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School-based surveillance for detection of children with acute pharyngitis, rheumatic fever/rheumatic heart disease in Shimla district, Himachal Pradesh, India—A cluster randomized controlled trial



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ABSTRACT

Background: The lack of surveillance system is a major barrier in prevention and control of rheumatic fever/rheumatic heart disease (RF/RHD). Efficacy of school-based surveillance was evaluated for detection of acute pharyngitis and RF/RHD in Shimla district, HP.

Methods: The schools in district Shimla were randomly assigned to intervention and controlled arm (442 vs. 441 schools). The trained nodal teachers reported children with symptoms of acute pharyngitis and or RF/RHD in intervention arm and children taken to hospitals by parents for symptoms of acute pharyngitis and or RF/RHD under control arm through mobile phone to coordinating centre. Final outcome for presence of RF/RHD or other heart Diseases was recorded after examination at nearest primary health centers and/or at Indira Gandhi Medical College Hospital, Shimla. Difference in detection rate between intervention arm and control arm was compared using Z test.

Results: The number of school children reported from intervention group was significantly higher than in control due to suspected symptoms of acute pharyngitis and or RF/RHD were 65 (2.84/1000) and 15 (0.60/1000), respectively ($p < 0.01$). Only 4 children in each arm were found to have heart diseases, with prevalence of (0.17/1000 and 0.16/1000), respectively, after clinical and echocardiography evaluation. In intervention arm, one child had RHD while three had congenital heart disease; in control arm, one child had congenital heart disease and three had RHD.

Conclusions: School based surveillance had higher rate of suspecting children with acute pharyngitis and or RF/RHD although with low specificity. There is a need of future studies to demonstrate the effectiveness of the proposed intervention in endemic regions of the state.

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1. Introduction

In developing countries rheumatic fever/rheumatic heart disease (RF/RHD) is a major burden among children, adolescents, and young adults with estimated 15.6 million people having RHD, 470,000 new cases of RF and 233,000 deaths attributable to RF/RHD each year.¹ The global incidence of acute RF is roughly 300 000–350 000 per year. The global age-standardized mortality decreased by 47.8% due to RHD from 1990 to 2015, but across regions large differences were observed.² However, the prevalence of RHD in developed countries has declined sharply due to

improved living conditions, access to medical care, nutrition and introduction of antibiotics and preventive programs leading to substantial change in epidemiology of acute RF and RHD.¹ Primary prevention is the most cost effective intervention for prevention of RF/RHD.^{3,4} RF is the result of autoimmune response to rheumatogenic strains of group A beta hemolytic streptococcal infection of pharynx in genetically susceptible individuals.^{5,6} Children with history of RF are at high risk of recurrence of RF with carditis following streptococcal acute pharyngitis.⁷ The morbidity and mortality due to RF is related to severity of carditis during acute attack and recurrence of RF.⁸

Prevention of recurrence of RF with recommended secondary prophylaxis regimen is demonstrated to be effective in decreasing the associated morbidity and mortality.⁹ Identification of silent RHD (showing no clinical signs) with minimal valve lesions by

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early echocardiography-based active surveillance programs might be of major importance but further research will be needed to define models of echocardiographic screening that are, affordable, practical and widely applicable.¹⁰ The lack of surveillance system is the major barrier in primary and secondary prevention of RF/RHD in developing countries.

Children in the age group of 5–15 years are high risk group for developing RF following streptococcal pharyngitis that needs close surveillance for acute pharyngitis and RF/RHD for timely detection and for preventive interventions.^{11–14} A strong population-based surveillance is probably the ideal system for capturing high risk groups for timely intervention for primary and secondary prevention of RF. The school-based surveillance for detecting children with symptoms of acute pharyngitis and or RF/RHD could still be a cost-effective method for primary and secondary prevention of RF in high-risk population in low-income countries. However there are no data available on its efficacy. In the state of Himachal Pradesh (HP) the school enrollment is more than 90%; it forms an ideal setting for establishing school-based surveillance system and evaluating its effectiveness for detection of children with acute pharyngitis and or RF/RHD.

We aimed to evaluate the efficacy of creating awareness about symptoms of acute pharyngitis and or RF/RHD among school teachers and students on change in detection rates of children suspected with RF/RHD and or acute pharyngitis between intervention and control arm in Shimla District of HP

2. Methodology

Study set up and area: All the schools; primary, middle, matriculation and senior secondary Schools both in government and private sector in district Shimla of state of HP formed the study setup and area.

Study period: The study period was of two years duration from Jan 2015 to Dec 2016.

Study Design: It was a cluster randomized controlled trial

Randomization method: The list of all the schools both in government and private sector in urban and rural areas of Shimla district was obtained from the directorate of elementary and secondary education of HP. The schools were assigned to intervention or control group randomly from the list of schools prepared using computer generated random numbers. The randomly generated even numbers were assigned intervention arm and odd numbers were assigned a control arm from the list. Thus, out of total of 2642 schools (clusters) in district Shimla with total enrollment of 1,43,523 students 442 and 441 schools were randomly assigned to intervention and control arms with enrollment of 22861 (15.9%) and 24980 (17.4%) students respectively. The number of schools was selected in such a way that in each arm forms minimum of about 20000 students.

2.1. Interventions strategy

Obtaining permission: Permission for implementation of project activities in selected schools was obtained from directorate of elementary and secondary education HP and district education officer of Shimla district. The copy of permission letter was also issued to all selected schools from directorate of education. The verbal consent was obtained from parents of children with suspected symptoms of acute pharyngitis and or RF/RHD in intervention arm and from parents of children from control schools who sought medical attention on their own due to symptoms of acute pharyngitis and or RF/RHD.

Designing and Development of information education and communication (IEC) material: The IEC materials; pamphlets, folders and posters were designed and developed by the

Investigators to enhance the knowledge about acute tonsillopharyngitis, RF and RHD to the target audience; teachers, students and parents.

Training of field research assistant: Three field research assistants were employed and trained about symptoms of acute tonsillopharyngitis, RF and RHD by the project investigators.

Training of nodal teachers and students: In order to reach out to selected schools under intervention and control clusters in shorter period of time we utilized the opportunity of monthly scheduled meetings of school teachers at block level with prior permission of the block education officer. The district is divided into twenty blocks as the developmental units. Each block has number of schools ranging from 21 to 187 depending on the geographical terrain and population density. The teachers from selected schools attending the meeting were made as the nodal teachers. The nodal teachers were assigned the responsibility of creating awareness about symptoms of acute pharyngitis, RF/RHD in their respective schools. They were instructed to periodically remind during morning prayer meetings.

Separate meeting with nodal teachers under intervention and control arms were held. The Principle investigator, Co investigators participated in meetings with nodal teachers as per the roster prepared and with their availability and utilized the opportunity to create awareness about the purpose and intervention involved and reporting mechanisms under intervention and control clusters.

2.2. Intervention arm

a) During meeting at block level and at individual school meetings in some of the schools with the investigator, awareness about symptoms of acute pharyngitis, RF/RHD was created in the intervention schools among trained nodal teachers through talks/interactions and using posters. The nodal teachers were given pamphlets to be shared with the parents of each child; booklets and posters for school were also provided, which were to be put on school notice boards so that all the teachers, students are sensitized about importance of symptoms and their reporting to nodal teachers. Periodic reminders to nodal teachers through telephonic calls from coordinating center were done. All the class teachers, students of the intervention schools were advised to report to nodal teacher about any child found to have symptoms of sore throat, fever with cough, effort intolerance, exertional feeling of fast heart beat, joint pains and or abnormal involuntary movements. The nodal teachers were instructed to report about details of suspected children e.g. demographics, class, symptoms, school, contact numbers of parents of affected children to coordinating center through mobile phone. The parents of the children with suspected symptoms of acute pharyngitis, RF/RHD were counseled by nodal teachers to seek medical attention in the nearest hospital. The children were examined to rule out bacterial pharyngitis and treated accordingly while examining for any evidence of RF/RHD. Children who were already diagnosed cases of RF/or RHD were reported as cases after reviewing the medical records at primary health center/community health center (PHC/CHC) hospital and/or the coordinating center. The local medical practitioners evaluated the children for presence or absence of heart disease and the children who were suspected to have heart disease were referred to the local PHC/CHC. Once the child was reported to have symptoms of acute pharyngitis and or RF/RHD by the nodal teacher the referral progress of the child was tracked by project coordinator through phone calls to their parents till child was seen at PHC/CHC or to Indira Gandhi medical college (IGMC) hospital Shimla. The final outcome after cardiologist's examination clinically and or echocardiographically was reported as with RF and or RHD or congenital heart disease (CHD) or no heart disease. The children with confirmed diagnosis of RF/RHD were enrolled in

ongoing RF/RHD registry in the department of cardiology for monitoring of secondary prophylaxis.

b) Field research assistants paid random visits to intervention schools to see implementation of intervention by the nodal teachers by checking the display of posters, distribution of pamphlets and assessing the awareness about symptoms of sore throat, RF/RHD from other teachers and school children and about the intimation to nodal teacher in case of any suspected child found.

2.3. Interventions in control arm rather than clusters

a) The nodal teachers from control arm were trained during their monthly meeting with block education officer by the investigators or field investigators. They were asked to sensitize other teachers and students in their respective schools to observe for any child falling sick and urging them to seek medical attention at the coordinating center on their own for symptoms of acute pharyngitis and or symptoms of RF/RHD. Children found to have RF/RHD or CHD on screening at PHC/CHC were reported as case. The suspected case referred by primary care physician was examined at IGMC hospital for final diagnosis. If the child was found to have RF/RHD, it was recorded and the child was registered in RF/RHD registry for monitoring for secondary prophylaxis. The children with CHD were managed as per the guidelines in the department of cardiology IGMC hospital Shimla. Nodal teachers in control arm were not advised to create awareness about symptoms

of RF/RHD or sore throat but were asked to report if any child had sought medical attention for the symptoms of RF/RHD or sore throat.

b) Periodic reminders were send telephonically by the project coordinator and field research assistants to nodal teachers in control arm to report if any child was taken to hospital by parents for symptoms of sore throat or for RF/RHD to avoid under reporting from control arm.

External validation of reporting status by nodal teachers: To evaluate the performance of nodal teachers in reporting children with symptoms of acute pharyngitis, RF/RHD the trained field research assistant made random visits to intervention and control schools to assess whether the nodal teacher missed reporting any child with suspected symptoms of acute pharyngitis and or RF/RHD. The field research assistant visited each class and asked whole class if any child having fever with cough or sore throat or joint pains, breathlessness and or palpitations on walking playing games. If the response was yes details of the child was recorded and they were advised to report at IGMC Shimla. The data was compared with the reporting status reported by nodal teachers of these particular children before.

Data analysis: The demographic characteristics of the children reported with symptoms of acute pharyngitis, RF/RHD in intervention and control arms were reported as counts and percentages for categorical variables and mean ± standard deviation for continuous variables with normal distribution. The prevalence of children with suspected acute pharyngitis and RF/

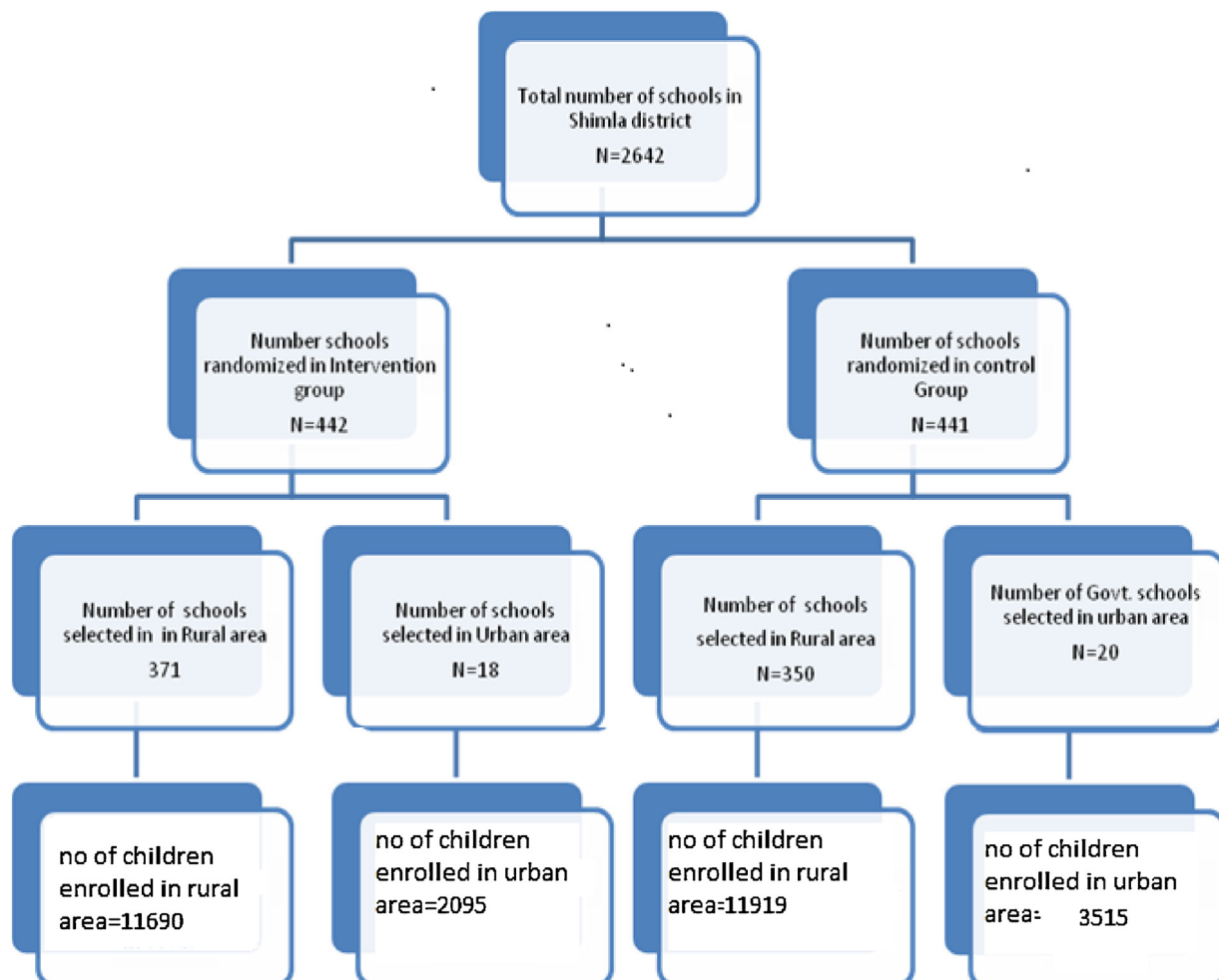


Fig. 1. Flow chart of selection of schools and number of children enrolled in randomly selected schools under intervention and control arm.

RHD by nodal teachers were reported as counts per one thousand. School based intervention undertaken in intervention arm was exposure variable and number of children suspected to have symptoms of RF/RHD and or acute pharyngitis per one thousand children was outcome variable. Differences in proportion of children suspected to have acute pharyngitis and or RF/RHD individually and combined as outcome between intervention and control arm was analyzed using Z test. Two-sided p value of ≤ 0.05 was taken as statistically significant.

3. Results

Characteristics of the schools selected under intervention and control arms: Out of total of 2642 schools in district Shimla, 442 and 441 schools (clusters) were selected under intervention and control arm respectively. The enrollment of students under intervention and control arm was 22861 and 24980, respectively. The detailed distribution of schools in government and private sector in urban and rural area is given in Fig. 1. In brief, 391 and 382 government schools and 51 and 59 private schools, respectively, were selected randomly under intervention and control arm. The geographic distribution of schools in government and private sector in district Shimla under intervention and controlled arm is depicted in Fig. 2.

Intervention meetings: The field research assistants visited total of 372 and 363 schools under intervention and control arms respectively during intervention period for site inspection as well as for sensitization. Project investigators held meeting in 15 and 10 schools under intervention and control groups at school level and 8

and 7 meetings at block level with schools under intervention and control arms, respectively (Fig. 3).

Characteristics of suspected Children and their outcomes under Intervention and control clusters: The details of the children referred with suspected symptoms of RF/RHD or acute pharyngitis from intervention and control arms are described in Table 1. Number of children reporting with suspected symptoms of RF/RHD and or acute pharyngitis was significantly high under intervention clusters 65 (2.8/1000) vs. 15 (0.60/1000) $p < 0.001$. The detection rate of children with acute pharyngitis (25 (1.09/1000 vs. 3(0.12/1000) and RF/RHD (40 (1.74/1000) vs. 12 (0.48/1000) were significantly high in intervention arm compared to control arm $p < 0.01$. The children with suspected acute pharyngitis were treated in nearby health centre and IGMC hospital and were not found to have RF/RHD by the doctor. Among 65 children with suspected symptoms of acute pharyngitis and or RF/RHD, 46 children reported at IGMC either directly or were referred by doctors at PHC while 19 children were examined at PHCs level and were found to have no RF/RHD under intervention group. Cardiologists examined the 46 children who reported to IGMC hospital clinically and echocardiographically. Only one child was found to have RHD and has been registered in RF/RHD registry for secondary prophylaxis monitoring and 3 children were detected to have CHD. Among control group, nodal teachers reported 15 children as they were taken to hospitals by their parents for suspected symptoms of RF/RHD or acute pharyngitis. Out of 15 children one child was examined at local PHC and was reported to have no heart disease. The remaining 14 children were evaluated at IGMC hospital and three children were found to have RHD who

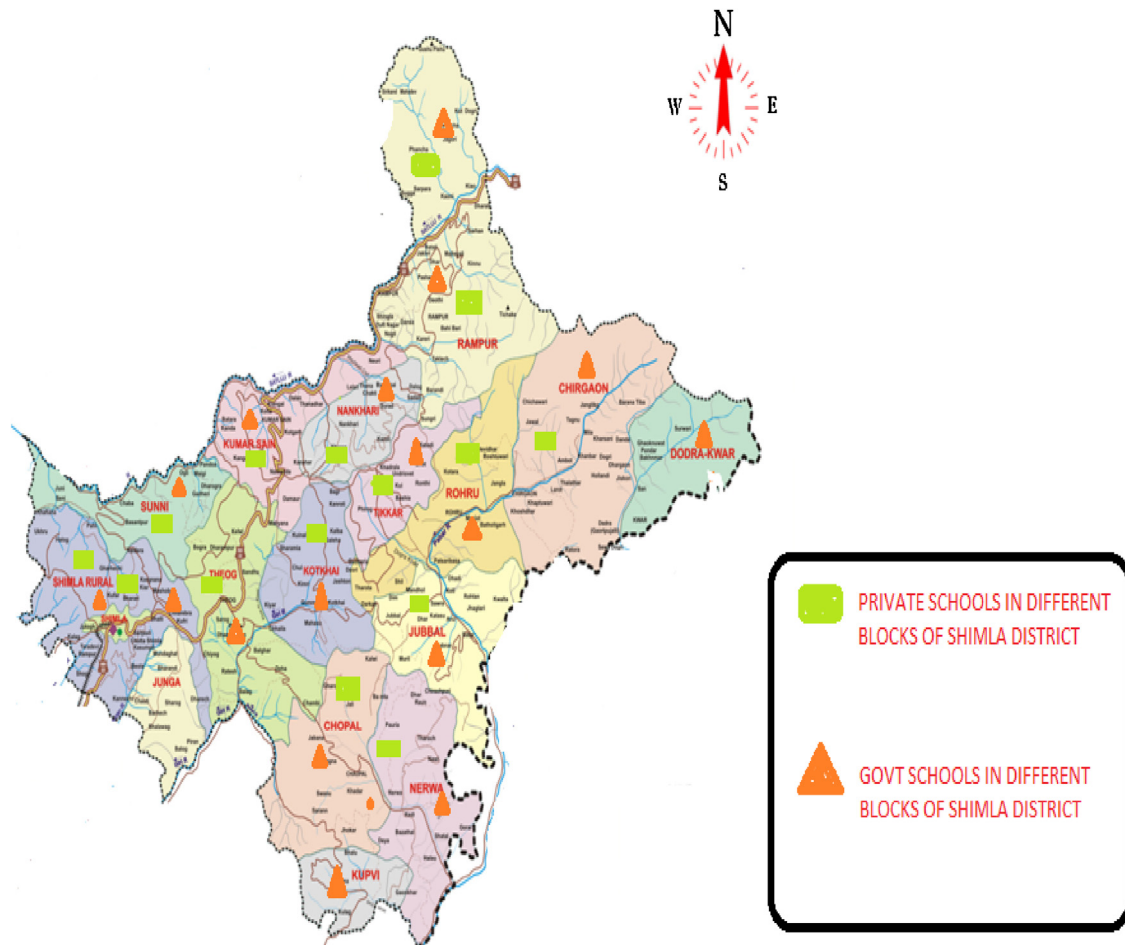


Fig. 2. Mapping of private and government schools selected under intervention and control group in different blocks in Shimla district.

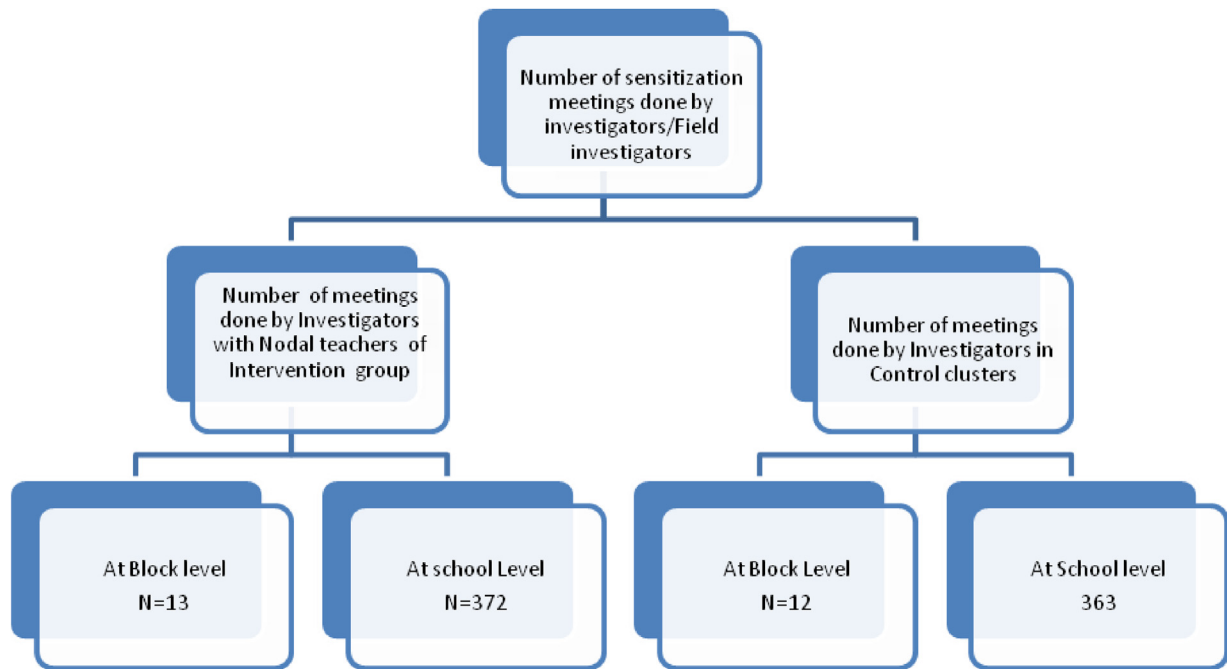


Fig. 3. Flow chart of sensitization meetings conducted by investigators/field investigators at block level and at school level under intervention and control groups.

Table 1
Distribution of children reported with symptoms of acute pharyngitis and RF/RHD reported by nodal teachers and their referral status and outcomes between Intervention and control arm.

Sr. No.	Symptoms reported	Intervention arm N = 22861	control arm N = 24980	P value
1	Number of children reported due to Symptoms of acute pharyngitis by nodal officers from school	25 (1.09/1000)	3 (0.12/1000)	0.001
2.	Number reported due to symptoms suggestive of RF/RHD by nodal officers from school	40 (1.74/1000)	12 (0.48/1000)	0.001
3	Total number of school children suspected to have pharyngitis/RF/RHD by nodal children and reported to nodal center	65 (2.84/1000)	15(0.60/1000)	0.001
3	Number of suspected children reported in nearby Hospital	19	1	
4.	Number found to have heart disease at PHC	0	0	
4	Number of suspected children reported at IGMC directly for final evaluation by Cardiologist (clinically/ echocardiography)	46	14	
7	Number of Children found to have Heart disease at IGMC hospital (RHD + Congenital heart disease)	4 (0.17/1000)	4 (0.16/1000)	0.45
9	Number of Children found to have rheumatic Heart disease at IGMC hospital	1(0.04/1000)	3(0.12/1000)	0.81

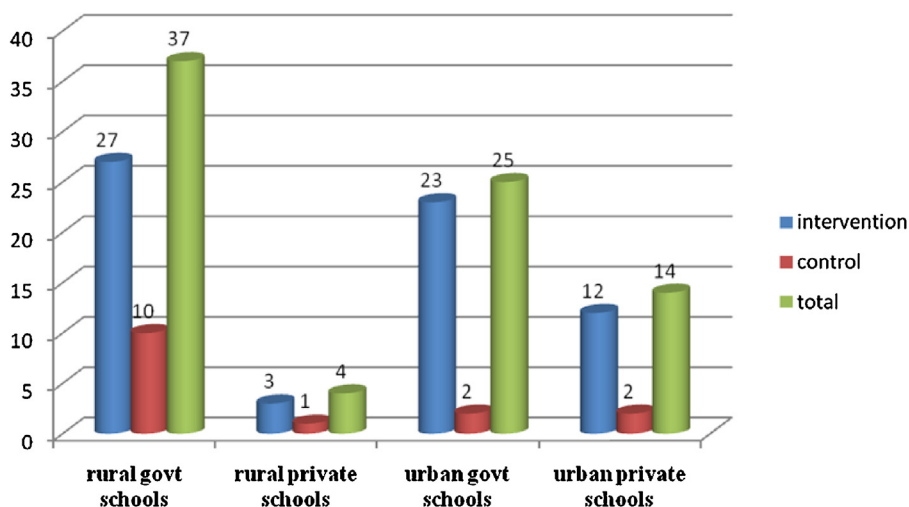


Fig. 4. Distribution of children reported to have symptoms of RF/RHD and or acute pharyngitis among rural and urban government and private schools.

have also been registered in RF/RHD register. The one child was found to have CHD and was treated as per guidelines.

Distribution of suspected children from urban and rural schools: The detailed description is reported in Fig. 4. In brief number of children with suspected acute pharyngitis and or RF/RHD was higher from government schools compared to private schools both in rural and urban areas.

Demographic characteristics of children with suspected acute pharyngitis and or RF/RHD: The detailed description of the demographic characteristics is given in Table 2. The mean age, proportion of children from different age groups and the distribution of boys and girls reported to have symptoms of pharyngitis, RF/RHD was similar in intervention and control arms. The predominant symptoms were breathlessness on playing/walking followed by symptoms of pharyngitis. None of the children had arthritis although joint pains were reported by 20% in intervention and 14% in control group. Proportion of children reported to have symptoms of acute pharyngitis and or RF/RHD was significantly low from private schools than from government schools both in intervention and control group.

Seasonal variation in reported symptoms of acute pharyngitis and or RF/RHD: Number of referral by nodal teachers both in intervention and control group increased during the month of August to December (Fig. 5).

Characteristics of children with RF/RHD and CHD: The detailed description is given in Table 3. One child in intervention group and three in control group had RHD. None had RF. Four children had CHD, three in intervention and one in Control group, respectively.

Performance of nodal teacher-based detection and reporting of RF/RHD and or acute pharyngitis: Fig. 6 reports the details. Field research assistants in twelve and eleven schools under intervention and control arms made random visits respectively. The field research assistants detected seventeen children with symptoms suggestive of RF/RHD and or acute pharyngitis in four schools out of twelve schools visited under intervention arm and was examined at IGMC hospital Shimla and nearby PHC and none was found to have RF/RHD. However nodal Teachers of these twelve schools had detected seven children with symptoms suggestive of RF/RHD and or acute pharyngitis and were examined at IGMC Shimla and nearby PHC and one child was found to have RF/RHD. The random visit by field investigators was made to eleven schools under control arm to cross check if the nodal school teacher missed reporting of any child. They visited each class and enquire if any child had visited hospital due to symptoms of fever

with sore throat, RF/RHD and found only one child in eleven schools had visited and was invited to visit IGMC Shimla to know the status of RF/RHD and was found to have no RF/RHD or other heart disease. However nodal teacher had not reported the child.

4. Discussion

RF/RHD is a potentially preventable cause of disease burden in developing countries. Primary and secondary prevention of RF requires prompt treatment of acute pharyngitis and prevention of recurrence of acute pharyngitis respectively. A strong population-based surveillance system is required for effective implementation of preventive programs. In developing countries lack of a robust surveillance system is a major barrier in effective prevention and control of RF/RHD leading to a high associated morbidity and mortality. The present study evaluated the effectiveness of school-based surveillance system through empowering teachers and students about symptoms of acute pharyngitis and or acute RF and RHD in a cluster randomized controlled trial in schools of Shimla district, HP on change in detection rate of children with suspected symptoms of acute pharyngitis and or RF/RHD. The number of children with suspected symptoms of RF/RHD and or acute pharyngitis reported from intervention group was significantly higher compared to control arm 65 (2.84/1000 vs. 15 (0.60/1000) $p < 0.01$.

Although number of children with suspected symptoms of RF/RHD reported by nodal teachers was significantly higher in intervention group compared to control group (40 (1.81/1000 vs. 12 (0.5/1000) respectively $p < 0.01$ but children with confirmed heart diseases on echocardiography were small and was similar, 4 children in each group (0.18/1000 and 0.16/1000) respectively. The commonest symptoms for which children were suspected to have RF/RHD were breathlessness, and joint pain. Thus, symptoms of breathlessness, exertional palpitations in remaining children could be due to non-cardiovascular causes that were not investigated in present study. Out of four children, one had RHD and remaining three had CHD in the intervention arm, and three children had RHD and fourth child had CHD in the control arm.

The number of children with RF/RHD detected in present school-based surveillance system is significantly lower than the figures reported from active surveillance studies in school children.^{15–19} In a survey study of school children aged 5–15 years in government schools of Shimla district in 2007–08 under Gian Vigyan Mission mode project prevalence of RF/RHD was 1.0/1000 (unpublished data).

The survey studies reported from different urban and rural areas in India using auscultation based screening and echocardiography confirmation in suspected cases by different investigators suggests declining trends especially in last decade or so.^{15–18,21} The two-point survey study done by our group among school children of Shimla city and adjoining rural area in year 1992–93 and in year 2006–07 using same screening method demonstrated about five fold decline in the prevalence (2.89/1000 to 0.89/1000).²¹

The low detection rate of children with RF/RHD in present school-based surveillance could thus be due to declining incidence of RF/RHD, limited sensitivity of symptom-based detection, inadequate sensitization of teachers and students about symptoms of RF/RHD, reporting inertia of nodal teachers.

The hospital based active surveillance had better detection rate for children with RF/RHD. Rajesh et al. reported capturing of about two third of children who were detected to have RF/RHD in sample survey in about seven years of prospective health system-based surveillance.²⁰ Higher capture rate in health system based active surveillance suggest higher sensitivity than population based passive surveillance in a longer period of surveillance.

Table 2

Characteristics of the school children referred from intervention and controlled clusters with suspected symptoms of acute pharyngitis and or RF/RHD.

Characteristics	Intervention cluster	Control cluster
Age	65(12.60 ± 3.39)	15(11.60 ± 4.13)
5–10 years	18(27.7%)	7(46.7%)
11–15 years	35(89.7%)	4(26.7%)
>16 years	12(18.7%)	4(26.7%)
Boys	25(38.5%)	7(46.7%)
Girls	40(61.5%)	8(53.3%)
Convent schools	14(21.5%)	2(13.3%)
Government schools	51(78.5%)	13(86.7%)
Sore throat	25(38.5%)	3(20.0%)
fever with cough	7(31.8%)	3(33.3%)
Joint pains	13(20.0%)	2(14.3%)
Poly arthritis	0	0
Abnormal movements of limbs/body	5(7.7%)	0
Breathlessness on walking/playing	30(46.2%)	6(40.0%)
Fatigue on walking/playing	6(9.2%)	3(20.0%)
Palpitations on walking/playing	6(9.2%)	9(60.0%)
Number confirmed to have RF/RHD	1(1.5%)	3(20.0%)
Number confirmed to have CHD	3(4.6%)	1(6.7%)

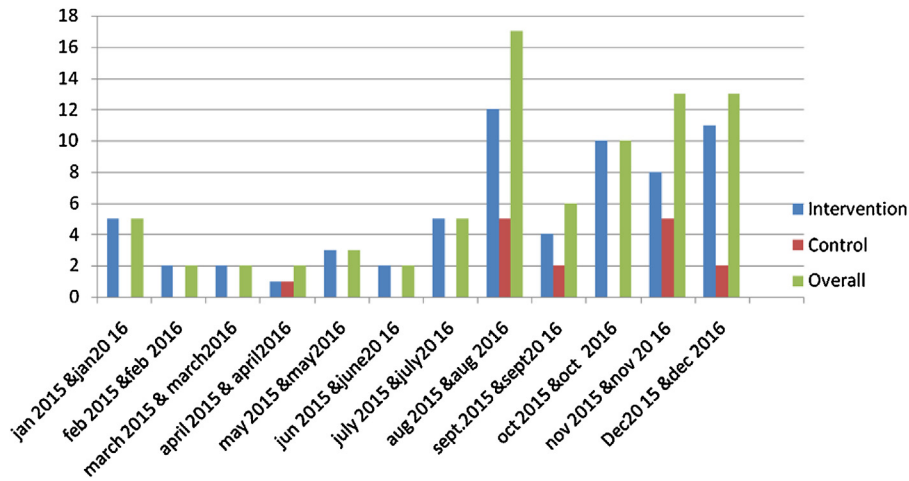


Fig. 5. Depiction of seasonal variation in reporting of acute pharyngitis RF/RHD in intervention and control arms.

Table 3
Demographic distribution of children with confirmed RHD and CHD in Intervention and control arm.

Group	Age/Sex	Diagnosed
RHD		
Intervention group	9/M	RHD with Mod MS, Mild AR, MILD TR,NSR, class 11
Control group	11/F	RHD with Severe MR, Mild TR,NSR, class 11
Control group	14/M	RHD with Severe MR, Mod. AR, Mild TR, NSR, Class 11
Control group	11/M	RHD with Mod MR, Mild MS, Mod. TR, NSR, Class 11
CHD		
Intervention group	12/M	TOF
Intervention group	9/F	VSD
Intervention group	12/F	VSD
Control group	10/M	VSD

The detection of children with RF/RHD is challenging in field setting as number of children with RHD or isolated rheumatic Carditis as the manifestation of RF may have clinically insignificant valvular dysfunction that may be asymptomatic with no audible murmurs especially in nonconductive environment like field settings. The portable echocardiography-based screening improves the sensitivity and specificity of detection of clinically silent valvular lesions.^{22,23} However the clinical significance of subclinical RHD detected by echocardiography needs to be studied in future studies to justify use of echocardiography as the primary screening tool in population settings.

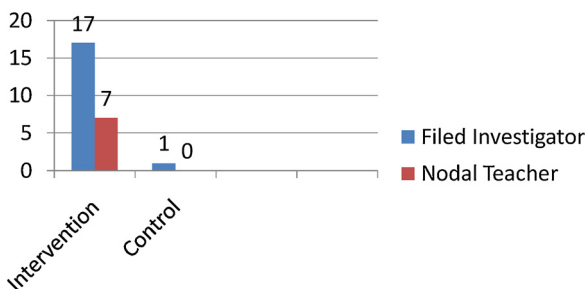


Fig. 6. Comparison of detection rate of children with symptoms of acute pharyngitis and or RF/RHD between field investigators and nodal teachers.

The detection rate of acute pharyngitis was significantly higher from intervention arm compared to control arm 25 (1.09/1000) vs. 3 (0.12/1000) respectively $p < 0.01$. However, prevalence of acute pharyngitis in school children of Shimla district in sample survey in 2007–2010 was significantly higher 16% (unpublished data, under Jai Vigyan Mission mode project of ICMR). In a survey study, twelve months questionnaire-based recall survey of acute pharyngitis episodes and throat examination among school children in Zambia about 24% children had at least one episode of acute pharyngitis.²⁴ Thus the children with symptoms of acute pharyngitis reported in present study are significantly low. The low rates of acute pharyngitis reported in present study may be due to a number of reasons. Firstly, it was not an active surveillance study thus children with mild pharyngitis may have been missed. Secondly, it could be due to reporting inertia and or failure to detect by nodal teachers, suggested by the observation that out of seventeen children suspected to have acute pharyngitis, RF/RHD by field research assistants only seven children were reported by nodal teachers, observed during random visits to twelve intervention schools. Thirdly, it may also be due to declining incidence of acute pharyngitis due to improved living conditions and easy access to health care services and prompt treatment thus preventing cross infections. The possibility of declining incidence of acute pharyngitis due to improvement in socioeconomic state of the population over the years is also supported by the observations that no child with RF was reported from either arm during the study period and also pharyngitis was significantly lower in private schools compared to government schools.

The seasonal variation in incidence of acute pharyngitis has been described in earlier studies with highest during winter and spring and least in summers.²⁵ We also recorded a higher prevalence of acute pharyngitis and or symptoms of RF/RHD from August to December both in intervention and control group. The number of children reporting symptoms of acute pharyngitis with and without RF/RHD was lowest in children from rural private schools. This is due to the fact that overall number of private schools in rural area is smaller compared to number of schools in government sector and private schools in urban area.

There is a scope for improving the detection rate in school-based surveillance in future studies through sustained capacity building efforts for longer period of time to evaluate its utility and efficiency. Thus, in resource starved countries the school-based surveillance could play important and supplementary role with the health system based surveillance in enhancing detection rate of children with suspected symptoms of acute pharyngitis and or RF/

RHD and in linking them with health system for early detection, management and prevention and control of RF/RHD. This will improve effective implementation of primary and secondary preventive intervention. Future studies are required to validate the sensitivity of school-based surveillance system especially in endemic regions for reducing incidence and disability related to RF/RHD in low-income countries.

4.1. Limitations

The conclusions drawn in present study should be inferred in the context of some of the major limitations. First, the intensity, frequency and duration of school-based intervention to create awareness about symptoms of acute pharyngitis and or RF/RHD among school children was limited due to shorter period of intervention in large number of schools enrolled thus may underestimate the role of school-based surveillance. Second, the school-based surveillance system evaluated was not validated against standard active screening tools to assess sensitivity, and negative predictive value in detection of RF/RHD and acute pharyngitis. Finally, the number of children detected with RHD was very small for meaningful comparison of detection rate of actual cases of RF/RHD cases. However, this is the only study to best of our knowledge evaluated the effectiveness of school-based surveillance in detection of children with symptoms of RF/RHD and or acute pharyngitis in a large cohort.

5. Conclusion

Sensitization about symptoms of acute pharyngitis and or RF/RHD to teachers and students increase the detection of these children significantly. Thus, school-based surveillance system could be integrated with ongoing Rashtriya Bal Swasthya Karyakarm in order to improve early detection and for primary and secondary prevention intervention to reduce morbidity and mortality related to RF/RHD.

Conflict of interest

No conflict of interest.

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