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Research Article

Evaluating an incentive based syndromic case reporting model using local health volunteers for predicting and preventing chikungunya epidemics in North Kerala, India

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ABSTRACT

Background: We attempted to explore the utility of incentive based syndromic surveillance for chikungunya, by identifying, training and utilizing female health volunteers and testing its adaptability in a low resource setting.
Methods: A prospective evaluation of the syndromic reporting model was done in five selected urban and two rural units of Kozhikode district in North Kerala. Since large gaps were identified in the district health system reports of CKG for 2009 epidemic, an incentive based reporting and intervention model was developed which functioned independently from the official reporting systems by training health volunteers. For comparison baseline fever levels were generated using 5 year district health system data, calculating Z-scores. Statistical forecasting using time series analysis was done in both rural areas for the year 2011. Official IDSP and health volunteer fever reports were compared to predicted fever counts for 2011.Timeliness and completeness of reporting units and completeness of case reporting was monitored by WHO inventory method.
Results: The current reporting model detected higher fever counts compared to the official data. For every 100 fever counts by the LHVs only 15 fever counts were reported by the official health system. Timeliness and completeness of reporting units exceeded 70% and completeness of case reporting 75%.
Conclusions: The present study reiterated the ability of syndromic surveillance in detecting and monitoring out breaks. Timeliness and completeness of reports goes to prove the effectiveness of incentive based reporting system at the regional level. Incentive based disease surveillance and reporting at grass root levels, is effective in detecting early outbreaks triggering a reactive community participation leading to prompt disease containment measures and is applicable in resource poor settings.

Keywords: Syndromic case reporting, Evaluation, Local health volunteers, Chikungunya epidemic

INTRODUCTION

Chikungunya (CKG) virus is no stranger to the Indian sub-continent. Since its first isolation in Calcutta, in 1963, there have been several reports of CKG virus infection in different parts of lndia.[1-4]

In 2008 and 2009, Kozhikode, a northern district of Kerala state, India was hit on a massive scale with CKG. Official figures of District Medical office, revealed 56 Panchayaths out of 78 in the district to be affected, with 3339 probable and 64 confirmed cases. [5] Actual picture is different as the possibility of under reporting exists. Central team from the National Institute of Virology Pune, following field investigations of the affected districts noted that CKG fevers were officially reported as viral fevers leading to a delay in prompt containment measures. Large gaps were evident in the district health

system reporting of CKG. Multitude of factors contributed to the large scale affliction, of which lacunae in disease surveillance and reporting needs special mention.

Against this background, investigators from a tertiary health facility in North Kerala, India carried out a situational analysis of CKG in 2009 in selected panchayaths and urban wards. Comparison of official figures and independent evaluation by field surveys showed marked variation pointing to gross underreporting. This prompted the researchers to explore the possible gaps in disease reporting at three levels namely district health system, local self-governments and community done in phase 1 of the project.

In phase 2, an incentive based syndromic disease reporting model was introduced in the year 2011, which we hypothesized would be a highly effective strategy for early disease detection and timely response.

Objectives

- Implement an incentive based syndromic disease reporting model in selected rural and urban units for chikungunya.
- Evaluation of the quality of surveillance and effectiveness of this model using WHO guidelines.

METHODS

Institutional research committee and ethics committee permission was obtained by the investigators. Research was supported by district health system, urban Kozhikode corporation, IDSP and the District Kudumbrashree mission. Project proceeded through January to December 2011.

Two sampled rural and five urban units with <25% CKG reports were selected based on official reported figures (2009).[1] However non-reliability of reports prompted us to determine actual attack rates by field investigators in 2010 using lot quality assurance technique.

Absence of fever reports in the local health institutions of urban wards led us to accessing data from infectious disease cell at the tertiary centre. Five urban wards with less than 30% affection were selected by random evaluation and lot quality assurance.

Intervention model in the selected rural and urban units included sensitization programmes, volunteer recruitment and training. Sensitization programs prior to active reporting targeted stakeholders viz; panchayat president, elected ward members, medical officers of the health centres, health staff of the panchayat, ward councilors and members of the resident's associations in urban setting.

Health volunteers including ASHAs (accredited social health activists) under the NRHM and LHVs were recruited and trained. Due to the absence of any trained health workers in the urban areas, women in neighborhood self-help group were chosen to participate in fever reporting. Training sessions focused on vector, vector surveillance, the diseases and the method of disease reporting.

Incentive based fever reporting adapted and modified the basic format for fevers in form S of IDSP, incorporating few more syndromes relevant to the present scenario. Weekly submissions of reports including nil reports were made mandatory. A nodal ASHA was entrusted with supervision of report.[3-5] Additional LHVs in her area assisted in information gathering. Vector surveillance was done by each ASHA in her defined area in a sample of fifty houses every month. Fever and vector surveillance reports were collected and compiled into the database. A monthly meeting of the ASHAs coordinated by the field investigators took stock of the situation and collected feedbacks of difficulties and the shortcomings in the model of reporting introduced. A similar method was adapted in urban units too, with fortnightly reports due to high population density.

The reporting format comprised of nine fever related syndromes, including fever with rashes and fever with joint pains. Suggested syndromes were CKG, dengue, acute respiratory illness, tuberculosis, hepatitis, encephalitis, fever of long duration (PUO) and viral syndromes.

If a number of cases reported with fever and joint pain, a subsample of the cases were examined by the medical team and morbidity assessment done. Cases fitting into the probable case definition of CKG or dengue were subjected to serological tests. We followed the possible case definition for surveillance of CKG, which is acute onset of fever > 38.5^{o}C and severe arthralgia/arthritis not explained by other medical conditions for the purpose of identification of CKG.[6]

A predicted fever level model was constructed for the year 2011 in the study areas for comparing fever reports from the two other sources, namely official and ASHA/ LHVs. Official reports of fever in these areas for the past 5 years (2005 to 2010) were utilized for calculation, excluding the data for 2009, being year of an epidemic. The expected number of cases was calculated using the average for that month (and the previous and following month) during the past 5 years using cumulative sum (C-SUM) method for epidemic detection.[7,8] Monitoring of the reporting system was done using three criteria, namely timeliness of the reports, completeness of the reports and the completeness of case reporting. [9]

Timeliness referred to the percent of the reporting units submitting timely reports to the field investigators. Completeness of reporting units is the percentage of

reporting units submitting reports to the field investigators irrespective of the time.

Completeness of case reporting was done by the inventory method using two sources of data: reports by ASHA/Kudumbasree workers as well as active surveillance for fever cases by field investigators.[10,11] The cases from two sources were matched and a composite list containing all fever cases in the area constructed. The numbers of cases reported by LHVs were divided by the total number of cases in the composite list to derive the completeness of case reporting. Local steering committees were formed in both areas for monitoring the project.

Data analysis

The quantitative data were entered into excel spreadsheets and analyzed using SPSS version.[18] Results were expressed in frequencies and percentages. Fever counts reported by LHVs were standardized by calculating the Z-scores using the monthly baseline fever predicted. The Z-scores were used to assess how much the fever counts varied from the baseline predicted values and if it had gone beyond the epidemic threshold.

RESULTS

The resulting levels of baseline predicted fever levels and epidemic thresholds in the two rural units are shown in table1. Calculation of baseline and threshold limits in urban setting could not be done due to lack of existing official health MIS.

Fever reporting was done in the rural areas from March-October 2011 and in the urban areas from May-October 2011 by LHVs. The consolidated reports were shared to the LSG and local steering committees monthly. The monthly trends of the fevers reported by the LHVs, IDSP and the baseline predicted fever counts for 2011 in rural units were generated. Both rural units show a marked increase in the fever counts captured by LHVs as compared to the official and the predicted baseline values which peaked above the epidemic thresholds generated.

Table 1: Baseline fever levels and epidemic thresholds in the rural units (2011).

	RIP1		RIP2	
	Baseline fever predicted 2011 (C-SUM)	Epidemic threshold (C-SUM + 1.96 SD)	Baseline fever predicted 2011 (C-SUM)	Epidemic threshold (C-SUM + 1.96 SD)
Follow up period				
January	38	92	31	75
February	34	86	27	70
March	34	88	28	72
April	41	111	34	91
May	70	203	57	165
June	118	314	96	255
July	137	328	112	266
August	123	310	100	252
September	83	203	67	164
October	64	144	52	117
November	54	112	44	91
December	46	102	37	83

Lay reported fevers by LHVs were compared to the baseline fever levels using data at the district health system for 5 years. A statistical forecasting using time series analysis (moving average method) was done in both rural areas for the year 2011. LHV fever counts were compared to the baseline fever predicted using the Z-score .

LHV reports revealed a higher proportion of isolated fevers followed by fever with acute respiratory infection, though the project focused on picking up CKG. Following epidemiological case definitions the pickup rates of fever with joint pains were 8% and 4.3% in rural units respectively and 19.87% in the urban areas. In an attempt to identify cases which were suspect for possible CKG cases with associated other syndromes were excluded from further analysis.

LHVs reports were compared to the official counts by calculating the ratio of the fever count reported by the health institution to 100 LHV reports. Strike by the health officials led to non-submission of the fever reports from October 2010 to July 2011.Reports of June and July were retrospectively given by IDSP after the withdrawal of

strike. On consolidation of all the above data it was noted that for every 100 fever counts reported by the LHVs 15 fever counts were reported by the official health system both being independent of each other.

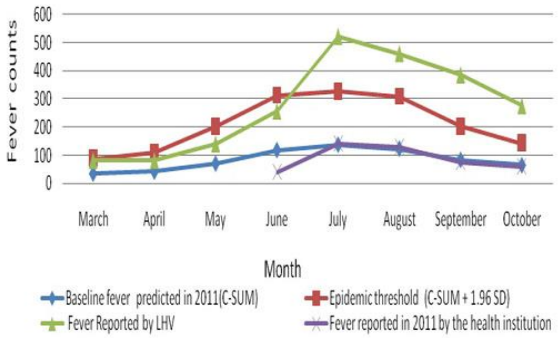

Figure 1: Monthly fever trends of LHV, IDSP reports and the baseline predicted in rural unit 1 (2011).

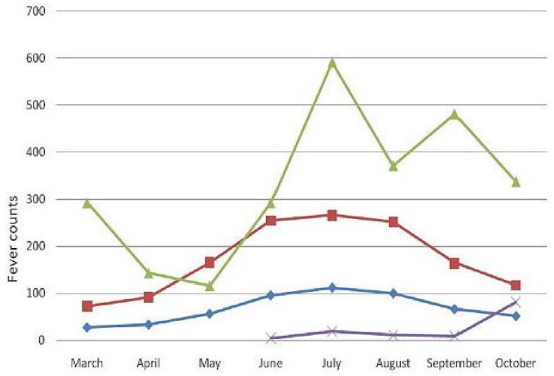

Figure 2: Monthly fever trends of LHV, IDSP reports and the baseline predicted in rural unit 2 (2011).

Table 2: Comparison of the fever reported by lay reporting to the official counts and expected total fever in rural unit 2.

Month	Fever reported by LHV (a)	Baseline fever predicted for 2011# (b)	LHV report-Z score [(a-b)/SD]
March	292	28	11.76
April	143	34	3.75
May	116	57	1.07
June	292	96	2.42
July	591	112	6.1
August	371	100	3.49
September	481	67	8.37
October	337	52	8.59

Reporting model was assessed using the completeness of reporting units, completeness of case reporting and timeliness. It was noted that timeliness and completeness exceeded over 70% in urban and rural, which emphasizes the reliability of this approach (Figure 3).

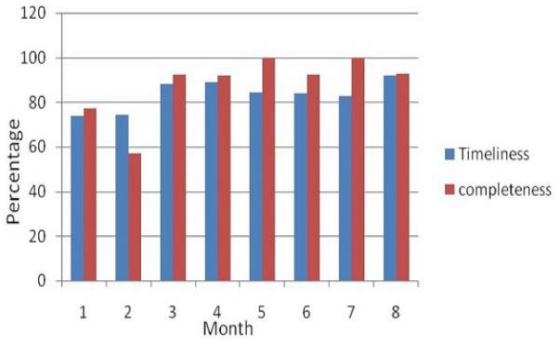

Figure 3: Completeness and timeliness of reporting units (urban).

DISCUSSION

The results of this experiential model of reporting in the rural and urban project locations are encouraging. The present study reiterated the ability of syndromic surveillance in detecting and monitoring out breaks across the globe in the last decade.[12-16] To ensure timeliness and completeness of fever surveillance and to prevent program fatigue, an incentive based zero reporting system was an inbuilt component of this project. The timeliness and completeness of reports goes to prove the effectiveness of this system at the regional level. Criticisms may be raised towards the cost effectiveness of this model. But estimates show that economic damage caused by recurring epidemics and pandemics are huge.[17,18] Implementing this model leads to earlier detection and control of such outbreaks, thus benefits are likely to outweigh the costs. Adapting this model into the routine health system ensuring sustainability with rapid, timely diagnostic facilities will help in detecting a large proportion of CKG and dengue, thereby triggering outbreak response measures on a real time basis. Predicting the baseline total fever counts using the C-SUM method helped us smoothen out artificial variations in monthly reported data due to late reporting and other errors inherent to the surveillance system.[8]

Results showed that in both the areas the incentive based surveillance system has been able to capture fever counts consistently above the predicted baselines and counts exceeded the calculated epidemic thresholds at several points in the year 2011.

Though our major objective was to identify CKG and dengue, the syndromic analysis of fever peaks helped us identify three syndromes namely isolated fevers, fever with ARI and fever with joint pains contributing to probable outbreaks. Compared to the LHV reports diminished fever counts by the official system could be approximately estimated in our analysis. Probably this could be due to the incentive component and the independent monitoring of the fever by the project personnel.

A point worth noting is that two outbreaks in the study units, isolated fevers and fever with ARI were neither detected nor reported at any time in the official health MIS. Similar event may have contributed to the failure of the health MIS in detecting CKG epidemics timely in the past. This model highlights the fact educational innovation projects in public health can be successfully incorporated in the primary urban health care system provided there is a will to identify ample human resources from within the community to carry on health programs.

It has been noted that if the completeness of reports is only 50% then the incidence of diseases would be under reported by nearly 50%.[19] An alert system will have timeliness and completeness approaching 100%. In a system where the level of reporting of detected cases is very high, the completeness of case reporting will be directly related to the sensitivity and alertness of the surveillance system, which we have been able to demonstrate in the project.[9]

Inspite of the ongoing strike by the health officials on certain administrative issues from October to July 2011, this model goes to prove that any barriers in disease reporting could be transcended in a decentralized reporting model with an inbuilt component of community participation.

In this project as investigators we ensured community participation in monitoring of reporting activities, vector control measures, organizing fever camps and awareness generation.

Situational analysis of the health system factors associated with the CKG epidemic (2009) revealed several shortcomings in the health MIS namely, under reporting of cases, lack of early detection of outbreak, failure to disseminate actual data, lack of coordination between health system and LSGs, poor stress on the process of surveillance at grass root levels in rural areas and an absent surveillance mechanism in the urban areas. In relation to the fever epidemic (2009) we noticed that the probable/ suspect cases of CKG/DEN got submerged into the viral fever pool in the official health MIS.

The reporting model of the project using LHVs in rural and urban areas has detected higher fever counts and outbreaks in comparison to the official reporting data. Irrespective of the fever pattern, spiking of the fever counts triggered a reactive community participation leading to disease containment measures.

In spite of having integral components like grass root level reporting in the official health MIS, the actual figures failed to be either detected or disseminated in the health system. The LHV based lay reporting system we implemented differed from the official surveillance mechanism in two key areas, namely extrinsic motivation of reporting units through financial and non-financial incentives and sustaining the timeliness and completeness of report through a process of independent monitoring by the project personnel. This collaborative project with intersectoral coordination ensured the participation of the community and health workers in the key project activities.

This study highlights that a syndromic disease surveillance with a strong timely reporting component enables the health authorities to initiate appropriate public health response so that further illness can be prevented. Research methodology in this study aimed towards addressing the gaps in the existing official rural and urban disease surveillance network utilizing community resources and functioning independently from the official reporting system. Effectiveness of the reporting model evaluated using WHO guidelines adds to the outcome.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Shah KV, Gibbs CJ Jr, Banerjee G. Virological investigation of the epidemic of haemorrhagic fever in Calcutta:isolation of three strains of chikungunya virus. Indian J Med Res. 1964;52:676-83.
2. Jadhav M, Namboodripad M, Carman RH, Carey DE, Myers RM. chikungunya disease in infants and children in Vellore: a report of clinical and haematological features of virologically proved cases. Indian J Med Res. 1965;53:764-76.
3. Dandawate CN, Thiruvengadam KV, Kalyanasundaram V, Rajagopal J, Rao TR. serological survey in Madras city with special reference to chikungunya. Indian J Med Res. 1965;53:707-14.
4. Thiruvengadam KV, Kalyanasundaram V, Rajgopal J. Clinical and pathological studies on chikungunya fever in Madras city. Indian J Med Res. 1965;53:729-44.
5. IDSP Data-Kozhikode district -2006-2009,Integrated surveillance disease programme.

6. WHO/SEAROCasedefinition. Available at www.searo.WHO.int / entity/ emerging_diseases / topics / Def_Chikungunya_Fever.pdf. Accessed on 26th October 2010.
7. Keusch GT, Pappaioanou M, Gonzalez MC, Scott KA, Tsai P. Sustaining Global Surveillance and Response to Emerging Zoonotic Diseases. Washington, DC: The National Academies Press; 2009.
8. World Health Organization 2004; Field guide for malaria epidemic assessment and reporting.
9. World Health Organization 2006; Communicable disease surveillance and response systems. Guide to monitoring and evaluating.
10. World Health Organization 2012; Assessing tuberculosis under-reporting through inventory studies.
11. Timothy J, Doyle M. Glynn K, Samuel L. Groseclose; completeness of notifiable infectious disease reporting in the United States: An analytical literature review. Am J Epidemiol. 2002;155(9):866-74.
12. Cooper DL, Verlander NQ, Smith GE, Charlett A, Gerard E, Willocks L, O'Brien S. Can syndromic surveillance data detect local outbreaks of communicable disease? A model using a historical cryptosporidiosis outbreak. Epimediol Infect. 2006;134(1):13-20.
13. Heffernan R, Moshtashari F, Das D, Karpati A, Kurldoff M, Weiss D. Syndromic surveillance in public health practice, New york city. Emerg Infect disease. 2004;10(5):858-64.
14. Bellika JG, Hasvold T, HartvigsenG. Propogation of programme control: a tool for distributed disease surveillance. Int J Med inform. 2007;76(4):313-29.
15. Josseran L, Fouillet A, Caillere N, Brun-Ney D, Ilef D, Brucker G, Medeiros H, Astagneau P. Assessment of a syndromic surveillance system based on morbidity data: results from the Oscour network during a heat wave. PLoS One. 2010;5(8):e 11984.
16. Caudle JM, Dijk VA, Rolland E, Moore KM. Tele health Ontario detection of gastrointestinal illness outbreaks. Can J Public Health. 2009;100(4):253-7.
17. Dan YY1, Tambyah PA, Sim J, Lim J, Hsu LY, Chow WL, Fisher DA, Wong YS, Ho KY. Cost effectiveness and analysis of hospital infection control response to an epidemic respiratory virus threat. Emerg Infect Dis. 2009;15(12):1909-16.
18. Browsers L, Cakici B, Carnitz M, Tegnell A, Boman M. Economic consequences to society of Pandemic H1N1 influenza 2009-preliminary results for sweden. Eurosurveill.2009;14(37):19333.
19. Srivastava DK, Venketesh S, Pandey S. Completeness and timeliness of reporting under IDSP in rural surveillance unit of Nainital district. Indian J.Prev.Soc.Med. 2009;40:138-42.
20. M'Ikanatha N, Southwell B, Lautenbach E. Automated Laboratory Reporting of Infectious Diseases in a Climate of Bioterrorism. Emerg Infect Dis. 2003;9(9):1053-7.

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