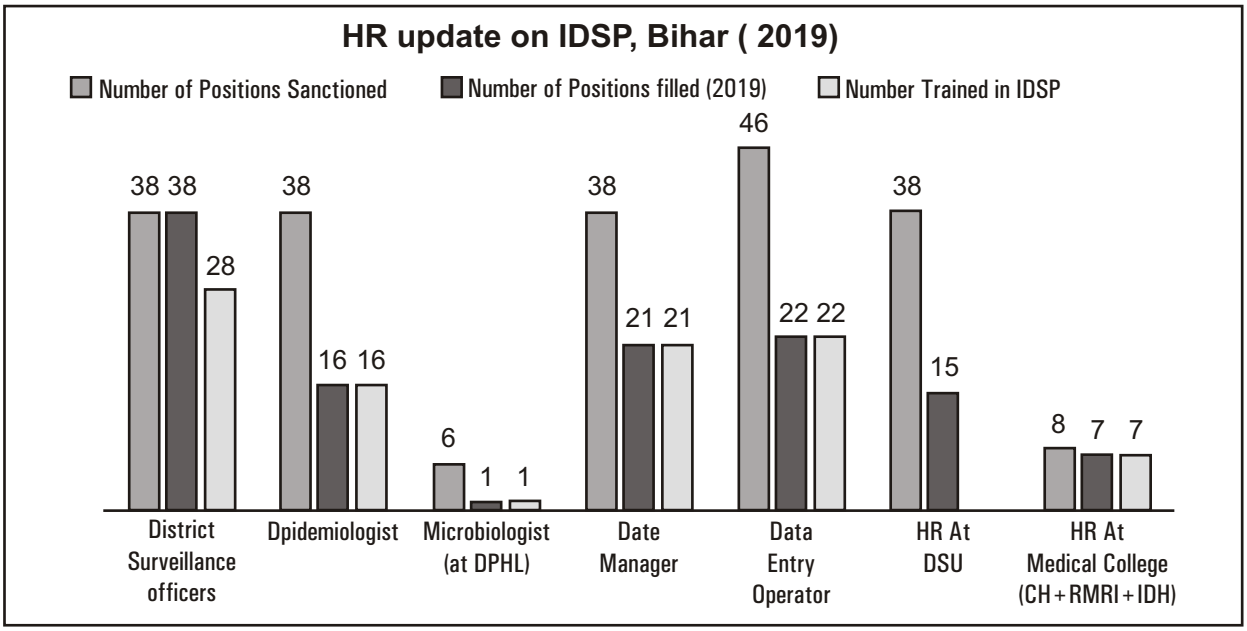
Human Resource

The Government of India has created and approved the positions of Epidemiologists, Microbiologist, Data Manager, Data Entry Operators and District Surveillance Officers under the IDSP. Of the sanctioned posts in Bihar, under the IDSP, majority are currently vacant even though the intake during the commencement of the program in 2009 was high. The challenge presently is to fill in these posts urgently with motivated individuals and arrange for their induction training along with necessary field epidemiology and microbiology training. The critically high attrition rate among the staff of the IDSP is a major setback for the continued performance of the programme. Moreover, in addition to the routine program-related training on public health, IDSP training has to cater to the larger need of Epidemiologists and Microbiologists, enabling them to organize and oversee programme activities at state and district levels. At present, a two-week Field Epidemiology training along with an introductory training is the norm at the time of joining, but a very small fraction of the IDSP staff working at the district and hospital settings acknowledged receiving them. (Figure 6)

Three key personnel that district surveillance units of the IDSP have been sanctioned with are the Epidemiologist, Data Manager, and the Data Entry Operator. In majority of the cases, the post had not been completely filled. Of the 38 districts in Bihar, only 4 have all the three personnel (10.52%). (Figure 7)

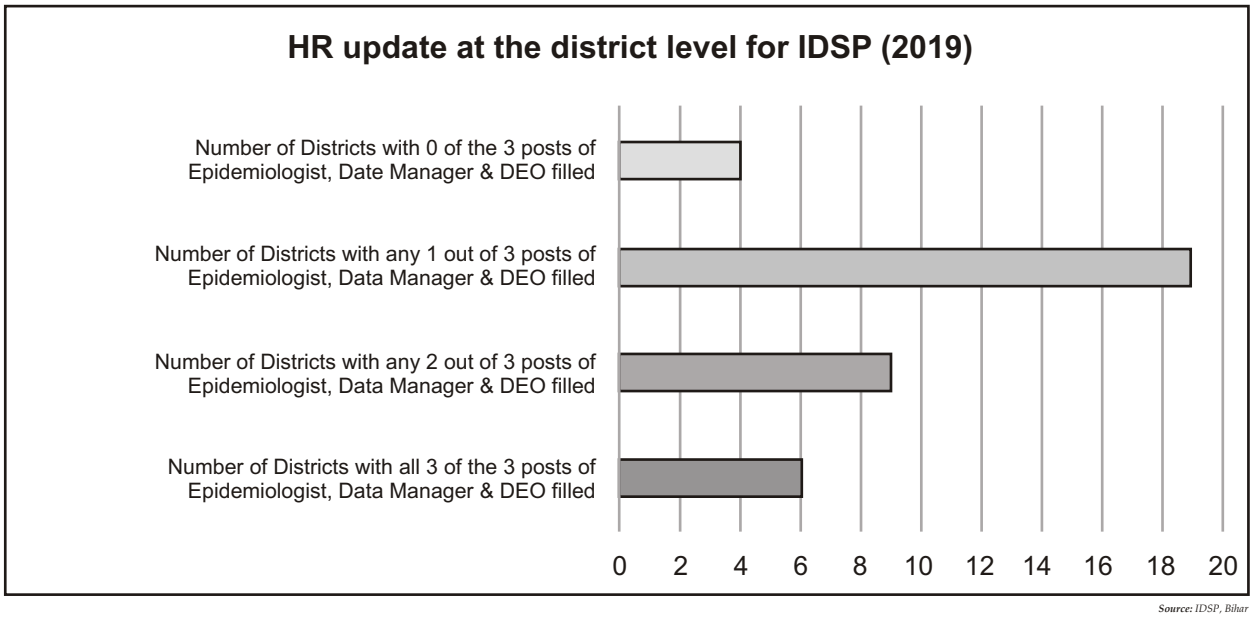
As no separate funds for training were provided before 2016, no training sessions were conducted focussing on Medical Officers (MO), health workers, nurses/pharmacists before 2015-16 for IDSP. From 2017 onwards, ASHAs were also being trained in IDSP, though they did not do any reporting at the present format but were important for identification of syndromic cases reported in the S-Form. (Table-3)

Figure 6: Human resource scenario of IDSP, Bihar in 2019



Source: IDSP, Bihar

Figure 7: Human Resource (HR) availability at the District Surveillance Units of IDSP, Bihar in 2019



Source: IDSP, Bihar

Table 3: Personnel trained by the IDSP, Bihar over the years (2009-2018)

Personnel received training under IDSP

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ASHA	–	–	–	–	–	–	–	–	533	393	521
MO* (PHC/DH/RH/SDH)	–	–	–	–	–	–	–	105	200	151	173
MO (MCH)	–	–	–	–	–	–	–	182	93	270	31
Pharmacist/Nurse	–	–	–	–	–	–	–	78	490	578	1507
BHN/Block Health team	–	–	–	–	–	–	–	189	178	232	3310
Lab technician	–	–	–	–	–	–	–	–	38	–	–

*MO=Medical office

Dissemination of data

The infectious diseases captured in Presumptive, Lab-confirmed and Syndromic surveillances and data collected from several National Vertical Disease Control Programs are collected, compiled and presented by the IDSP Bihar state unit in its weekly, monthly and annual reports.

The annual reports published by the IDSP Bihar update on previous and current annual summaries of reportable communicable disease data for the State collected under IDSP. These include information on new cases, distribution and also on occurrence of outbreaks. Monthly and weekly data are also available through specific formats from the IDSP cell in Bihar and act as a source of disease pattern of reportable diseases, outbreak analysis, completeness and timeliness of reporting.

The annual reports are available till 2017 and the annual report of 2011 includes data from 2009 and 2010. Monthly reports are not available for the first three years of IDSP in Bihar (2009-2011) and are incomplete for later years too. There are several months between 2012 and 2017 for which reports were missing. Weekly reports are available from 2013 onwards and provides a summary of reportable disease incidence. (Table-4)

Table 4: Availability of monthly and annual reports of the IDSP in Bihar (2009-2019)

Availability of IDSP monthly and annual reports													
IDSP year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Report
2009	×	×	×	×	×	×	×	×	×	×	×	×	-
2010	×	×	×	×	×	×	×	×	×	×	×	×	-
2011	×	×	×	×	×	×	×	×	×	×	×	×	✓
2012	×	×	×	×	×	×	×	×	✓	✓	✓	✓	✓
2013	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2014	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓
2015	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2016	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	X	✓
2017	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓
2018	×	×	×	×	×	×	✓	✓	✓	✓	✓	✓	×
2019	×	×	×	×	×	×	×	×	×	×	NA	NA	×

× = Not Available; ✓ = available; Annual report of 2011 includes 2009 and 2008; Source: IDSP, Bihar

Discussion

To the best of our knowledge, this is the first ever comprehensive review of IDSP performance in Bihar. Findings revealed significant improvement in some of the core functions during the first 10 years of IDSP implementation in Bihar. Commendable progress in the implementation of IDSP was demonstrated by several indicators such as 'completeness' and 'timeliness' of reporting. Such gradual improvements in completeness and timeliness of reporting over the years have been observed in other studies as well (28, 29). Although the involvement of private sector in IDSP appeared limited, the number increased over the years. Capturing of data from the private sector has always been a public health challenge for the IDSP, but needs further exploration of barriers to such involvement as reported elsewhere (30, 31). Efforts should be directed towards establishing a standard real-time data capturing platform with mandatory reporting as a part of routine surveillance activities from both the public and private sectors so that an idea of probable cases at the population could be estimated. And, which might also act as a performance indicator for IDSP.

ARI or ILI were the most reported disease in the presumptive surveillance of IDSP over the

course of 10 years followed by Acute Diarrhoeal disease. From the laboratory surveillance data over the years, it was observed that cases of Kala-azar declined, while typhoid detection increased. This improvement may be attributable to infrastructural capability of the laboratories in detecting typhoid and the effectiveness of kala-azar control measures. While collating IDSP reports, few discrepancies were observed in the reported number of cases across different documents published by IDSP. The cumulative aggregate of number of cases shown in monthly reports did not match with that of the annual reports in most of the years. In addition, inconsistencies in reports were also observed in annual reports. Similar findings were also observed in a prior research (32).

There had also been more timely detection and response to acute outbreaks of infectious diseases by the IDSP in Bihar. Currently, all the districts in the state has a rapid response team (RRT) in place to investigate and respond to disease outbreaks. The RRT predominantly involved health experts at block and district levels, and in 2018 food safety officer and animal husbandry officer were also included in the RRT. From 2015 onwards, 98% of the outbreaks were reported within 48 hours and investigated by the RRT. Laboratory confirmation of the outbreaks has been a priority but is lacking due to infrastructural limitations and trained personnel. Outbreak detection and investigation of diseases by the IDSP has gradually risen over the years (33). Difficulties or inadequacy in laboratory confirmation of outbreaks were also observed in other states too (34, 35).

The option of determining the case fatality rate from the IDSP data appeared difficult because of ill-defined numerator and denominator. Only the case fatality of AES is available. However, caution is needed while interpreting the case fatality for AES, as clinical diagnosis of AES remained a challenge in the absence of a standardized case definition. In addition, there is also an influx of cases from NVBDCP portal having different reporting format. Moreover, IDSP and NVBDCP report separately on AES cases in the state. Additionally, information on the at-risk population is missing in most cases and therefore indicators like attack rate and case fatality rates need to be carefully construed. Therefore, a proper mapping of the at-risk population and identification of probable cases in the community through clinical examination and laboratory support appears to be the necessary steps for the overall improvement of IDSP performance.

While IDSP initially got the financial support from the World bank, the subsequent drop in funding from the Central Government was temporarily managed by contributions from the state. The review of financial resources revealed a steady decline in fund allocations at

the state level. Such a decline in funding is likely to affect the performance of IDSP in Bihar. Gradual decrease in financing of IDSP is a common phenomenon all over the world (29, 36). Therefore, a more balanced investment in the said program are likely to yield a more robust surveillance system and better epidemic preparedness.

Availability of well-trained and motivated human resources is essential for the proper functioning of a surveillance system (37). A large portion of sanctioned positions under IDSP were lying vacant in the state. This finding corroborated with previous studies (38, 39). To boost surveillance activities and response mechanisms, an extensive network of Epidemiologists, Microbiologists and Entomologists has to be made available in all districts and the State headquarter under IDSP.

Data dissemination and appropriate feedback were some of the critical issues in the current IDSP, which needs further exploration. Though reports have largely been made available by the IDSP Bihar, it is not complete for all the years, months and weeks, and lots of discrepancies are noted.

The apparent progress in the disease surveillance since 2009 suggested that there is a strong political, bureaucratic and financial commitment. Similarly, activities at the district level, which included case detection, laboratory surveillance, data analysis and outbreak investigation and response also showed good progress but there are some gaps. Good quality epidemiological studies are required to identify implementation gaps. Establishment of an evidence-based actionable strategy with clear financial and technical commitments will further improve the IDSP performance. For example, currently the system mostly captures probable cases via passive surveillance and the data in IDSP does not reflect the true burden of the disease. Hence, to make an evidence-based argument to improve the performance of IDSP, good quality epidemiological research is needed to estimate the true burden of epidemic and endemic-prone diseases, disease trend, changes in disease epidemiology and emergence of new pathogens in the population, and to establish a performance indictor at the community level so that actual capture of potential cases in the community could be determined. Furthermore, quantitative study related to knowledge and practice of key players under IDSP as well as in-depth qualitative deep dives exploring their views and perceived implementation barriers are essential for designing an effective disease surveillance strategy for Bihar.

Limitations

Reporting bias is a probability as data captured under IDSP might be related to program success/failure and, hence, there might be under-reporting or over-reporting. As this paper is based on secondary data analyses, some of the grey literature might have been missed. Despite these limitations, we believe this study can serve as the first baseline document on evaluation of IDSP for the Government of Bihar and the findings can effectively guide the planning and implementation stages.

Way forward

Based on learnings, following recommendations are made:

- Enhancing epidemic preparedness in the state by designing a robust infectious disease surveillance mechanism
- Capturing real-time data through web-enabled electronic system
- Capacity building through regular training
- Filling up the sanctioned positions
- Establishing accountability mechanism along with real-time feedback

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Notes

Notes

Notes

The Centre for Health Policy (CHP) at the Asian Development Research Institute (ADRI) has been set up with support from the Bill & Melinda Gates Foundation to strengthen the health sector in Bihar with a multidimensional and multi-disciplinary approach. Its aim is to engage in rigorous analysis of the health system and inform policy makers to fine-tune interventions for even stronger outcomes.

- Research and Analytical Studies

  It constitutes the core of CHP's activities. The areas of research include health infrastructure and delivery with emphasis on equity, health outcomes such as IMR, MMR, TFR and its predictors, health financing, private-public partnerships, regulatory framework and its implementation, and other issues which might emerge.

- Informing Policymakers on Strengthening the Existing Health System

  CHP aims to be the trusted partner of the state Government in providing evidence-based inputs in making the health system stronger, resilient and equitable.

- Sustainable Health Solutions

  CHP recognizes the need for establishing a strong health system which will be self-sustaining. It means immunity to natural disasters/calamities, financial uncertainties and other unanticipated factors. These pillars may be interrelated; CHP will provide a framework of synergy among actors working on these pillars.

- Collaboration

  CHP engages in collaboration with an extensive network of academic and policy research institutions both in India and abroad in health and the broader social sciences.