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Role of modern technology in public health: opportunities and challenges

Jai P Narain\textsuperscript{a} & Roderico Of\textsuperscript{b}

During the past two decades, the world has seen profound changes in technology development, heralding an information age.\textsuperscript{1} As a result of the information and communication boom, a combination of new technologies is being used to obtain, disseminate and share information as never before. Moreover, social media has also become a powerful tool to share ideas and solutions in almost all spheres of daily life. This also offers great opportunities to bring about better health to populations at large in a different way. An important question however is: how can modern technology be deployed to improve quality of health delivery at a lower cost? What are the challenges and opportunities that lie ahead?

It is due to today’s internet connectivity and (smart) mobile phone penetration, more than air travel, that the world is now literally a global village. With information and communication devices available even in remote villages, there is a potential that these technologies could revolutionize health service delivery and act as a “game changer” for an efficient and people-centered health care system in the 21\textsuperscript{st} century. For example, an early warning system during emergencies via short text messaging, or even availability of mobile phones in remote villages can be used to call for help in the event of a difficult labour thereby preventing maternal or infant mortality. Mobile phones which are now virtually ubiquitous with 700 million users in India alone are being used to track distribution of bed nets by malaria programmes. In the global adult tobacco surveys, handheld devices or PDAs\textsuperscript{6} are used by health care workers to collect and collate survey data, and to transfer data to a central location in no time; such a facility can be used in other similar field surveys without use of the printed forms. Satellite connectivity helps greatly in distance learning, and in transmission of data as well as information pertaining to early warning of unusual health events.

Similarly, text messaging information on new cases of influenza from hospital settings as a part of online surveillance or alerting patients with diabetes or stroke through messages regarding their medicine...
intake; conducting information-sharing sessions through videoconferencing and teleconferencing thereby reducing the number of face-to-face interactions/meetings; using email for fast and non-bureaucratic means of communication; risk mapping through the use of geographic information system and geographic positioning system; social networking such as Facebook and Twitter for news gathering, updating of an emergency or an outbreak; and carrying out clinical or bedside e-consultations regarding patients in remote or rural sites as a part of telemedicine are some of the applications where modern technology can modernize health care and bring in efficiency and quality. Dissemination of technical information is another example. While many scientific journals are presently facing a cost crunch in publishing hard copies, the trend is now moving towards free online or web publishing.

Given these advances, a global consultation on eHealth was organized by WHO in 2004 which recommended that WHO should support information for health promotion and awareness, health and biomedical research and e-learning; information for health information system including disease surveillance; and information for health care delivery including diagnostics, treatment and consultation. Then, in May 2005, the World Health Assembly discussed the topic in the context of health and passed a resolution on eHealth using Member States to create long-term strategies, develop necessary infrastructure and collaborate with private and non-profit sectors. During 2005-2006, WHO undertook a global survey on e-Health to obtain baseline data on the current status of eHealth, which indicated that after a slow start in the 1990s there is growing momentum for eHealth uptake by countries which is very likely to continue, particularly in developing countries.

These are just some examples where technology can be used. But technology is growing rapidly and it is often difficult to keep pace with it. Internet and social media use is growing in various countries in the South-East Asia Region. However, despite the improved access to such technologies public health and clinical health services are not dominant in their content and/or applications.

There are many barriers and challenges to the rapid use of modern technology and in the implementation of various initiatives and specific World Health Assembly resolutions. In many countries, the infrastructure or connectivity does not exist. There are also concerns that investing in the use of modern technology comes at a high initial cost compared to basic health needs and other competing priorities. Demonstrating the cost-effectiveness of modern technology in promoting health is therefore a priority. Creative ways of investing and cost sharing should be discussed so that the information highway has health as one of its main applications. Building capacity of health care workers through training is also urgently needed. There are also issues that have legal, security, accountability and ethical implications. For example, those related to the uniformity in legal standards, especially those that are in place in developing countries regarding the security and safety of medical information. There are concerns also that the rapid developments and penetration of technology is further causing a digital divide between “haves” and “have nots”, causing further disparities in society and along the social gradient.

Nevertheless, technology must be used appropriately. Whether technology can be of benefit or harm will depend largely on the way it is used. The potential applications of information/communication technology for
health to strengthen health systems and improve efficiency, safety and quality of health care are truly enormous. As recognized by the World Health Assembly, all countries must use the opportunities to build or strengthen basic eHealth systems as a part of health programmes thereby improving health services. While governments have a key role in pushing the agenda, it will be important to strengthen collaboration with international and nongovernmental organizations, the private sector and other key stakeholders. Member States can also learn from success and failures of other countries and partners in order to move forward in this area. Based on evidence, it is clear that enhancing use of modern technology is an excellent investment for the future.

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Malaria control in India: has sub-optimal rationing of effective interventions compromised programme efficiency?

Habib H Farooqui, Mohammad A Hussain, Sanjay Zodpey

Despite more than five decades of intensive control efforts, malaria is still a challenge to the Indian health system. 1.6 million cases and around 1000 deaths were reported in 2010 as per National Malaria programme. These estimates of malaria burden, however, are uncertain. Incidence gaps have been identified. Lack of accurate estimates for population at risk is one of the elementary problems in defining intervention strategies against malaria. The Government of India has recognized these facts while updating operational guidelines for malaria control. There is evidence of the decreasing trend in cases over the past few years. However, recent estimates of malaria deaths made by independent researchers have raised questions on progress of the malaria control programme. Increasing the pace of malaria control in India requires a meticulous assessment of malaria control interventions in terms of operational feasibility, cost-effectiveness, net-effectiveness and rationing of various interventions.

Epidemiologically, malaria is extremely complex; it is a focal disease the distribution of which is influenced by a multitude of factors related to human, mosquito and parasite population, as well as to the environment. The emergence, transmission and sustainability of malaria depends largely upon the interaction between and among these factors. Epidemiological reasoning and mathematical modelling has shown that the key to malaria control lies in reservoir reduction and vector control. As per the classic Ross–Macdonald mathematical model, the efficiency with which an arthropod vector transmits a pathogen, known as vectorial capacity, depends on the density of the vector species, number of susceptible host species, the probability that a vector, having acquired the pathogen, will live long enough to transmit the pathogen, which is a combination of its daily survival probability and the extrinsic incubation period. Thus, the interventions that reduce the host-vector contact (e.g. bed nets) target reduction of host species. Those that target adult vectors [e.g. the application of dichlorodiphenyltrichloroethane (DDT) to the walls of dwellings] influence the probability of vector survival. Finally, vectoral capacity is also affected by vector competence, which is the chance that when a vector feeds on an infected host it will actually acquire the pathogen and support its development to the infectious stage. This is affected by
Control strategies for vector-borne infectious diseases can target the reservoir, the pathogenic microorganism, the vector, the human host, or combinations of these elements. Traditionally, reservoir reduction has been achieved through early case detection and prompt treatment (EDPT) and vector control through indoor residual insecticide spray (IRS) with insecticides that reduce the daily survival rate of the mosquito whereas the insecticide-treated mosquito nets (ITN) reduce the human biting rate of the mosquito and its daily survival rate. However, critical prerequisites to have positive effects of IRS would depend on walls of dwellings being sprayable, mosquitoes resting indoors and sensitivity to insecticide. Similarly, the ITNs require a consistent use by humans whenever there is a chance of a human-mosquito contact. The adoption of newer methods of malaria diagnosis (rapid diagnostic kits) and treatment (artemisin-based combination therapy) as well as preventive instruments like long-lasting insecticidal nets (LLIN)/insecticide-treated bednets (ITNs) have improved the efficiency of malaria control programmes. All these present-day antimalarial interventions help in reducing the endemicity by reducing the human infectivity through early and effective treatment and reduction in vectorial capacity through mosquito control measures. However, operationalization of these strategies has been a story of success and failures during different phases of malaria control in India.

The cost of scaling up and maintaining of the existing level of coverage of essential interventions has been a challenge. Despite a considerable increase in the past few years, global funding for malaria control still falls short of the estimated requirements to provide complete intervention coverage to those at risk in endemic regions. The current international funding for malaria control represents approximately 20% of the estimated total need for a gradual scale-up of interventions for controlling malaria. National government spending also falls short in many countries including India. Thus, there is a need for effective and efficient utilization of all available resources. There is a growing body of evidence on best practices and cost-effectiveness of malaria control interventions across the globe, which can serve as guidance for financial decision-making. It is important to ask whether interventions currently in practice are being appropriately used and what is the most cost-effective way to scale up activities to the levels needed? In particular, which prevention or treatment strategies, and what combination, are most effective and where?

An analysis of the budget documents of National Vector-borne Disease Control Programme (NVBDCP) in India has shown that financial allocations have been scaled up from Indian Rupees (INR) 1370 million during the Tenth Five Year Plan (2002-2007) to INR 3190.2 million for the Eleventh Five Year Plan (2007-2012). The actual expenditure has also increased. However, the allocative efficiency of the programme is compromised as a result of inappropriate financing at geographical, operational and technical levels. In terms of geographical distribution, five states (Orissa, Chhattisgarh, Madhya Pradesh, Jharkhand and West Bengal) accounted for 60% malaria cases and 75% falciparum malaria cases in 2002-2003. However, the financial allocations represented only 41.5% of the total funds. Micro-stratification of risk areas for better targeting of interventions is very poor in India. Also, it is found that malaria is most common in areas where reliable data are least...
available so exact numbers are not easy to determine.3 This in turn affects the optimum allocative efficiency. The estimated number of cases used for policy planning are basically generated from routine reporting of malaria data. However, independent researchers have reported that 86% deaths due to malaria are not recorded in any formal government health system, indicating that deaths from malaria are predominantly unnoticed by the existing health-reporting system.3 Besides this, the health management information system in India has not been found fit for the recording of malaria morbidity and mortality.12

Some malaria control intervention are technically more efficient than others; for instance, it has been argued that early diagnosis and treatment through rapid diagnostic kits and artemisin-based combination therapies offer much higher net effectiveness over residual insecticidal sprays on the basis of operational feasibility. Estimates have revealed that during the Eleventh Five Year Plan the contribution for drugs and diagnostics has increased from 8.3% to 15.5% and from 0.7% to 6.3% respectively. Similarly, allocation for LLINs has been increased from 0% to 7.5%, highlighting the fact that programme is moving in the direction of improved technical efficiency. However, there is slight reduction in the budgetary allocation for bednets (ITN) from 5.2% to 3.4%. Also, it has been argued that the production and availability of LLNs is compromised in the country. It was also observed that the insecticide spraying budget has reduced from 52.5% to 28.1%. Such reduction may result in poor efficiency as it is well recognized that incremental cost-effectiveness of preventive measures are a good bargain.

In the context of operational efficiency and programme management, increasing the investment in training, and monitoring and evaluation to 3.2% and 3.5% respectively, offers positive synergies with intervention efficiencies. However, the financial allocation for behaviour change communication at 8.46% may result in reduced programme efficiency as it has poor net effectiveness and is prone to potential leakages. Similarly, the operational cost at 39.1% of total budget also raises concerns on efficiency. The programme does not conform to evidence-based recommendations on financial allocation for drugs, diagnostics, LLINs, ITNs and spraying, etc.

Allocative efficiency of funding can be enhanced by prioritizing financial allocation to key interventions on the basis of their net effectiveness and operational feasibility. This will ensure enhanced technical efficiency of the programme along with reduced operational costs. Financial allocation for interventions based on early diagnosis and treatment should be prioritized over IRS and ITNs/LLIN. With 85% of Indian population residing in high and low malaria-risk areas, the coverage scale of preventive intervention appears to be limited to less than 30% of population at risk.13 Evidence suggests that both interventions are effective in reducing malaria, as compared with active case detection and treatment. However, ITNs are effective than IRS in averting malaria cases. However, in terms of efficiency of interventions the evidence from African countries has shown that in a very low-income country, the cost-effectiveness per DALY averted ranges from US$ 19 to US$ 85 for ITNs (nets plus insecticide), US$ 32 to US$ 58 for residual spraying (two rounds per year) and US$ 1 to US$ 8 for case-management improvements.14 The health outcome measured in a randomized cluster trial in India has shown that the mean cost per case averted for ITNs was statistically significantly lower (US$ 52) than IRS (US$ 87).15 High coverage with artemisinin-based combination treatments was found to be
the most cost-effective strategy for control of malaria recently. However, it has been argued that treatment alone can achieve less than half the total benefit obtainable through a combination of interventions, hence, scaling up the use of ITNs or IRS with insecticides is also critical. An assessment of cost-effectiveness and cost-benefit implications of increasing the coverage of all interventions (comprehensive), prevention (bednets and indoor spraying) and improved case management, found that increasing the coverage of improved case management is the most economically attractive strategy for the Asia-Pacific region. The cost per DALY averted in malaria case management strategies is US$ 88 as compared with US$ 1722 and US$ 1567 through strategies like spraying and bednets, and comprehensive strategies involving all interventions respectively (Personal Communication: Swarup Sarkar, GFATM and Ross Mcloed, Asian Development Bank). There are very limited cost-effective analysis studies available on environment-friendly antimalarial measures, i.e. biolarvicide, Gambusia fish and Bacillus thuringensis var israelis etc. in the Indian context. Hence, more effort should be made to find out the feasibility of these interventions to enable decisions on whether to advocate these environment-friendly initiatives on long-term basis on a large scale. There is also the need for conducting a cost-effective analysis of various control measures initiated under the national malaria control programme.

The choice of intervention should not be one over another, rather it should be a rational mix that can offer a comprehensive control strategy inclusive of all interventions, and is focussed on regional programme requirements based on disease epidemiology. A decade ago the way to decide on interventions was to look for disease burden and its epidemiological manifestations in terms of mortality, morbidity and DALYs lost. However in the current scenario different malario-metric indices like the *Plasmodium falciparum* parasite rate (PPR), entomological inoculation rate (EIR) within the limits of *Plasmodium falciparum* transmission (PFEIR), Pf annual parasite incidence (PfAPI), basic reproductive number for malaria under malaria control (PfRc) should be taken under consideration while allocating resources. The Malaria Atlas Project (MAP) could be of great help while considering the above matrices. Information obtained from the National Anti-Malaria Management Information System (NAMMIS) could be of important, provided the validity of the reporting system is justified. Evidence from developing countries on best practices and cost-effectiveness of malaria control interventions can serve as guidance for financial decision-making. However, care must be taken when comparing the cost-effectiveness of prevention and treatment-based interventions, as the denominator populations at risk may not be directly comparable due to differences in age, location or exposure to malaria. Similarly, valuable insights from economic analysis, mathematic models such as decision-tree models and probabilistic sensitivity analysis models can be considered for rational resource allocation by donors and domestic health budgets and for the selection of optimal packages of interventions by malaria control programmes. The model described by Ross and Macdonald can be a good starting point for identifying the epidemiological rationale and the utility of various interventions across different situations, and it should be complemented by a cost-effectiveness analysis and financial analysis to serve as guidance for policy decisions.
Malaria control in India: has sub-optimal rationing of effective interventions compromised programme efficiency?

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References


Original Research

Abuse against women in pregnancy: a population-based study from Eastern India
Bontha V Babu,a, b & Shantanu K Kar a

Background: Violence against women is widely recognized as an important public health problem. However, the magnitude of the problem among pregnant women is not well known in several parts of India. Hence, the prevalence and characteristics associated with various forms of domestic violence against women in pregnancy were studied in Eastern India.

Methods: A population-based cross-sectional sample survey covering married women with a history of at least one full-term pregnancy (n 1525) was carried out in the Orissa, West Bengal and Jharkhand states of India. Interviews were conducted using a pre-piloted structured questionnaire to inquire about physical, psychological and sexual domestic violence. Data on socioeconomic characteristics and behaviours were also collected. The association of independent variables with domestic violence were examined by using logistic regression models.

Results: The prevalence of physical, psychological and sexual domestic violence during a recent pregnancy was found to be 7.1%, 30.6% and 10.4% respectively, and the lifetime prevalence during all pregnancies was 8.3%, 33.4% and 12.6% respectively. Urban living, higher maternal age and husbands’ alcoholism were the factors associated with domestic violence in pregnancy. Women belonging to lower social groups were less likely to have physical domestic violence. Factors such as higher prevalence of undesirable behaviours like denying adequate rest and diet, demand for more sex, not providing antenatal care and pressure for male child were also associated with domestic violence in pregnancy.

Conclusions: Considerable proportions of women experience some type of domestic violence during pregnancy. Health-care providers should be able to recognize and respond to pregnant women’s victimization and refer them for appropriate support and care.

Key words: Violence, pregnancy, retrospective, cross-sectional, survey, India.

Introduction

Violence against women is widely recognized as an important public health problem. A substantial number of women across several countries have reported abuse by intimate partner at some point in their lives.1-3 Estimates of domestic violence prevalence vary widely from 18% to 70% in India. Differences in study methodology may account for such large variations. It is also realized that the magnitude of the problem has not been studied very well in several parts of India.4 Prevalence of domestic violence in pregnancy, which is a serious concern in both developing
and developed countries, is reported to be 33%. The occurrence of domestic violence across women’s life-course is not inevitable but it can be a normalized behaviour in certain social circumstances.

There is some support to the argument that prevalence of domestic violence decreases during pregnancy. It seems that domestic violence is not initiated during pregnancy. However, whether pregnancy is a risk factor or a protective factor for women against domestic violence is inconclusive. In several countries including India, pregnant women retain the privileged public position. Cultural norms may play an important role in affecting the degree to which women are protected from domestic violence at family level. Regardless of these issues, several pregnant women do report a history of domestic violence. They should be identified as high-risk group for developing preventive interventions in view of severe health consequences. These consequences include a general loss of interest on the part of the mother in her or her baby’s health, both during the pregnancy and after the child is born. In addition, women subjected to several abusive behaviours during pregnancy may lack emotional support of their partners during pregnancy. Many women have no access to health care during pregnancy and this proportion is high among women who experience domestic violence. Pregnant women who experience domestic violence have been found to have higher risks of obstetric and other complications to mother and foetus/child that warrant antenatal care. The desire for male child is rampant in Indian communities and exerting pressure on women for bearing a male child is very common. It is established that violence and abuse against pregnant women affects not only the health and well-being of the mother, but also that of the foetus and the child.

There is paucity of data on domestic violence during pregnancy in India. A population-based study undertaken across the country reported the prevalence of physical domestic violence to be 18%. In addition, some clinic-based studies revealed that 22% to 48% of women report physical domestic violence during pregnancy. These studies have reported the prevalence of psychological and sexual domestic violence to be 29% and 6% respectively. We hypothesized that domestic violence is a wide-spread phenomenon, however, its prevalence may vary across Indian states. These variations may occur within the population due to differences in socioeconomic characteristics such as habitation (rural or urban residence), age, religion and caste affiliation, education, occupation and income. Hence, this study was conducted to determine the prevalence and associated characteristics of women with various forms of domestic violence during pregnancy.

Methods
A population-based study was undertaken in three eastern states of India. The population of the selected states, i.e. Orissa, West Bengal, and Jharkhand, was 31.7 million, 80.2 million and 26.9 million, respectively in the year 2001. This cross-sectional study was carried out in 2004-2005. Quantitative data were collected through interviews using a structured questionnaire. The questionnaire contained items on socioeconomic data and domestic violence experience. To assess domestic violence exposure, women were asked several questions on various behaviours related to violence. Questions were posed to get women’s experience to a specific act of violence during their pregnancy. These behaviours and corresponding questions have been identified, based on previous studies in other settings. A multiphase process was used.
to develop these questionnaires to ensure that they were culturally and linguistically appropriate. Later the questionnaires were piloted to check appropriateness, clarity and flow of questions, but villages where pilots were conducted, were not included in the study. The other details of the questionnaire and the interviews are available elsewhere. Interviews were conducted by women investigators after obtaining consent from women respondents.

The sample size was calculated based on the estimate of domestic violence prevalence from the sampled states. The multistage sampling strategy was used. This is described in detail elsewhere. Briefly, from each state, four districts were selected from different corners of the state. Out of these four districts, two each were allocated to draw rural and urban samples. From each district chosen for a rural sample, two blocks (administrative units in the district) were randomly selected. From each block, two villages were randomly selected. From each district allocated for an urban sample, an urban area (a city or a town) was selected and in this area, eight pockets comprising people belonging to different socioeconomic strata (high-income groups, middle-income groups, low-income groups and slums) were identified. A married woman up to the age of 50 years was sampled from each selected household. Initially, 1753 women were contacted; however, 35 women refused to participate, yielding a refusal rate of 2%. Of 1718 women, 1525 women who were chosen for the study had at least one full-term pregnancy. Only women with full-term pregnancy were included in the study to examine the association between domestic violence and pregnancy outcome. Complete data were available on all 1525 women included in the analysis.

**Study variables**

**Independent variables**

Data were collected on a number of characteristics of women that were expected to have association with domestic violence. The community-level variables included in the study were the state of residence (Orissa, West Bengal or Jharkhand), area of residence (rural or urban), religion (Hindu, Muslim, Christian or any other religion) and social group (scheduled tribe, scheduled caste, backward caste or general caste). The other independent variables were age and education, which were categorized into illiterate (those who can neither read nor write), functional literate (those who can read or write, but did not have formal schooling), school education (1-10 years of schooling), and college or higher education (those having more than 10 years of education). The occupation of the participant was recorded and categorized into housewives, salaried jobs (those in permanent or temporary jobs with fixed monthly salary), farming and small business (those engaged in agriculture-related activity and small businesses) and labourer (daily-waged skilled and unskilled labourers). The monthly income of the family was calculated during data analysis, based on the information collected on income of all members as well as from common sources of the family. The income details were collected in Indian rupees. One rupee was equivalent to 0.02 United States dollar. The information on parity was also recorded. The husband’s habit of drinking alcohol was also noted.

**Outcome variables**

The three principle domestic violence outcome variables considered in our analysis were: (i) physical domestic violence; (ii) psychological domestic violence; and (iii) sexual domestic violence. These variables were identified from
the responses to a set of questions that were asked for each of the outcome variables. If a woman (as a victim) gave a positive response to any of the questions in a set, it was considered as presence of domestic violence for that category. These questions are described in detail elsewhere. In addition, experiences of women for other behaviours namely change in sexual activity, availability of rest and diet, seeking of antenatal care and exposure to demand for male child by the family were also investigated. For change in sexual activity, the respondent was asked about the frequency of sexual activity during pregnancy. For availability of rest and diet, she was asked whether adequate food and rest were given during pregnancy. For these two questions, the respondent was given three options – as usual, decreased or increased during pregnancy. For seeking antenatal care, respondents were asked whether or not they visited any health facility during pregnancy for check-up. Respondents were specifically probed to know whether the woman was pressurized by her husband or other family members for delivering a male child.

**Statistical analysis**

The association of independent variables with different types of domestic violence were examined by using multivariate procedures. Binary domestic violence variables (experienced domestic violence or did not experience domestic violence) were modelled with multivariate logistic regression as a function of each independent variable. The independent variables were categorized into different groups as described earlier. Multiple logistic regression models were run by backward step-wise elimination procedure. The fit of the logistic regression models was checked by applying the Hosmer-Lemeshow Goodness of Fit tests. A p value of less than 0.05 was considered as the minimum level for statistical significance.

**Results**

The prevalence of physical, psychological and sexual domestic violence during the recent pregnancy was found to be 7.1% (95% confidence interval (CI): 5.9%-8.4%), 30.6% (95% CI: 28.3%-32.9%) and 10.4% (95% CI: 8.9%-12.0%) (Table 1). The lifetime prevalence of physical domestic violence during pregnancy was 8.3% (95% CI: 7.5%-9.2%), psychological domestic violence was 33.4% (95% CI: 31.9%-34.9%) and sexual domestic violence was 12.6% (95% CI: 11.5%-13.6%). The variability in domestic violence during pregnancy was very small across the states.

The association of women’s characteristics with three forms of domestic violence during pregnancy was presented in terms of adjusted odds ratios (AORs) (Table 2). With regard to physical domestic violence, urban residence, older age, salaried job and husband’s alcoholism emerged as the risk factors, whereas women’s affiliation to lower social group, higher levels of education and family income were protective against physical domestic violence. Religion was not included in the model.

Women who lived in urban areas, were older in age, belonged to backward castes and scheduled tribes, were multiparous and those whose husbands were alcoholics, were found to be more likely to experience psychological domestic violence. However, some variables, i.e. belonging to scheduled castes and having higher education, emerged as significant protective factors against psychological domestic violence.

The regression analysis for sexual domestic violence revealed that five of the nine variables had significant association. Urban residence, higher age of women, multiparity and husband’s alcoholism were found to be the risk factors. And women with higher levels of education were found to be less likely to experience sexual domestic violence during pregnancy.
Table 3 presents the prevalence of abusive behaviours against women by their partners. It is expected that there is decreased demand for sex by the husband when his wife is pregnant. About 85% (95% CI: 83.1%-87.5%) women who have not experienced any sort of domestic violence reported that the frequency of sexual activity decreased during pregnancy, whereas only 52% (95% CI: 47.7%-56.5%) women who had experienced domestic violence reported decreased frequency of sexual activity in pregnancy. Those who were exposed to sexual abuse had low level of sexual activity in pregnancy (23.3%; 95% CI: 16.7%-29.9%). Overall, 67.2% women reported that frequency of sexual activity decreased during pregnancy, about 25% women said that there was no change, and 7.4% said that there was no sexual intercourse during pregnancy. A very small proportion (0.9%) of women said that there was increase in the frequency of sexual activity during pregnancy.

With regard to allowing women to take adequate rest and diet, about 19% women reported that diet and rest increased during pregnancy, and the same proportion (19%) of women reported that diet and rest decreased, while 62.6% women said that there was no change in the provision of diet and rest. However, a higher number of women who had faced domestic violence during their pregnancy said that there was decrease in the adequate amount of rest and diet (26.7%; 95% CI: 22.8%-30.6%), compared to women who had not experienced any domestic violence (15.1%; 95% CI: 12.9%-17.3%). Overall 20% women did not receive antenatal care. This proportion was higher (29%; 95% CI: 25.0%-33.0%) among women who experienced domestic violence than those who had not experienced domestic violence during pregnancy (15.6%; 95% CI: 13.4%-17.8%).

About 18% women expressed that they faced pressure from family for having a male child. The pressure for having a male child was higher (25%; 95% CI: 21.1%-28.7%) among those women who had experienced domestic violence, compared with those who had not experienced domestic violence (15%; 95% CI: 12.8%-17.2%).

**Discussion**

This population-based study revealed that a considerable proportion of women had experienced some type of domestic violence during their pregnancy. These findings are similar to those of some hospital-based studies conducted in India. The prevalence of domestic violence among ever married women in this region was found to be 56%. The prevalence of domestic violence during pregnancy was lower than that of domestic violence during the lifetime (physical domestic violence - 7.1% vs 16.1%; psychological domestic violence - 7.1% vs 16.1%; and sexual domestic violence - 10.4% vs. 25.4% respectively). Considerable variation in the prevalence of lifetime and during-pregnancy domestic violence has been reported. With regard to the perpetrators of violence, usually husbands are the perpetrators, followed by very few cases of perpetration by husbands’ parents and kins.

Pregnant women were also victimised by abusive behaviours and by lack of emotional support. These behaviours were faced more frequently by women who experienced domestic violence. Usually, the men who perpetrate violence tend to hold conventional gender role attitudes, expecting women to take sole responsibility for household chores. Also, the inability to perform routine household tasks due to physical exhaustion and reduced mobility due to pregnancy frequently resulted in violence.
who experienced domestic violence reported lower utilization of antenatal care. Association between domestic violence and delayed and failed antenatal care-seeking was reported by previous studies also.\textsuperscript{12,13} Similarly, exerting pressure for male child was noticed more frequently among women who faced domestic violence. It is to be noted that this type of behaviour is a form of psychological domestic violence women experience. These abusive behaviours are also a risk factor for domestic violence during pregnancy. These behaviours had a positive association with all the three forms of domestic violence.

Living in urban areas was found to be a risk factor than living in rural areas. Other studies from developing nations support this finding.\textsuperscript{22,23} The urban social environment can be more stressful and alienating than rural areas. These conditions may influence spousal relations.\textsuperscript{23} Women from the higher age groups were at a higher risk of all forms of domestic violence during pregnancy.\textsuperscript{12,24} Multiparity is usually correlated with higher maternal age. However, some studies have found that younger pregnant women are more likely to have been exposed to domestic violence than older pregnant women.\textsuperscript{13,25,26} Alcohol consumption is positively associated with domestic violence during pregnancy and also with lifetime domestic violence in several communities.\textsuperscript{27-29} In India, alcoholism is usually a cause of spousal conflict, as women questions husband’s habit of alcohol consumption. They try to stop him from taking alcohol and squandering money on it. Domestic violence is a consequence of this type of conflict, as men take it as challenge to their authority. This phenomenon goes on in several Indian households on a regular basis.

Higher levels of education and family income were found to be protective factors against risk of domestic violence during pregnancy. Educational attainment has repeatedly been found to reduce the likelihood of domestic violence even in developed communities.\textsuperscript{30} Women with education are typically more autonomous and possess the resources and skills necessary to better recognize and terminate a potentially abusive relationship.

Though this study has identified some risk factors and protective factors with regard to domestic violence during pregnancy, it is important not to assume that any group or individual is especially at a low risk. In addition, the limitation of the study is the cross-sectional design itself, which does not allow for establishing a cause-and-effect relationship. Hence, the associations observed during regression analyses could be the function of some prior cause. However, study results provide vital information to develop policies and interventions for preventing domestic violence in pregnancy. Women should have access to information on the health hazards of domestic violence during pregnancy and sources of help.

A higher prevalence of domestic violence in pregnancy has public health implications. Health-care providers should have a role in preventing domestic violence during pregnancy and its health consequences. Hence, health-care providers should be trained to recognize and respond to violence during pregnancy and refer women for appropriate support and care, if required. Further research is needed on the feasibility and benefits of universal screening for domestic violence in pregnancy, particularly for encouraging the utilization of antenatal care services to prevent the health consequences of domestic violence.

**Acknowledgements**

This study received financial and technical support from the Indian Council of Medical Research (ICMR), New Delhi, India.
Table 1: Prevalence of domestic violence per 100 women during pregnancy in Eastern India

<table>
<thead>
<tr>
<th>Type of domestic violence</th>
<th>State</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orissa</td>
<td>West Bengal</td>
<td>Jharkhand</td>
<td>All</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Number of women</td>
<td>410</td>
<td>657</td>
<td>458</td>
<td>1525</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In most recent pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>8.0</td>
<td>5.8</td>
<td>8.3</td>
<td>7.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5.4-10.6)</td>
<td>(4.0-7.6)</td>
<td>(5.8-10.8)</td>
<td>(5.9-8.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological</td>
<td>29.3</td>
<td>28.6</td>
<td>34.7</td>
<td>30.6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(24.9-33.7)</td>
<td>(25.1-32.1)</td>
<td>(30.3-39.1)</td>
<td>(28.3-32.9)</td>
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<td></td>
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</tr>
<tr>
<td>Sexual</td>
<td>13.9</td>
<td>7.3</td>
<td>11.8</td>
<td>10.4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(10.5-17.2)</td>
<td>(5.3-9.3)</td>
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<td>(8.9-12.0)</td>
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</tr>
<tr>
<td>In all pregnancies during the lifetime</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pregnancies</td>
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<td>1524</td>
<td>1264</td>
<td>3827</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>9.7</td>
<td>6.9</td>
<td>8.9</td>
<td>8.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7.9-11.5)</td>
<td>(5.6-8.2)</td>
<td>(7.3-10.6)</td>
<td>(7.5-9.2)</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Psychological</td>
<td>31.6</td>
<td>31.2</td>
<td>37.5</td>
<td>33.4</td>
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<td></td>
<td></td>
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<tr>
<td>(28.8-34.4)</td>
<td>(28.9-33.5)</td>
<td>(34.7-40.3)</td>
<td>(31.9-34.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual</td>
<td>16.7</td>
<td>9.2</td>
<td>13.2</td>
<td>12.6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(14.4-19.0)</td>
<td>(7.7-10.6)</td>
<td>(11.3-15.2)</td>
<td>(11.5-13.6)</td>
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<td></td>
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</table>

Figures in parenthesis are 95% confidence intervals
### Table 2: Association of socioeconomic variables of women with the prevalence of domestic violence in Eastern India

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Adjusted odds ratio (95% confidence intervals)</th>
<th>N</th>
<th>Physical violence</th>
<th>Psychological violence</th>
<th>Sexual violence</th>
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</thead>
<tbody>
<tr>
<td><strong>Habitat</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td>1037</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td>452</td>
<td>2.37 (1.37-4.11)</td>
<td>1.81 (1.33-2.46)</td>
<td>1.58 (1.02-2.43)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td></td>
<td>180</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>20-29 years</td>
<td></td>
<td>971</td>
<td>1.99 (0.71-5.59)</td>
<td>1.81 (1.15-2.83)</td>
<td>1.48 (0.70-2.16)</td>
</tr>
<tr>
<td>30 years and above</td>
<td></td>
<td>374</td>
<td>3.22 (1.09-9.50)</td>
<td>1.36 (0.83-2.25)</td>
<td>2.24 (1.01-4.97)</td>
</tr>
<tr>
<td><strong>Caste category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General castes</td>
<td></td>
<td>716</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Backward castes</td>
<td></td>
<td>337</td>
<td>0.89 (0.51-1.55)</td>
<td>1.33 (0.97-1.81)</td>
<td>0.92 (0.41-2.07)</td>
</tr>
<tr>
<td>Scheduled castes</td>
<td></td>
<td>341</td>
<td>0.43 (0.22-0.84)</td>
<td>0.62 (0.44-0.88)</td>
<td>0.97 (0.42-2.20)</td>
</tr>
<tr>
<td>Scheduled tribes</td>
<td></td>
<td>131</td>
<td>0.85 (0.39-1.89)</td>
<td>1.15 (0.73-1.80)</td>
<td>1.64 (0.71-3.78)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td></td>
<td>482</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Functional literate</td>
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<td>122</td>
<td>0.49 (0.20-1.20)</td>
<td>0.76 (0.48-1.20)</td>
<td>0.60 (0.29-1.24)</td>
</tr>
<tr>
<td>School education</td>
<td></td>
<td>718</td>
<td>0.53 (0.31-0.88)</td>
<td>0.71 (0.53-0.95)</td>
<td>0.80 (0.54-1.20)</td>
</tr>
<tr>
<td>College education and above</td>
<td></td>
<td>203</td>
<td>0.04 (0.01-0.46)</td>
<td>0.23 (0.14-0.40)</td>
<td>0.25 (0.10-0.63)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td></td>
<td>1216</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Labourer</td>
<td></td>
<td>180</td>
<td>0.77 (0.39-1.52)</td>
<td>0.99 (0.40-2.47)</td>
<td>1.33 (0.27-6.49)</td>
</tr>
<tr>
<td>Farming/small business</td>
<td></td>
<td>81</td>
<td>0.44 (0.15-1.36)</td>
<td>1.14 (0.42-3.14)</td>
<td>1.83 (0.37-10.02)</td>
</tr>
<tr>
<td>Salaried job</td>
<td></td>
<td>48</td>
<td>9.16 (1.41-59.36)</td>
<td>0.66 (0.24-1.86)</td>
<td>2.48 (0.41-14.95)</td>
</tr>
<tr>
<td><strong>Family income per month</strong></td>
<td>(Indian rupees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2000</td>
<td></td>
<td>639</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
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<tr>
<td>2001-4000</td>
<td></td>
<td>463</td>
<td>1.03 (0.64-1.66)</td>
<td>0.64 (0.33-123)</td>
<td>0.42 (0.14-1.28)</td>
</tr>
<tr>
<td>4001-6000</td>
<td></td>
<td>126</td>
<td>0.18 (0.04-0.82)</td>
<td>0.65 (0.34-1.25)</td>
<td>0.43 (0.14-1.32)</td>
</tr>
<tr>
<td>6001-8000</td>
<td></td>
<td>93</td>
<td>0.62 (0.21-01.82)</td>
<td>1.06 (0.51-2.18)</td>
<td>0.64 (0.19-2.20)</td>
</tr>
<tr>
<td>8001-10000</td>
<td></td>
<td>64</td>
<td>0.29 (0.03-2.45)</td>
<td>1.14 (0.55-2.39)</td>
<td>0.59 (0.17-1.99)</td>
</tr>
<tr>
<td>&gt;10000</td>
<td></td>
<td>140</td>
<td>0.11 (0.01-1.10)</td>
<td>0.89 (0.40-1.97)</td>
<td>0.84 (0.19-3.74)</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td></td>
<td>371</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Two</td>
<td></td>
<td>514</td>
<td>0.83 (0.37-1.88)</td>
<td>1.36 (0.95-1.95)</td>
<td>0.92 (0.50-1.72)</td>
</tr>
<tr>
<td>More than two</td>
<td></td>
<td>640</td>
<td>1.52 (0.72-3.24)</td>
<td>2.07 (1.45-2.96)</td>
<td>2.04 (1.14-3.63)</td>
</tr>
<tr>
<td><strong>Husband's alcoholism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>1162</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>363</td>
<td>7.84 (4.93-12.48)</td>
<td>3.59 (2.76-4.67)</td>
<td>4.97 (3.47-7.10)</td>
</tr>
</tbody>
</table>

Religion was not included in any of the logistic regression models. Occupation and income were not included in the model for psychosocial domestic violence. Caste, occupation and income were not included in the model for sexual violence.
Table 3: Prevalence of selected behaviours against women during recent pregnancy, by type of domestic violence in Eastern India (data in percentage)

<table>
<thead>
<tr>
<th>Behaviours</th>
<th>Type of domestic violence</th>
<th>Physical</th>
<th>Psychological</th>
<th>Sexual</th>
<th>Any</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pregnant women</td>
<td></td>
<td>109</td>
<td>467</td>
<td>159</td>
<td>490</td>
<td>1035</td>
</tr>
<tr>
<td>Sexual activity</td>
<td>As usual</td>
<td>67.0</td>
<td>46.3</td>
<td>76.1</td>
<td>46.9</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>(58.1-75.9)</td>
<td>(41.8-50.8)</td>
<td>(69.4-82.7)</td>
<td>(42.5-51.3)</td>
<td>(11.8-16.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased</td>
<td>0.9</td>
<td>1.1</td>
<td>0.6</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>(-0.9-2.7)</td>
<td>(0.1-2.0)</td>
<td>(-0.6-1.8)</td>
<td>(0.1-1.9)</td>
<td>(0.1-0.9)</td>
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</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>32.0</td>
<td>52.7</td>
<td>23.3</td>
<td>52.1</td>
<td>85.3</td>
</tr>
<tr>
<td></td>
<td>(23.2-40.8)</td>
<td>(48.2-57.2)</td>
<td>(16.7-29.9)</td>
<td>(47.7-56.5)</td>
<td>(83.1-87.5)</td>
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</tr>
<tr>
<td>Rest and diet</td>
<td>As usual</td>
<td>65.1</td>
<td>66.6</td>
<td>57.9</td>
<td>65.1</td>
<td>61.4</td>
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<tr>
<td></td>
<td>(56.1-79.1)</td>
<td>(62.3-70.9)</td>
<td>(50.2-65.6)</td>
<td>(60.9-69.3)</td>
<td>(58.4-64.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased</td>
<td>3.7</td>
<td>7.9</td>
<td>4.4</td>
<td>8.2</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>(0.1-7.3)</td>
<td>(5.4-10.3)</td>
<td>(1.3-7.5)</td>
<td>(5.8-10.6)</td>
<td>(20.9-26.1)</td>
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</tr>
<tr>
<td></td>
<td>Decreased</td>
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<td>25.5</td>
<td>37.7</td>
<td>26.7</td>
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<tr>
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<td>(22.5-39.9)</td>
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<td>(30.1-45.3)</td>
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<td>(12.9-17.3)</td>
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<tr>
<td>Not received antenatal care</td>
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<td>46.8</td>
<td>30.0</td>
<td>37.1</td>
<td>29.0</td>
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<td></td>
<td>(37.4-56.2)</td>
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<td>(29.6-44.6)</td>
<td>(25.0-30.0)</td>
<td>(13.4-17.8)</td>
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<tr>
<td>Pressure for male child</td>
<td></td>
<td>34.9</td>
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<td>15.0</td>
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<td>(12.8-17.2)</td>
<td></td>
</tr>
</tbody>
</table>

Figures in parenthesis are 95% confidence levels.
References


Prognostic indicators in patients with snakebite: analysis of two-year data from a township hospital in central Myanmar

Myo-Khin*, Theingi-Nyunt*, Nyan-Tun-Oo*, Ye-Hla*

**Background:** Rural people seek medical treatment for snakebite at peripheral health care facilities. Hence, identification of the characteristics, which can be used at peripheral levels of health care as reliable predictors of mortality, are required.

**Methods:** Hospital records of 101 patients (70 males and 31 females) with age ranging from 3 to 80 years, admitted to Nahtogyi township hospital in central Myanmar during January 2005 to December 2006 were reviewed retrospectively. Binary logistic regression was used for estimating odds ratio (OR) and 95% Confidence Interval (CI) for various prognostic indicators of mortality.

**Results:** Almost all snakebites were on extremities; more in legs (62%) than hands (37%). Most (52.5%) bites occurred in the morning (4 am to noon). Mean (SD) time for bite-to-hospital and bite-to-injection of anti-snake venom (ASV) was 134.6 (78.6) and 167 (187.8) minutes respectively. Eleven cases (10.9%) had died. Case fatality ratio (CFR) was significantly higher in 39 patients with un-clotted blood as compared to 62 patients with clotted blood (25.6% vs 1.6%, p <0.0005). Significantly higher CFR was observed in 49 patients who received ASV in >2 hours after the bite compared to 52 cases who received ASV within two hours (9.9% vs 0.9%, p <0.0001). Odds ratio of fatality were higher among those who had urine output of <400 ml in the first 24 hours (OR 26.4; 95% CI 2.4 to 288.3), un-clotted blood (OR 4.6; 95% CI 0.3 to 66.7), bite-to-injection time of >2 hours (OR 4; 95% CI 0.1 to 219.8) bite-to-hospital time of >2 hours (OR 3.1; 95% CI 0.1 to 136.3) and bites in the morning (OR 2; 95% CI 0.3 to 16.0).

**Conclusions:** Clinical parameters could be used by healthcare providers to identify snakebite patients for referral, who may have fatal outcome.

**Key Words:** Snakebite, urine output, anti-snake venom, prognosis, predictors, Myanmar.

**Introduction**

Snakebite, an important cause of death in agriculture workers of developing countries, is a priority health problem for rural populations. Recent studies show that most of the snakebites occur in South Asia, South-East Asia and Sub-Saharan Africa. About 5 million cases occur annually throughout the world leading to 125 000 deaths.
In Myanmar, snakebite cases occur in almost all the regions especially in Mandalay, Bago, Sagaing, Ayeyarwady and Yangon Divisions. It has been reported that 10,000 cases of snakebite occur annually with more than 1,000 deaths. Seventy percent of the bites are caused by Russell’s vipers \( (Daboia russelli siamensis) \). Therefore, mortality from snakebite is quite high (10%) in Myanmar. A prospective study on 500 snakebite victims revealed that the mortality could be as high as 50% in cases with severe envenomation.

Most of the snakebite patients are from rural populations living in villages and working on agricultural land. Once bitten by snakes, they seek medical treatment at rural health centres or township health care facilities. However, apart from simple clotting test and urinary examination, many of the facilities have limited laboratory and clinical capabilities required for care of critically ill patients with multi-organ dysfunction as a complication of snakebite. Thus, it is important that the health care providers should be able to identify patients with snakebites at high risk of fatal complications so as to be able to refer them to a hospital with more facilities.

The availability of complete clinical records of all snakebite patients at a township hospital prompted us to study prognostic indicators keeping in view relative interdependence or interaction of various factors that could determine morbidity and mortality. The specific aim of the study was to identify simple healthcare-related clinical characteristics, for use at peripheral levels of health care, that can serve as reliable predictors of mortality.

**Methods**

This retrospective study was carried out using hospital records. The hospital records of all snakebite cases admitted to Nahtoogyi township hospital, Mandalay Division, during the period of January 2005 to December 2006, were reviewed. The clinical outcome was listed as survived or died. Those classified as absconded, discharged on request, left against advice, referred to the tertiary centre were followed up in 2008 to classify them as alive or dead.

Descriptive characteristics of the patients and the snakebite event such as gender, age, time of bite, site of bite, bite-to-hospital time were recorded. Clinical data such as bite-to-injection time of antisnake venom (ASV), urine output on first day, clotting time, unclotted to clotted time interval, initial and total anti-venom doses administered were also noted. Signs and symptoms such as hypotension, tachycardia, swelling, vomiting, epigastric pain, and renal angle pain were also documented. Majority of hospitals in Myanmar used Mono-specific Liquid Equine Russell’s Viper Anti-Venom in liquid form (Myanmar Pharmaceutical Factory, Yangon, Myanmar).

**Statistical analysis**

MINTAB Statistical Software, Release 14 for Windows, Minitab Inc. USA was used for data entry and analysis. Following univariate analyses, comparison of the descriptive features and clinical data between survivors and non-survivors were done using ‘t’ test and chi-square test as appropriate. Bite-to-hospital interval and bite-to-injection of ASV interval, urine output in first 24 hours, clotting status, were further categorized as binary variables. Binary logistic regression models were constructed and the most significant model with the highest number of concordant and discordant pairs was selected and odds ratios (OR) and 95% Confidence Interval (CI) were calculated.

**Results**

One hundred and one snakebite cases were admitted to the hospital during the two-year
study period. The age of the victims ranged from 3 to 80 years with a mean (SD) of 32.3 (15.5) years. Males predominated with a ratio of 2.2: 1. The number of snakebite cases was highest in 21-30 years age group (34, 33.7%), followed by 13-20 years (19, 18.8%), 31-40 years (16, 15.8%), > 50 years (14, 13.9%), and 41-50 years age group (13, 12.9%). Lowest numbers of cases were in children under 12 years of age (5, 5%).

Snakebite occurred throughout the year but high peaks were observed in October and January. Very low occurrences were observed in February to April. More than half (52.5%) of the bites occurred in the morning (4 am to noon), followed by afternoon (noon to 6 pm) (28.7%) and evening hours (6 pm to midnight) (18.8%). Most of the patients who died (72.7%) were bitten in the morning. Almost all bites were on extremities; legs were the more common site (62%) as compared to the hands (37%).

The time to reach the hospital ranged from 20 minutes to 7.5 hours with a mean (SD) of 134.6 (78.6) minutes (median 120 minutes). Among them, 79 (78.2%), 47 (46.5%) and 19 patients (18.8%) failed to reach the hospital within one, two, and three hours respectively and 23 cases failed to receive ASV within three hours. The initial amount of ASV received was 20 ml in 51 cases (51%), 40 ml in 35 (35%), 10 ml in 14 (14%) and 50 ml in one case (1%). On an average (SD), 25.6 (11.3) ml of ASV was given initially; median dose being 20 ml. Seven cases received ASV at the village-based primary health care centre before they were referred to the hospital.

During the course of the treatment up to 120 ml of ASV was given at the hospital. On average (SD), 43.9 (39.0) ml of ASV was used per snakebite case (median 40 ml). A significantly larger amount of ASV (almost three times) was used in ‘non-clotted’ cases as compared to ‘clotted’ cases (Table 1). Also, a significantly larger amount of ASV per case

<table>
<thead>
<tr>
<th>Coagulation status (number)</th>
<th>Total amount of ASV used (ml) per case</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Non-clotted (39)</td>
<td>70.8</td>
<td>27.8</td>
</tr>
<tr>
<td>Clotted (62)</td>
<td>26.9</td>
<td>18.3</td>
</tr>
<tr>
<td>All cases (101)</td>
<td>43.9</td>
<td>39.0</td>
</tr>
</tbody>
</table>
was used in those who died as compared to those who survived (7.5% vs 4.0%, p <0.002). Among 39 cases with ‘non-clotted’ blood status, 32 cases reverted to ‘clotted’ stage following ASV therapy. The median clotting time on hospital admission was 540 minutes (range - 60 to 1110 minutes).

Eighty-six patients recovered and were discharged from the hospital. The average (SD) duration of stay in hospital was 6.9 (3.2) days with a range of 1 to 21 days and a median of 7 days. Some of the patients (6) had to be referred for further management. Among them, three patients died and three survived. One patient, who had absconded from the hospital, was later confirmed to be alive and well. One patient who left against advice was later confirmed as died. Thus a total of 11 cases had died and 90 cases survived. Although a higher case fatality ratio (CFR) was observed in males (11.4%) than females (9.7%), the difference was not statistically significant. Higher CFR was also observed in children under 5 years of age (20%) as compared to older children and adults (Table 2).

Binary logistic regression models were constructed and the final model revealed that the odds of fatality were higher in urine output less than 400 ml in first 24 hours (OR 26.4; 95% CI 2.4 to 288.3), ‘un-clotted’ blood status (OR 4.6; 95% CI 0.3 to 66.7), bite-to-injection time of >2 hours (OR 4; 95% CI 0.1 to 219.8), bite-to-hospital time of >2 hours (OR 3.1; 95% CI 0.1 to 136.3), and bite in the morning time (OR 2; 95% CI 0.3 to 16.0).

**Discussion**

In Myanmar, viper snake bites are estimated to be 7000 to 8000 per year with over 500 deaths. Although there is no doubt that the disease course may be fulminant and lethal, recognition of predictor signs with prompt necessary action could reduce the mortality.

The regression model we constructed in this study for the first time indicates that oliguria, ‘un-coagulable blood status’ on admission to the hospital, delayed bite-to-injection time, delayed bite-to-hospital interval, and morning bites have association with increased mortality for snakebite in Myanmar though only oliguria was found to be statistically significantly associated with mortality. The importance of these factors as major determinants of mortality in viper bite has been studied from various aspects using different types and levels of scientific evidence. Our model also reveals the importance of these predictors by providing the degree of statistical significance of each factor. Other factors such as the length of snake, characteristic of snakes which are

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Number of cases</th>
<th>Died</th>
<th>Case Fatality Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>5</td>
<td>1</td>
<td>20.0</td>
</tr>
<tr>
<td>13-20</td>
<td>19</td>
<td>3</td>
<td>15.8</td>
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<tr>
<td>21-30</td>
<td>34</td>
<td>3</td>
<td>8.8</td>
</tr>
<tr>
<td>31-40</td>
<td>16</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>41-50</td>
<td>13</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>&gt;51</td>
<td>14</td>
<td>1</td>
<td>7.1</td>
</tr>
<tr>
<td>All</td>
<td>101</td>
<td>11</td>
<td>10.9</td>
</tr>
</tbody>
</table>

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Prognostic indicators in patients with snakebite

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beyond control have been studied previously by others.7

Haemostatic disturbances are known to be the pathological mechanism causing fulminant disease in viper bite, and bleeding tendency is well recognized as an indicator of greater risk of death.6,8,9 The present study also indicates blood incoagulopathy as a predictor of mortality.

The importance of bite-to-injection time is also well known as a significant factor influencing mortality. A study from Nepal showed that the delay in receiving treatment was significantly longer for victims with a fatal outcome.10 The optimum time for administration of ASV has been previously suggested as "as soon as possible" or within 4 hours. Bite-to-injection time of less than 4 hours is associated with rapid recovery of renal function.11 Although we were not able to determine the renal function of our patients, we found that bite-to-injection time of more than two hours could increase the mortality by four times than those who receive ASV within two hours. Our findings indicate that a delay of even two hours in neutralizing the action of venom would be enough to do pathological damage and increase the mortality.

Viper bites is one of the most common causes of acute renal failure in hospital practice in Myanmar.12 It has been demonstrated by in-vitro and in-vivo studies that viper venom has direct nephrotoxic effect in addition to causing renal impairment through disturbed blood coagulation mechanism.13,14,15 Oliguria as evidence of renal function impairment has been pointed out but opinion differs as to when it should become a deciding factor in clinical management.16 We found that urine output of less than 400 ml in the first 24 hours is a strong predictor (26 times higher risk) of mortality.

A recent paper shows the value of low dose dopamine-high dose furosemide regimen in the management of acute renal failure and suggests that this regimen may abort onset of acute renal failure if given early and should therefore be considered when a warning red flag such as oliguria or albuminuria signals impending renal failure.17 Albuminuria which is easy to perform has also been shown to be a sign of renal impairment but it may sometimes be a late sign.14,15 Detection of urinary N-acetyl-beta-D-glucosaminidase (NAG) may be an early indicator of renal damage in viper envenomation but it is not practical to do this test in township or most other hospitals.18

Numerous studies and guidelines have discussed the quantity of ASV to be given in viper bite. It is generally agreed that this should neutralize the average quantity of venom injected by the viper at one bite. Based on studies of the average quantity of venom injected by Russell’s viper (given as 63mg) and the neutralization capacity of ASV produced by Myanmar Pharmaceutical Factory (MPF) (given as 2 mg per ml) it has been recommended that the standard dose of ASV should be 40 ml for patients with systemic envenomation but with no complications.19 This ASV dose regimen was used at our study hospital during the study period, and served as a basis for our analysis.

Regarding the seasonal pattern of snakebite, the present study is one of many other studies that have shown the importance of season in snakebite problem in Myanmar. However, the morbidity pattern of the present study differs from previous findings where highest incidence of snakebite was found during the harvesting season from October to December.20 This might be due to the difference in study area; the present study focused on data from central Myanmar where
paddy as well as other crops are planted as compared to the data from lower Myanmar which has mainly paddy plantations. In the study township, in addition to rice, green peas and sesame were cultivated during the months of May, June and July. The paddy harvesting season is during September and October. In addition to the peaks in snakebite morbidity during the sowing and harvesting seasons, a third peak was observed during the months of December and January when sunflower and groundnuts were cultivated. The only period of the year where cultivation work is not done is between the months of February and April. This period coincided with a decreased snakebite morbidity observed in the present study.

Male predomination in this study was similar to the findings of previous studies.\textsuperscript{20,21,22} This risk is associated with greater number of outdoor activities of males than their female counterparts. Although the CFR of 10.9% is higher than our previous findings from central Myanmar\textsuperscript{21} it is in agreement with other previous reports from Myanmar.\textsuperscript{3,5}

It has been documented that longer snakes cause more severe envenoming and more extensive swelling than the snakes with shorter length.\textsuperscript{7} In the present study, the length of the snake was not documented. Hence, length of the snake as a predictor of fatality should be investigated in future studies.

Regarding hypotension, a significant rise of blood cortisol in patients with unclotted blood has been reported.\textsuperscript{23} In a large study carried out in India, hypotension was identified as a large (22 times) predictor of mortality.\textsuperscript{24} However, relatively few cases had presented with hypotension in the present study, therefore, its significance could not be assessed.

The present study has some limitations. It was focused mainly on the predictors of mortality based on retrospective analysis of a small number of medical records from a township hospital. It will be interesting to carry out a larger clinical auditing study prospectively to identify imperfections in the management of snakebite at the peripheral level where manpower and laboratory facilities are inadequate.

In conclusion, snakebites are still a common medical emergency encountered in township hospitals, especially in rural areas. Timely treatment is the mainstay for reduction of mortality. Recognition of predictor signs is essential for clinical management and early referral which could lead to a significant decrease in mortality. Our study has established the validity of some of the predictors being used in Myanmar which will help in deciding clinical management options including ASV dose and onward referral to tertiary centers.

**Acknowledgements**

We are most grateful to Dr Aung-Than-Ba-Tu, former Director-General, Department of Medical Research for his encouragement, valuable advice and inputs to the study as well as in writing this report.

**References**


Performance of cause-specific childhood mortality surveillance by health workers using a short verbal autopsy tool

Rakesh Kumar\textsuperscript{a}, Suresh K Kapoor\textsuperscript{b}, Anand Krishnan\textsuperscript{a}

**Background:** The routine use of verbal autopsy in health-care delivery settings has been limited. Hence, the performance of neonatal and postneonatal verbal autopsy (VA) tools developed at the Comprehensive Rural Health Services Project (CRHSP), Ballabgarh (India), were assessed.

**Methods:** Short VA tools developed by CRHSP were filled by health workers during their routine house visits while standard VA tools of the International Network of Field Sites with continuous Demographic Evaluation (INDEPTH) were filled by trained research workers for all 143 under-five-children deaths that occurred in 2008. The level of agreement in the cause of death assigned by the two VA tools was assessed by kappa and by comparison of the cause-specific mortality fractions.

**Results:** Among 65 neonatal deaths, the cause specific mortality fraction (CSMF) was 43.1% and 40% for low birthweight, 15.4% and 26.2% for birth asphyxia, and 7.7% and 10.8% for pneumonia by INDEPTH and CRHSP VA tools respectively. In 78 deaths among 29-days to <5-year olds, the CSMF was 29.4% and 26.9% for diarrhoea, and 16.6% each for pneumonia using the INDEPTH and CRHSP VA tools respectively. Kappa for most causes of death was more than 0.8, except for birth asphyxia, which had a kappa of 0.678.

**Conclusions:** Short VA tools have a satisfactory performance in field settings, which can be used routinely by health workers for filling the gaps in the cause-of-death information in places where medical certification of cause of death is deficient.

**Key words:** Verbal autopsy, neonatal, mortality, child, India.

**Introduction**
Child mortality is a global priority as enunciated by the Millennium Development Goals (MDGs). The target is to reduce the under-five-child mortality by two thirds in each country. Though child deaths are declining the world over, the rate of decline is not enough to achieve the target by 2015.\textsuperscript{1,2} India has made some progress in reducing child mortality but it is still far from achieving the MDG. Also, there is large regional variability in childhood morbidity and mortality rates.\textsuperscript{3}
The information on the distribution and trends of the causes of childhood mortality is important to develop effective health policies and for evaluating existing health programmes addressing the issue of childhood mortality. However, this information is lacking in many developing countries. There is considerable lacuna in vital registration as well as in reporting of the cause of death. The vital registration system in India has been estimated to complete in only be 50% of all deaths. Reliable, medically certified cause-of-death data are available only in 14.5% of all registered deaths.

In places where the system of medical certification of cause of death is deficient, verbal autopsy (VA) is an alternative method to ascertain the cause of death. Verbal autopsy is based on the assumption that most causes of death have distinct symptom complexes that can be recognized, remembered and reported by the lay respondents. Various VA tools have been used in different settings to obtain cause-of-death data. The VA tool developed by the International Network of Field Sites with continuous Demographic Evaluation (INDEPTH) is one such standard tool that is used by many demographic surveillance sites. The INDEPTH VA tools have separate questionnaires for neonatal (0-28 days) and postneonatal (29 days - <5 years) mortality. The factors that may affect the validity of a VA include questionnaire design, type of interviewers and respondents, recall period, cause-of-death ascertainment mechanisms and cause-of-death classification.

Verbal autopsies for childhood deaths have been used in research settings and in surveys on a large sample of the population. Various verbal autopsy tools for childhood mortality have been validated in different settings, but the focus has largely been on methodological issues. Most of the available VA tools require specialized training and need longer time to complete the interview. Consequently the use of verbal autopsy under routine health-care delivery settings has been limited.

A shorter VA tool that takes less time and requires less intense training was developed at the Comprehensive Rural Health Services Project (CRHSP), Ballabgarh (India) in 2002, which was revised in 2007. Keeping in mind the information needed for ascertaining the causes of death, verbal autopsy tools were designed separately for neonatal (0-28 days) and post-neonatal (29 days – <5 years) deaths. While the experience with these tools has been encouraging, the performance of the tools has never been examined. This study was done with the objective of comparing the cause-specific mortality fraction and agreement between CRHSP and INDEPTH VA tools for major causes of childhood mortality.

**Methods**

This study was carried out from January to December 2008 in the Intensive Field Practice Area of CRHSP, Ballabgarh, which is a field practice area of the All India Institute of Medical Sciences (AIIMS), New Delhi, India, as well as an INDEPTH Health and Demographic Surveillance site. It covers a population of about 86 000 in 28 villages through its two primary health centres (PHCs). Around 2000 live births occur in this area in one year. Health workers make house-to-house visits to provide basic health services. All deaths are routinely reported and verbal autopsies are done by health workers. Assignment of the cause of death is done by the Medical Officer of the PHC.

**Verbal autopsy**

The CRHSP neonatal and post-neonatal VA tools are used for deaths in the age groups 0 to 28 days, and 29 days to <5 years,
respectively. These tools have seven sections comprising identification detail; narrative regarding the events leading to death; specific questions on symptoms and signs; history of immunization; treatment; and past diseases in the deceased or other family members. The neonatal VA tool, besides an open narrative section, has 52 close-ended questions without having any filter questions, whereas the post-neonatal tool, in addition, has questions on nutrition history, and five modules with one filter question in each. In the 5 modules the number of items range from 5 to 11. The CRHSP tools require minimal training and take approximately 20 minutes to complete.

The INDEPTH neonatal and post-neonatal VA tools are used for all deaths in the age groups of 0 to 28 days, and 29 days to 12 years, respectively. These tools have seven sections comprising background detail of the deceased; background information of the interview; information regarding the informant; open narrative section; signs and symptoms during neonatal period; accidents and injuries; and treatment history. It takes approximately 60 minutes to complete an INDEPTH VA tool.

The INDEPTH VA tools were translated into the local dialect and pretested at Ballabgarh in a non-project village. Subsequently, independent back-translation of the tools was done. The CRHSP VA tools were developed by modifying the earlier versions of the VA tools. An open narrative section was added. These tools were already being used for routine mortality surveillance in the CRHSP area.

Field research assistants were recruited and trained for three days to administer the INDEPTH VA tools. The assistants were female lay workers with previous experience in data collection for health-related projects. They were trained in the interview technique, as well as on the causes of death. Health workers and health supervisors were trained for a day on administering the CRHSP VA tools. Their training was shorter as they were already using these tools.

All deaths that took place in the intensive field practice area of CRHSP, Ballabgarh, among under-five-children during January to December 2008 were included in the study. The verbal autopsy using both tools (CRHSP and INDEPTH) was conducted for all deaths. As a first step, the CRHSP VA tools were filled by health workers. A time gap was kept between the filling of forms and the date of death (over two weeks but not exceeding six weeks for CRHSP VA tools). After a gap of two weeks and within three months of the death, the same families were visited by field research assistants who completed the translated INDEPTH VA tool. Field supervisors verified the details in the INDEPTH VA tool. In the case of the CRHSP VA tool, details were verified by health supervisors after visiting the household. They also checked the forms for completeness.

Assigning the cause of death
Cause of death assignment for the INDEPTH VA tool was done by the medical officer in-charge of the primary health centre. For the CRHSP VA tool, this function was performed by one of the investigators (RK). Subsequently, causes of death were coded as per the International Statistical Classification of Diseases 10th Revision (ICD-10). Medical officers working in PHCs have public health qualifications, and their course work includes ICD coding. During their postgraduation they would also have gained some hands-on experience on assigning the cause of death and coding the diagnoses. Only one physician was used for the purpose of assigning the cause of death, as use of multiple coders does not have any added benefit.21
Statistical analysis
Data were entered into Microsoft Excel 2007 and analysed by using the SPSS version 17.0. The cause-specific mortality fractions (CSMF) were calculated as per the ICD-10 codes. The CSMFs were compared for the CRHSP and INDEPTH VA tools. The performance of CRHSP VA tools was considered satisfactory if the CSMF estimate using the CRHSP VA tools was within 20% of the CSMF obtained by the INDEPTH VA tools. The chance-corrected concordance was also estimated for various causes of childhood mortality using Cohen’s kappa. A kappa value of more than 0.75 was considered as “excellent”, 0.40 to 0.75 “as fair to good” and below 0.40 as “poor.”

Ethical issues
Approval from the AIIMS Ethics Committee was obtained before the start of the study. Field workers and assistants were trained in interview techniques, so as to minimize the trauma to the respondent when discussing the death of a loved one. Written informed consent was taken from all interviewees before administration of the INDEPTH VA tools. The CRHSP VA tools were already being used as a routine surveillance activity; hence, consent was not taken for it. Information gathered from interviewees was kept confidential.

Results
One hundred and forty three deaths occurred among under-five-children in the CRHSP population during 2008. Sixty five deaths occurred in the neonatal period (0-28 days); 60% of these deaths were in the early neonatal period (0-7 days). Seventy eight deaths occurred in the period from 29-days to <5 years; 58% of these deaths were between 29 days to <1 year. Most neonates died in hospital (56%) or on way to hospital (38%), whereas only 22% of the 29-days to <5 year-olds died at hospital and 65% died at home. There were more males (58%) among neonatal deaths compared to the 29-days to <5 year-olds (50%). The number of deaths for which a specific cause could be assigned was found to be greater in the case of CRHSP VA tools as compared with the INDEPTH VA tools (Table 1). There was not much misclassification in ascertainment of the cause of death as the chance-corrected concordance for major causes of death was “fair to good” or “excellent” (Table 2).

Low birthweight was the most common cause of death in both early and late neonatal period. The CSMF of low birthweight and prematurity by INDEPTH and CRHSP VA tools was 46.2% and 41.1% respectively, in the early neonatal period, and 38.4% by both tools in the late neonatal period. Birth asphyxia was another common cause of death in the early neonatal period, using both the VA tools, with a CSMF of 25.6% and 38.5%, respectively; however it was a less common cause of death in the late neonatal period with a CSMF of 0% and 7.7% respectively, using the INDEPTH and CRHSP VA tools. The CSMF of pneumonia in the early neonatal period was 5.1% according to both tools, and 11.5% and 19.2% in the late neonatal period, using the INDEPTH and CRHSP VA tools respectively. The CSMF of congenital malformation was 7.7% according to both tools in the early neonatal period, and 7.7% and 3.8% in the late neonatal period, using the INDEPTH and CRHSP VA tools respectively.

Diarrhoea was the most common cause of death among 29-days to <5 year-olds (Table 1). In children aged 29-days to <1 year, diarrhoea was the cause of death in 42.2% and 37.7% children, according to the INDEPTH and CRHSP VA tools respectively; however in children aged 1 year to <5 years, diarrhoea was the cause of death in 12.1% children, using both tools. Among children of 1 year...
**Table 1: Cause-specific mortality fractions in less-than-five-year old children by INDEPTH and CRHSP verbal autopsy tools**

<table>
<thead>
<tr>
<th>Cause of death (ICD codes)</th>
<th>0 - 28 days N=65</th>
<th>29 days to &lt;5 years N=78</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INDEPTH</td>
<td>CRHSP</td>
</tr>
<tr>
<td>Low birthweight (P07.0- P07.3)</td>
<td>43.1</td>
<td>40.0</td>
</tr>
<tr>
<td>Birth asphyxia (P21.9)</td>
<td>15.4</td>
<td>26.2</td>
</tr>
<tr>
<td>Diarrhoea (A09)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pneumonia (J18)</td>
<td>7.7</td>
<td>10.8</td>
</tr>
<tr>
<td>Neurological disorder (G00-G99)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>External injury (S00-Y98)</td>
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<td>4.6</td>
</tr>
<tr>
<td>Protein-energy malnutrition (E40-E46)</td>
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</tr>
<tr>
<td>Other infectious diseases (A00- B99 except A09)</td>
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<tr>
<td>Congenital malformation (Q00-Q99)</td>
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</tr>
<tr>
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</tbody>
</table>

CRHSP = Comprehensive Rural Health Service Project, IDEPTH = International Network of Field Sites with continuous Demographic Evaluation

**Table 2: Level of agreement between INDEPTH and CRHSP verbal autopsy tools for various causes of death among under-five children**

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>0 - 28 days N=65</th>
<th>29 days - &lt;5 years N=78</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Kappa (SE)</td>
</tr>
<tr>
<td>Low birthweight (P07.0- P07.3)</td>
<td>28</td>
<td>0.878 (0.109)</td>
</tr>
<tr>
<td>Birth asphyxia (P21.9)</td>
<td>10</td>
<td>0.678 (0.118)</td>
</tr>
<tr>
<td>Pneumonia (J18)</td>
<td>5</td>
<td>0.817 (0.125)</td>
</tr>
<tr>
<td>Diarrhoea (A09)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Congenital malformation (Q00-Q99)</td>
<td>4</td>
<td>0.881 (0.118)</td>
</tr>
<tr>
<td>Malignant neoplasm (C00-D48)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Protein-energy malnutrition (E40-E46)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Neurological disorder (G00-G99)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>External injury (S00-Y98)</td>
<td>5</td>
<td>0.849 (0.148)</td>
</tr>
</tbody>
</table>

SE=Standard Error, CRHSP=Comprehensive Rural Health Service Project, IDEPTH = International Network of Field Sites with continuous Demographic Evaluation
to <5 years in age, external injury was the common cause of death, with CSMF according to both tools being 15.2%. Pneumonia was another common cause of death in this age group with 17.7% and 22.2% deaths respectively, using the INDEPTH and CRHSP VA tools. Neurological disorders and protein-energy malnutrition were the other important causes of death in this age group.

**Discussion**

The ideal mortality measurement should be routine, reproducible, low cost and sustainable. Use of short verbal autopsy tools to generate cause-specific mortality fractions at the local level can help in better planning of health-care services as health workers who used short verbal autopsy tools had a “fair to good” level of agreement in causes of deaths, as compared with those arrived at by the INDEPTH tools (Table 2). A study in the CRHSP area had reported earlier that the performance of verbal autopsy tools by health-care workers in routine health-care delivery settings was good for adult deaths.22

In the neonatal age group, low birthweight and prematurity was the most common cause of mortality. It had a CSMF of 40%, using the CRHSP VA tool, which is within the acceptable limit (20%) of CSMF, according to the INDEPTH VA tool. Low birthweight as a cause of death was more common than other studies conducted in a similar setting8 or elsewhere,23,24 which reported a CSMF in the range of 10-30%. Misclassification of cases of sepsis or pneumonia as low birth-weight may be the reason for a higher CSMF in this study, as in this study the CSMF of pneumonia or sepsis was quite low in comparison with other studies.8,23-24 Most babies born prematurely or with a low birthweight are likely to die from sepsis or pneumonia, but this study underestimated pneumonia as a cause of death in many neonates. It is important to decide a priori, how to classify deaths in the neonatal period. Should prematurity or low birthweight be considered an “underlying cause” or a “risk factor” as many premature or low-birth-weight babies may die due to other causes such as pneumonia, diarrhoea or sepsis?

Birth asphyxia was another common cause of death in this study, though the CRHSP VA tool diagnosed it as a cause of death more commonly (26.2%) than the INDEPTH VA tool (15.4%). The reason for this large difference could be more unclassified deaths in the case of the INDEPTH VA tool. The narrative section plays a major role in assignment of the cause of death for birth asphyxia. It is possible that health-care workers were able to extract more information on events surrounding birth. They had worked in the area for a longer period and had a better rapport with the informants. The CSMF of birth asphyxia was similar to that reported globally or from the South-East Asia Region,23,24 though a study in northern India had found a much lower CSMF of birth asphyxia.8 The CSMF of perinatal conditions in the neonatal period was found to be 71% in a large sample survey in India.25 The CSMF of congenital malformations was similar in both CRHSP VA and INDEPTH VA tools and was consistent throughout the study,8,23-24

In the age group of 29 days to <5 years, diarrhoea and pneumonia were the two most common causes of death. The CSMF for these common causes of death by the CRHSP VA tool was within the acceptable limit (20%) of the CSMF, using the INDEPTH VA tool. The CSMFs during infancy obtained in this study, was similar to other studies.23,25 However, in the post-infancy period, the CSMF of diarrhoea was much lower in this study. Injuries were a common cause of death in this study; similar results have been found elsewhere.25
The chance-corrected concordance between CRHSP and INDEPTH VA tools was excellent for most causes of death except for birth asphyxia. Very few studies have presented results in terms of kappa; though some authors argue that it could be a better method. The chance-corrected concordance was better for pneumonia than a study conducted in Kenya. The performance of the CRHSP VA tool for birth asphyxia and low birthweight in the neonatal period was similar to other studies; however, the performance in these studies was measured in terms of validity. In contrast to the other studies, the performance of the 29 days to <5 year VA tool was better for diarrhoea and pneumonia.

In all cases, the CRHSP VA tools were administered before the INDEPTH VA tool. A gap of two to six weeks is too short to forget the elements of earlier interview, yet any longer gap would affect the quality of recall. The INDEPTH tool is more detailed. It was also felt that there is more chance of it influencing recall than the CRHSP tool. Also, the CRHSP tool is filled routinely, a practice that was not interfered with in the study protocol, whereas the INDEPTH tool was filled in the research mode. It would have been ideal to validate the VA instruments against medical certification; however preponderance of home deaths precluded this option. Attempts were made to retrieve the medical records of the deceased in case of hospital deaths, but these records could not be traced in most cases as these are usually destroyed after the death of the child. Records could not be retrieved from hospitals also, as deaths had occurred in hospitals that were spread across a wide geographic area. Moreover, selective admission to hospitals in a rural area may bias the validation of a tool that is used in a field setting.

Overall, in the 29 days to <5 year period, the CSMFs by CRHSP VA tool were within the 20% limit of the CSMF by the INDEPTH VA tool for most causes of deaths. However, in neonatal deaths, most CSMFs by the CRHSP VA tool were not found to be within the 20% limit of the CSMF by the INDEPTH VA tool. The smaller number of deaths in the neonatal age group could probably be the reason for this difference. Many factors including the design, type of interviewers and respondents, the recall period, cause-of-death ascertainment mechanisms and cause-of-death classification affect the performance of VA tools.

It can be concluded that despite the limitations mentioned above, the CRHSP VA tools performed satisfactorily in the field setting. The use of CRHSP tool takes less time to complete the forms, requires less intense training, and provides data that are useful for priority setting. Hence, the use of short VA tool by health workers can fill the gaps in cause-specific childhood mortality information in places where medical certification of cause of death is deficient.

Acknowledgements
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References


Initiating tobacco cessation services in India: challenges and opportunities

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Background: Tobacco use contributes significantly to the diseases burden in India. Very few tobacco users spontaneously quit. Therefore, beginning 2002, a network of 19 tobacco cessation clinics (TCCs) was set up over a period of time to study the feasibility of establishing tobacco cessation services.

Methods: Review of the process and operational aspects of setting up TCCs was carried out by evaluation of the records of TCCs in India. Baseline and follow-up information was recorded on a pre-designed form.

Results: During a five-year period, 34 741 subjects attended the TCCs. Baseline information was recorded in 23 320 cases. The clients were predominantly (92.5%) above 20 years, married (74.1%) and males (92.2%). All of them received simple tips for quitting tobacco; 68.9% received behavioural counselling for relapse prevention and 31% were prescribed adjunct medication. At six-week follow-up, 3255 (14%) of the tobacco users had quit and 5187 (22%) had reduced tobacco use by more than 50%. Data for three, three-monthly follow-ups was available for 12 813 patients. In this group, 26% had either quit or significantly reduced tobacco use at first follow-up (three-months), 21% at the second (six-months) and 18% at the third follow-up (nine-months) had done so.

Conclusions: It is feasible to set up effective tobacco cessation clinics in developing countries. Integration of these services into the health care delivery system still remains a challenge.

Key words: Tobacco cessation, health services, behaviour counselling, nicotine replacement therapy, India

Introduction
Tobacco use is a major modifiable risk factor for health globally. In the South-East Asia Region (SEAR), smoking prevalence ranges from 29.8% to 63.1% among men and 0.4% to 15% among women. The practice of tobacco chewing also needs attention. Smokeless tobacco use ranges from 1.3% to 38% among
men and 4.6% to 27.9% among women.\(^1\) India has a huge burden of tobacco-related morbidity, disability and mortality.\(^2\) Nearly one-third to more than half of those above 15 years use some form of tobacco.\(^2\) The Global Adult Tobacco Survey (GATS) in 2010 revealed that 47.9% of males and 20.3% of females, constituting 34.6% of the adult population, used tobacco in one or the other form in India.\(^8\)

The WHO Framework Convention on Tobacco Control (FCTC) recommends comprehensive policies for tobacco control, including cessation or treatment of tobacco dependence. Offer to help quit tobacco use is one of the six strategies for tobacco control advocated by WHO under MPower and technical guidelines for tobacco cessation have also been developed for different levels of health care providers. However, despite the enormous health burden resulting from tobacco use, there were no organized tobacco cessation services in India until 2001.

Global support for tobacco control policies and national data on mortality and morbidity related to tobacco use began to have its impact on policy and programming for tobacco control in India.\(^9\) In 2002, formal tobacco cessation facilities were set up for the first time. The purpose of the tobacco cessation clinics was to develop simple intervention models for tobacco cessation for smokers and smokeless tobacco users, to generate experience in the delivery of these interventions that can be applied in the primary care setting, and finally, to study the feasibility of implementing these interventions and their acceptability in general primary health care settings.

**Methods**

The first formal tobacco cessation clinics were set up in 2002, as a joint initiative of the Ministry of Health and Family Welfare, Government of India and the World Health Organization’s Country Office for India. Principal investigators from selected tertiary level health facilities were trained in tobacco cessation services in Thailand. Thirteen tobacco cessation clinics (TCC) were set up in psychiatry (3), cancer (5), surgical (2), cardiology (1), chest diseases (1) as well as in a nongovernment organizational setting (1). The TCCs were subsequently expanded to five more Regional Cancer Centres (RCC) in 2005. Another TCC has more recently been added in a general hospital setting.

The space for the TCCs was provided in the existing facilities. At a consultative meeting, organized by the Ministry of Health & Family Welfare, guidelines for assessment and intervention were evolved by consensus. The concept and operational plan was prepared by technical experts from three premier institutions, i.e. The Institute of Human Behaviour and Allied Sciences, Delhi, the National Institute of Mental Health and Neuro Sciences, Bangalore, and the Post-Graduate Institute of Medical Research, Chandigarh, supported by the WHO Country office, for India.

The staff involved in running the centers—either a psychologist, social worker or medical officer—was trained in a two-day workshop on psychosocial and pharmacological approaches to cessation. A similar workshop was held during the expansion phase. All investigators and staff were brought together annually for a review of the work and to enhance their skills in specific areas as per the need. Each clinic was supported with two personnel, a computer and a carbon monoxide monitor. The tobacco cessation approach followed at the tobacco cessation clinics is outlined in Table 1.

A brief intake form with minimum baseline information on socio-demographic information, duration and type of tobacco use and the type of...
Initiating tobacco cessation services in India

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A tobacco cessation intervention was developed and used in all the TCCs. Active efforts were made to recruit tobacco users for cessation at the TCCs through liaison with other medical services, community participation in camps and awareness programmes, referral by doctors, friends and relatives or by self-referral. All the TCCs maintained follow-up information for six weeks and some also maintained longer-term follow-up information.

Results

During the first five years of the setting up of the TCCs, 34,741 cases were registered across 18 TCCs. Baseline information was recorded for 23,320 cases.

Socio-demographic characteristics

Most of the clients were married (74.1%), males (92.2%), and above 21 years (82.5%). Nearly half of the respondents had more than 10 years of education. Median monthly income was ₹ 3,000. Women who sought treatment at the TCCs were comparatively older than the men, less educated and with lower monthly income levels. Students constituted a very small proportion of the TCC clients (Table 2).

Table 1: Tobacco cessation approach

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Enhancing knowledge of dangers of continuing tobacco use and benefits of quitting</td>
</tr>
<tr>
<td></td>
<td>Encouragement to quit with simple tips to deal with withdrawal</td>
</tr>
<tr>
<td></td>
<td>Handouts with information on tobacco dependence and cessation</td>
</tr>
<tr>
<td>Behaviour counselling</td>
<td>Focused on relapse prevention measures such as recognizing and coping with internal and external triggers for tobacco use.</td>
</tr>
<tr>
<td>Medication</td>
<td>Included bupropion and nicotine chewing gums (gums were not available in India in the first few years of initiation of the TCCs).</td>
</tr>
</tbody>
</table>

Tobacco use pattern

A majority of those accessing tobacco intervention services were chewers (65.5%). Smokeless tobacco use was significantly associated with income below ₹ 1,500 per month and education below 10 years (p < 0.001). Women accessing services were more likely than men to use smokeless tobacco (83.5% and 64% respectively). Self-report of alcohol use among the smokers was relatively low (18%), almost exclusively a male phenomenon. None of the tobacco chewers reported concomitant alcohol use.

Types of intervention

All cessation service seekers were provided motivation and simple tips on how to quit tobacco. Behaviour counselling (BC) as the primary strategy for cessation was provided to 16,070 (68.9%) subjects. In addition to behaviour counselling, 4,713 (20.2%) received medication (mostly bupropion), 2,362 (10.1%) received nicotine replacement therapy (NRT) and a few (175; 0.8%) got both NRT and medication. At the time of this study, varenicline was not available as a treatment option.
### Table 2: Profile of clients attending tobacco cessation clinics and six-week tobacco quit rates

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total N=23,320</th>
<th>Males N=21,500</th>
<th>Females N= 1820</th>
<th>6 week quit rates</th>
<th>Total N=10471</th>
<th>Males N=9875</th>
<th>Females N=596</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Age in years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>1759 (7.5)</td>
<td>1686 (7.8)</td>
<td>73 (4.0)</td>
<td>282 (16.0)</td>
<td>270 (16.0)</td>
<td>12 (6.4)</td>
<td></td>
</tr>
<tr>
<td>21-40</td>
<td>13267 (56.9)</td>
<td>12289 (57.2)</td>
<td>978 (53.7)</td>
<td>1833 (13.8)</td>
<td>1733 (14.1)</td>
<td>100 (10.2)</td>
<td></td>
</tr>
<tr>
<td>&gt; 40</td>
<td>8289 (35.6)</td>
<td>7520 (35.0)</td>
<td>769 (42.3)</td>
<td>1140 (13.8)</td>
<td>1072(14.3)</td>
<td>68 (8.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Education in years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2127 (9.1)</td>
<td>1713 (8.0)</td>
<td>414 (22.8)</td>
<td>254 (11.9)</td>
<td>219 (12.8)</td>
<td>35 (8.5)</td>
<td></td>
</tr>
<tr>
<td>1 to 5</td>
<td>2605 (11.2)</td>
<td>2216 (10.3)</td>
<td>389 (21.4)</td>
<td>353 (13.6)</td>
<td>324 (14.6)</td>
<td>29 (7.5)</td>
<td></td>
</tr>
<tr>
<td>6 to 10</td>
<td>7487 (32.1)</td>
<td>6879 (32.0)</td>
<td>608 (33.4)</td>
<td>1047 (14.0)</td>
<td>977 (14.2)</td>
<td>70 (11.5)</td>
<td></td>
</tr>
<tr>
<td>&gt; 10</td>
<td>11076 (47.5)</td>
<td>10668 (49.7)</td>
<td>408 (22.4)</td>
<td>1599 (14.4)</td>
<td>1553 (14.6)</td>
<td>46 (11.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>17274 (74.1)</td>
<td>15752 (73.2)</td>
<td>1522 (83.6)</td>
<td>2364 (13.7)</td>
<td>838 (15.0)</td>
<td>21 (11.8)</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>5760 (24.7)</td>
<td>5582 (26.0)</td>
<td>178 (9.8)</td>
<td>859 (14.9)</td>
<td>2212 (14.0)</td>
<td>152 (10.0)</td>
<td></td>
</tr>
<tr>
<td>Widowed/ separated</td>
<td>286 (1.2)</td>
<td>166 (0.8)</td>
<td>120 (6.6)</td>
<td>32 (11.1)</td>
<td>25 ( 15.1)</td>
<td>7 (6.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional/semi-</td>
<td>10933(46.9)</td>
<td>10383 (48.3)</td>
<td>530 (29.0)</td>
<td>1765 (16.2)</td>
<td>1720 (16.6)</td>
<td>45 (8.5)</td>
<td></td>
</tr>
<tr>
<td>professional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-skilled/ unskilled</td>
<td>1830 (7.8)</td>
<td>1634 (7.6)</td>
<td>43 (2.4)</td>
<td>201 (11.0)</td>
<td>195 (10.9)</td>
<td>6 (14.0)</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>1662 (7.2)</td>
<td>1787 (8.3)</td>
<td>28 (1.5)</td>
<td>215 (12.9)</td>
<td>212 (13.0)</td>
<td>3 (10.7)</td>
<td></td>
</tr>
<tr>
<td>Others/not classified</td>
<td>8895 (38.1)</td>
<td>7696 (35.8)</td>
<td>1219 (67.1)</td>
<td>1074 (12.0)</td>
<td>948 (12.3)</td>
<td>126 (10.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly income ₹</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500</td>
<td>4209 (21.5)</td>
<td>3761 (20.4)</td>
<td>448 (41.6)</td>
<td>899 (13.7)</td>
<td>779 (14.2)</td>
<td>120 (10.9)</td>
<td></td>
</tr>
<tr>
<td>1500 to 3000</td>
<td>5502 (28.2)</td>
<td>5215 (28.3)</td>
<td>287 (26.7)</td>
<td>652 (13.9)</td>
<td>637 (13.9)</td>
<td>15 (5.9)</td>
<td></td>
</tr>
<tr>
<td>&gt; 3000</td>
<td>9823 (50.3)</td>
<td>9482 (51.3)</td>
<td>341 (31.7)</td>
<td>1681 (14.4)</td>
<td>1640 (14.6)</td>
<td>41 (9.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Type of tobacco use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>6809 (29.2)</td>
<td>6549 (30.4)</td>
<td>260 (14.3)</td>
<td>830 (12.2)</td>
<td>798 (12.2)</td>
<td>32 (12.3)</td>
<td></td>
</tr>
<tr>
<td>Smokeless</td>
<td>15271 (65.5)</td>
<td>13751 (64.0)</td>
<td>1520 (83.5)</td>
<td>2309 (15.1)</td>
<td>2165 (15.7)</td>
<td>144 (9.5)</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>1240 (5.3)</td>
<td>1200 (5.6)</td>
<td>40 (2.2)</td>
<td>116 (9.4)</td>
<td>112 (9.3)</td>
<td>4 (10.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Type of Intervention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC alone</td>
<td>16070 (68.9)</td>
<td>14803 (68.9)</td>
<td>1267 (69.6)</td>
<td>2007 (12.5)</td>
<td>1893 (12.8)</td>
<td>114 (9.0)</td>
<td></td>
</tr>
<tr>
<td>BC+ Medication</td>
<td>7250 (31.1)</td>
<td>6697 (31.1)</td>
<td>553 (30.4)</td>
<td>1248 (17.2)</td>
<td>1182 (17.6)</td>
<td>66 (11.9)</td>
<td></td>
</tr>
</tbody>
</table>

* BC= behavioural counselling *both categories included motivation
Outcome at six weeks
Information on six-week outcome was available for 10,471 subjects (44.9% of the entire group). Of them, 3,255 (31.1%) had quit, 5,187 (49.5%) reported significant improvement (reduced intake by 50% or more compared to baseline) and 2,029 (8.7%) reported ‘no change’. Considering those lost to follow-up as ‘not improved’, the improved group was 36% (14% quitters and 22% who had reduced use by 50% or more).

Among men, factors associated with improved outcome at six weeks included a younger age, use of smokeless tobacco, and combined pharmacological and behavioural interventions. Among women, while outcome in general was poorer than men, combined use of pharmacotherapy and behavioural counselling was associated with a better outcome and lack of education with a poorer outcome.

Longer-term outcome
Only some of the TCCs maintained longer-term follow-up data. Three-monthly follow-up data (for nine months) was available for 12,813 clients. In this group, 26% were in the improved category at the first follow-up (three months), 21% at the second follow-up (six months) and 18% at the third follow-up (nine months). What is striking is that of those who remained in follow-up, a significant number moved from the ‘no-change’ to the ‘improved’ category over a period of time. This indicates the need for retaining people in follow-up for chronic, relapsing conditions like tobacco dependence, in order to improve longer-term outcome.

Discussion
In 2010, smoking is expected to have caused about 930,000 adult deaths in India. Because of population growth, the absolute number of deaths in this age group is rising by about 3% per year. As per GATS India, five in ten current smokers and users of smokeless tobacco planned to quit or at least thought of quitting. In this scenario, it became important for India to institute a tobacco control programme, including expansion of facilities for tobacco cessation.

A major lesson from the study is that it is possible to establish effective tobacco cessation services in diverse health settings with optimal use of existing infrastructure and minimal support. It is also evident that follow-up is a very important component of care to ensure better outcome. There is a need to build awareness regarding the availability and benefits of tobacco cessation services. Educating the community about the benefits of tobacco cessation interventions is likely to improve retention in tobacco cessation programmes.

Several predictors of tobacco cessation have been described in earlier studies including intention to quit, recent episode of quitting, longer duration of recent quit, negative attitudes to smoking and a younger age. It has also been suggested that stopping tobacco use before the age of 40 years may be critical to improve health. In our experience, help is sought usually in the fourth decade, when many tobacco-related health problems may have already occurred. Nevertheless, our findings that younger people are more likely to be retained in treatment and have better outcomes, is an indicator to provide outreach to tobacco users at an early stage. The feasibility of using innovative technology such as mobile phones or quit tobacco helplines could be explored to improve access by youth and in hard-to-reach cases.

Healthcare givers at all levels of the healthcare delivery system must be trained
Initiating tobacco cessation services in India

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in tobacco dependence treatment including behaviour counselling and pharmacotherapy. We found that physicians, in general, lacked knowledge of tobacco cessation protocols and felt uncomfortable or at a loss in their ability to handle needs of their patients for tobacco cessation. Data from the Indian Global Health Professionals Students Survey (GHPSS) between 2005-2008 among dental, medical, nursing and pharmacy students, showed high prevalence of tobacco use and a general lack of training among health professionals in patient cessation counselling techniques.13 Dental professionals also need to be aggressively involved in smokeless tobacco cessation.14

Education of health professionals is needed to occur both within the governmental health systems as well as in the private sector. It is important to ask every patient visiting any health facility about tobacco use as it has been observed that few physicians ask their patients about tobacco use.15 Educating physicians in asking and assessing tobacco use among patients as well as training them in tobacco cessation on a wider scale is an urgent need. In this regard, several resources have been developed by the Ministry of Health & Family Welfare, Government of India and the WHO Country office for India. These resources include a training manual for tobacco cessation developed under the cancer control programme, a manual for dentists, a training module for doctors; these can also be used for training in tobacco cessation.16-18 'National Guidelines for Tobacco Dependence Treatment' have also been developed which need to be widely disseminated.19 More detailed manuals on tobacco cessation for both doctors and nurses and other professionals have also been developed for the SEA Region.20,21

There has not been much research on tobacco dependence treatment or cessation in so far as smokeless tobacco is concerned. The Indian experience of offering cessation services to smokers as well as to smokeless tobacco users, especially the chewers, is unique. GATS India has also revealed that 26% of the adult population in India uses smokeless tobacco.8 Considering that only about 1% of smokeless tobacco users report having spontaneously quit,8 it is very important to address smokeless tobacco cessation in India.

Tobacco chewing is more prevalent among Indian women as compared to smoking; in some parts of India it is as high as 57%.22 A significant problem of tobacco use among students is recently coming to light,23 and a shift of use to younger persons is expected.24 In a study from a TCC at Chandigarh, 92% of subjects were in the 10-19 years age range and a majority (68.2%) had started tobacco use under peer pressure.25 The lower socio-economic stratum is underrepresented among our treatment seekers. These groups would benefit more from cost-effective interventions at the community level.

Studies in western settings,11 as well as the present study indicate improved quit rates with the addition of pharmacotherapy to behaviour counselling. Our experience also suggests a better outcome with the combination of these two approaches. Similar encouraging results have been reported with the combined approaches in a chest diseases tobacco cessation setting in India.26 The evidence for combined efficacy of pharmacotherapy and behavioural counselling in enhancing rates of tobacco cessation is now available.27-29

Taking into consideration the high prevalence of tobacco use in India, community cessation intervention programmes should be integrated in the primary health care delivery services within a proper monitoring and evaluation framework. A study from Thailand reports benefits from a community pharmacist-based smoking cessation programme.30
The data collected during the preliminary phase of establishment of the TCCs is extremely basic but provides some valuable insights into the kind of populations that have accessed tobacco cessation services. The sample is heterogeneous from diverse clinical settings and population groups. Although staff delivering the services received brief training in tobacco cessation intervention, there is likely to have been a great amount of variability in counselling depending on the staff's background, training and treatment setting. Despite these limitations, the establishment of the TCCs has been the first step in providing formal tobacco cessation services in India. In a country where use of tobacco is widespread, it is critical to establish the evidence for achievement of effective tobacco cessation by use of behavioural counselling and optimal pharmacotherapy. Extending tobacco cessation services to rural populations, given the higher prevalence of tobacco use in rural populations, is imperative. Behaviour counselling is applicable and acceptable in rural settings, where access to pharmacotherapy may be limited. Studies from India have shown that health education and community awareness has helped in tobacco cessation.\(^3\)\(^1\),\(^3\)\(^2\)

The existing TCCs are not sufficiently equipped to take care of any population-based cessation scale-up programme. It would be critical to build cessation capacity in the medical and dental college hospitals, both to provide the needed training to the students and also to cater to the cessation needs of the population. In low-resource settings, with limited access to pharmacotherapy, there is also a need to evaluate cost-effective behavioural interventions, particularly for smokeless forms of tobacco use, for further expansion of tobacco cessation activities.\(^3\)\(^3\)

The Government of India initiated the National Tobacco Control Programme in 2007-08. Taking into account the widespread use of tobacco and need for assisting tobacco users to quit, provision was made to establish tobacco cessation facilities at the district hospital level. This was a major step forward in establishing tobacco cessation facilities as near the community as possible. A psychologist and a social worker are provided at the District Tobacco Control Cell to undertake tobacco cessation activities. The Government of India has decided to make most of the TCCs self-sufficient and continue their activities in a sustainable manner from 2010-11 onwards. The focus of these RCTCs would be to build capacity of the states in tobacco cessation by conducting training of health professionals and also to focus on setting up cessation facilities in medical and dental institutions. National Guidelines for Tobacco Dependence Treatment have taken care of smokeless tobacco cessation along with the focus on smoking cessation. Training modules for doctors and health workers were also developed in 2010-11 emphasizing the “brief advice” for tobacco cessation. For the first time, tobacco cessation was also incorporated in the training modules of doctors under the Revised National Tuberculosis Control Programme (RNTCP). All medical and dental colleges, general hospitals and tuberculosis hospitals have been encouraged to set up tobacco cessation facilities as part of care giving, using existing infrastructure and resources to make these sustainable.

To conclude, tobacco cessation services established in selected tertiary level centres in India were well received and short-term outcome of subjects seeking help was encouraging. However, tobacco cessation activities clearly need to be up-scaled, and the public better informed of the availability and relevance of such interventions. Younger persons using tobacco, women users, rural populations and the economically under-privileged need to be more actively targeted.
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Tobacco cessation must be offered more widely in medical settings in both urban and rural areas. The integration of tobacco cessation with existing national health programmes is a cost-effective strategy to widen the cessation services for effective outreach at the community level. The use of innovative technologies like mobile phones and setting up quit-lines can give a major impetus to the ongoing efforts of the Government of India for providing cessation facilities to a larger population, especially in the remote and rural areas. A clear and definite need for well-designed studies to examine the longer-term impact of tobacco cessation interventions in low-and middle-income settings is important for further expansion of these services.

Acknowledgements

We acknowledge the contribution of Acharya Harihar Regional Cancer Center, Cuttack (UR Parija), Bhagwan Mahaveer Cancer Hospital, Jaipur (Vivek Sharma, Rahman AU), B Barooah Cancer Institute, Assam (Joydeep Das), Cancer Institute, Chennai (Rohini Prem Kumari, E Vidhubala), Chatrapati Shahuji Maharaj Medical University, Lucknow (Ramakant B), Chittaranjan National Cancer Institute, Kolkata (Utpal Sanyal), Institute of Behavior and Allied Sciences, New Delhi (SN Gupta, Uday Singh, Deepak Kumar, Rupali Shivalkar), Indira Gandhi Institute of Cardiology, Patna (Mahabir Das), Jawaharlal Nehru Cancer Hospital and Research Center, Bhopal (Dilip Kumar Kar), MNJ Institute of Oncology and Regional Cancer Center, Hyderabad (BN Rao), National Institute of Mental Health and Neuro Sciences (Issac M, Benegal V), Bangalore, National Organization for Tobacco Eradication, Goa (Shekhar Salkar), Post Graduate Institute of Medical Research, Chandigarh (Anil Malhotra), Pramukhswami Medical College and Shree Krishna Hospital, Gujarat (Girish Mishra), Regional Cancer Center, Mizoram (Jane R Ralte), Regional Cancer Center, Thiruvananthapuram (Jayakrishnan R), Tata Memorial Hospital, Mumbai (Surendra Shastri), Vallabhbhai Patel Chest Institute, New Delhi (Raj Kumar), Ministry of Health and Family Welfare, Government of India, WHO Country Office for India., and the staff of TCC IHBAS and NIMHANS. We also gratefully acknowledge the active role played by the subsequent co-ordinators of the various TCCs towards tobacco control and cessation.

References


Betel quid chewing and its risk factors in Bangladeshi adults
Meerjady S Flora, Christopher GN Mascie-Taylor, Mahmudur Rahman

Background: Despite its ill effects, betel quid chewing is a common practice in the South-East Asia Region. However, so far no large-scale study had been conducted, hence, this study was aimed at estimating the extent of betel quid chewing and its association with socio-demographic factors in Bangladeshi adults.

Methods: The data of a cross-sectional sample survey, involving 15,155 and 15,719 adults from rural and urban areas of Bangladesh respectively, were analyzed. Data were collected on betel quid chewing and socio-demographic characteristics by interview method using a pre-tested structured questionnaire. Anthropometric measurements were done following standard protocols.

Results: Overall 31% of the study samples chewed betel quid regularly. Prevalence was two times higher in rural (43.2%) compared to the urban areas (19.1%). Betel quid use was more common among Hindus (41.4%), farmers (55.3%), and people in the 40-year or more (63.9%) age group; and the habit was less common in unmarried (1.6%) and educated persons (19.6%). Ex-smokers (73.8%) and current smokers (37.3%) were more likely to use betel quid than never smokers (25.6%). The frequency of betel quid chewing was 5.15 times a day which varied significantly with age, locality, religion and occupation. Three-fourths of the betel quid users chewed tobacco with it which was not influenced by socio-economic variables. On average, 2.29 Takas (USD 0.03) was spent a day on betel quid chewing.

Conclusions: Betel quid chewing was found to be a common habit in Bangladesh. Mature adults (40+years) of low socio-economic status, i.e., rural residents, farmers and the illiterate are more likely to chew betel quid.

Keywords: Betel quid, areca nut, adults, risk factors, smoking, Bangladesh.

Introduction
Betel quid, the leaf of *Piper betle* vine, is usually taken with aqueous calcium hydroxide paste (slaked lime), pieces of areca nut (*supari*) and some other ingredients, which vary with individual taste and region. After introduction, tobacco soon became the most commonly used ingredient with the betel quid.¹ Betel quid chewing is a popular

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Betel quid chewing in Bangladeshi adults

Betel quid chewing is a traditional activity that is integrated into social and cultural practices and ceremonies. It is a cheaper pleasure, affordable by the least advantaged members of the community. The habit has been prevailing for at least 2000 years throughout South Asia, South-East Asia and the South Pacific. It is the fourth most commonly used psychoactive substance in the world after caffeine, alcohol and nicotine.

Areca nut is often chewed in a betel quid. It is regarded by many people in South Asia as good for health. It is used as an astringent, mouth freshener, a taste enhancer, purgative, intoxicant, for impotence and gynaecological problems, parasitic intestinal infection and for indigestion and prevention of pregnancy-related morning sickness. It is also used as a mildly euphoric stimulant because it contains relatively high levels of psychoactive alkaloids. Chewing increases the capacity to work, causes a hot sensation in the body and heightens alertness. It is used among the poor to avoid boredom and to suppress hunger.

A study in the UK reported that 42% of South Asian immigrants (from Bangladesh) chewed areca nut because it gave them a refreshing feeling and 35% used it because of its good taste, 29% used it as a snack and others used it because it helped to relieve stress and was believed to strengthen the teeth and gums.

It is estimated that 600 million people use betel nut globally. The habit of betel quid chewing has been reported in many countries including Pakistan, Sri Lanka, Bangladesh, Thailand, Cambodia, Malaysia, Indonesia, China, Taiwan, Papua New Guinea, several Pacific Islands, and migrant populations in places like South Africa, Eastern Africa, North America, UK, and Australia. In Thailand, a decline has been recorded, while in Taiwan an increase in consumption was noticed, especially among children and youths. The per capita consumption of betel quid in Taiwan has increased from 1.4 kg in 1981 to 7.5 kg in 1996. In 2001, 14.4% of adult males and 1.5% of adult females were current betel nut chewers. Betel quid chewing is socially acceptable in all sections of society, in all age groups, and among women; although in most countries it is more often confined to the older age groups. Blue collar workers and the rural poor had a higher chewing rate. Education and income were inversely correlated with betel quid use. In Pakistan, at least one chewable product of betel, areca and tobacco are used daily by 40% of the adolescents and adults.

Bangladeshis traditionally, for a long time, have been chewing betel quid as a popular habit. A study, done on a limited sample, reported that 30% of the adults were using betel nut regularly. However, large-scale studies have not been conducted to find out the extent of this habit in Bangladesh. This study was aimed to determine the magnitude of betel quid chewing and its association with locality, sex, education, occupation, smoking and other characteristics since betel quid, even without tobacco, was recently classified as a human carcinogen by the International Agency for Research on Cancer (IARC). Case-control studies from India, Pakistan and Taiwan reported an independent effect of betel quid as a risk factor for oral cancer. It had increased relative risks for pre-cancers; and dose-response trends were also noticed for both frequency and duration of betel quid use. People using betel quid without tobacco were 9.9 times more likely to develop oral cancer than non-users after adjustment for other covariates.

Methods

Cross-sectional sample surveys were conducted in 15 155 rural and 15 719 urban adults to find out the extent of betel quid chewing in Bangladesh. These surveys were conducted in Mirpur, an area in the capital city Dhaka and the rural Kaliganj sub-district which is...
approximately 42 km from the capital. These areas are representative of the general urban and rural populations of Bangladesh. The distribution of age and other background characteristics of this sample appear to reflect the profile of the adult Bangladeshi population.11,12 These areas were chosen to assess whether betel quid chewing differed markedly between rural and urban areas, independent of the variation in socioeconomic characteristics. At 99% confidence level with 5% relative precision, and assumed prevalence of betel quid chewing to be 30.3%,8 estimated sample size was 6108 individuals for each sex in each area. Considering non-response rate and missing data the targeted sample size was rounded to 15 000 in each area.

To select the sample households, the interviewers’ chose a specific place (usually the central point) as a start point for the survey and sampled every second household in the urban or rural areas. The direction for the survey in the locality was chosen entirely by chance (toss of a coin). Only households having at least one male and one female respondent over 18 years of age were included in the survey provided respondents agreed to participate in the study. The exclusion criteria were those who were extremely ill, mentally handicapped or unwilling to participate. However, all households agreed to participate in the study. Although equal representation of both sexes was targeted, about 54% were females in each survey.

Four teams comprising one male and one female interviewer were recruited from the local community. These teams were intensively trained. Male household members were interviewed by male interviewers and female interviewers collected data from the female members. A pre-tested structured questionnaire printed in Bangla was used for data collection. Verbal consent was obtained from every respondent. Interviews were conducted in private. Ethical approval was obtained from the Ethical Committee of the National Institute of Preventive and Social Medicine.

The socio-demographic data included age, sex, marital status, educational attainment, religion, and main occupation. The betel quid chewing data covered prevalence and its cost. Betel quid users were defined as those who took betel leaf with areca nut and lime (with or without tobacco) daily at the time of the data collection. Tobacco is chewed as part of a mixture with betel nut in two different forms, *zarda* and tobacco leaf. *Zarda* is a commercially prepared moist or dry chewed tobacco mixed with a variety of colourings, spices and essences while tobacco is used as dried, whole leaf after chopping it up. Current smokers were defined as those who smoked daily at the time of the data collection; ever smokers as those who had smoked at some time in their life either daily or occasionally; the past smoker category included those who had stopped smoking before the data collection period but used to smoke daily in the past, and occasional smokers were those who smoked occasionally.

The analyses were carried out using the Statistical Package for Social Sciences (SPSS) version 14.0. Prevalence was weighted to account for the age distribution, sex and locality stratification. Distribution of the data was checked and where necessary, log transformation was done to normalize the data before statistical analyses. Statistical tests used to determine the association between exposure and outcome variables included $\chi^2$ test, independent sample t-test and ANOVA. To test the statistical significance, $p$ value level of <0.05 was considered but due to the large sample size a more stringent cut-off of $p<$0.01 or less was usually used. In addition, as a number of statistical tests were conducted, the Bonferroni correction ($\alpha/K$, where $\alpha$ is the...
Overall 31% (95% CI: 30.99 to 31.01) of the study sample was found to be using betel quid but there was significant heterogeneity in relation to the socio-demographic variables (Table 1). Rural residents (43.2%) were twice as likely to chew betel quid as their urban counterparts (19.1%), (p <0.001). The chewing rate was two percent higher among females (31.8%) than males (29.8%).

Betel quid chewing increased significantly from younger to older age groups peaking in the 50-69 year age groups. More Hindus chewed betel quid compared to other religious groups. Unmarried respondents used betel quid least of all (OR 0.44; 95% CI: 0.34 to 0.56). Betel quid use decreased with increase in educational attainment. Farmers were more likely to chew betel quid (OR 1.23; 95% CI: 1.05 to 1.43). A sequential binary logistic regression model was significant (p<0.001).

Regular chewers took betel quid on average 5.15 times a day but there was variation by locality, occupation, religion and age (Table 3). Urban respondents and Muslims chewed betel quid more frequently. Businessmen took it significantly more frequently than the non-paid, farmers and servicemen or professionals. The frequency of betel quid chewing increased with age peaking in the 50-59 year age group. Multiple regression models did not show any effect of sex, marital status and education on the frequency of betel quid use after controlling for other variables. Although the model was significant (p<0.001) it could only explain 1.4% of the variation in betel quid chewing.

More than three-quarters of the betel quid users chewed tobacco with it. There was no significant difference in relation to socio-demographic status except for religion; Christians were more likely to take tobacco with betel quid (Table 4).

On an average, betel quid users spent 2.29 Takas (range <1-101 Takas) on betel quid and chewing tobacco. Table 5 shows that the mean expenditure varied markedly by the socio-demographic variables. Significant differences were found in expenditures by marital status, educational levels, religion and occupations. Multiple regression analyses controlling for other socio-demographic variables did not find any association with education and marital status. Only 18.2% of the variation could be explained in multiple regressions. Males, urban users, businessmen, and Muslims spent more money on betel quid chewing. Those in the 30-39 and 40-49 year age groups spent more than younger persons (<20 year age group).
Table 1: Betel quid chewing in relation to the socio-demographic characteristics in Bangladesh

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>Betel quid chewing n (%)</th>
<th>p-value**</th>
<th>Adjusted for socio-demographic variables*</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural*</td>
<td>15 155</td>
<td>6546 (43.2)</td>
<td>&lt;0.001</td>
<td>0.58</td>
<td>0.54 to 0.62</td>
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<tr>
<td>Urban</td>
<td>15 716</td>
<td>3009 (19.1)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
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</tr>
<tr>
<td>Male*</td>
<td>13 588</td>
<td>4055 (29.8)</td>
<td>&lt;0.001</td>
<td>1.20</td>
<td>1.04 to 1.37</td>
<td></td>
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<tr>
<td>Female</td>
<td>17 283</td>
<td>5500 (31.8)</td>
<td></td>
<td></td>
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<tr>
<td>Age (years)</td>
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<tr>
<td>&lt;20*</td>
<td>3654</td>
<td>30 (0.8)</td>
<td>&lt;0.001</td>
<td>6.71</td>
<td>3.46 to 7.36</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>10 033</td>
<td>674 (6.7)</td>
<td></td>
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</tr>
<tr>
<td>30-39</td>
<td>6502</td>
<td>2025 (31.1)</td>
<td>22.72</td>
<td>58.03</td>
<td>15.56 to 33.17</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>4887</td>
<td>2842 (58.2)</td>
<td>66.49</td>
<td>54.97</td>
<td>45.49 to 79.19</td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>2914</td>
<td>2003 (68.7)</td>
<td>96.90</td>
<td>59.99</td>
<td>65.90 to 142.48</td>
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</tr>
<tr>
<td>60-69</td>
<td>1822</td>
<td>1254 (68.8)</td>
<td>81.86</td>
<td>55.22</td>
<td>60.22 to 121.35</td>
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</tr>
<tr>
<td>70 +</td>
<td>1059</td>
<td>727 (24.90</td>
<td>&lt;0.001</td>
<td>63.54</td>
<td>43.02 to 96.82</td>
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<tr>
<td>Religion</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Islam*</td>
<td>28 834</td>
<td>8768 (30.4)</td>
<td>&lt;0.001</td>
<td>0.87</td>
<td>0.76 to 0.99</td>
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<tr>
<td>Hindu</td>
<td>1639</td>
<td>678 (41.4)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Christian</td>
<td>393</td>
<td>108 (27.5)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Marital status</td>
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<tr>
<td>Married*</td>
<td>23 685</td>
<td>8586 (36.3)</td>
<td>&lt;0.001</td>
<td>0.57</td>
<td>0.43 to 0.75</td>
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<tr>
<td>Unmarried</td>
<td>5819</td>
<td>91 (1.6)</td>
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<tr>
<td>Widow/ divorced</td>
<td>1366</td>
<td>878 (64.3)</td>
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<td>Educational status</td>
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</tr>
<tr>
<td>No schooling*</td>
<td>8669</td>
<td>5195 (59.9)</td>
<td></td>
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<tr>
<td>1-5 yrs of schooling</td>
<td>6547</td>
<td>2274 (34.7)</td>
<td></td>
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<td></td>
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<tr>
<td>6-10 yrs of schooling</td>
<td>10 498</td>
<td>1707 (16.4)</td>
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<tr>
<td>Higher secondary +</td>
<td>5134</td>
<td>37 (7.3)</td>
<td>&lt;0.001</td>
<td>0.17</td>
<td>0.15 to 0.20</td>
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<td>Occupation</td>
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<tr>
<td>Non-paid*</td>
<td>15 380</td>
<td>5504 (35.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>2138</td>
<td>6 (0.3)</td>
<td></td>
<td></td>
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<tr>
<td>Manual labourer</td>
<td>640</td>
<td>270 (42.2)</td>
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<tr>
<td>Farmer</td>
<td>3290</td>
<td>1818 (55.3)</td>
<td></td>
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<tr>
<td>Skilled labourer</td>
<td>993</td>
<td>215 (21.7)</td>
<td></td>
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<tr>
<td>Business</td>
<td>3152</td>
<td>1003 (31.8)</td>
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<tr>
<td>Service</td>
<td>4485</td>
<td>617 (13.8)</td>
<td>&lt;0.001</td>
<td>0.73</td>
<td>0.63 to 0.85</td>
<td></td>
</tr>
</tbody>
</table>

* Reference Group, OR- Odds Ratio, CI-Confidence Interval, **p-value by χ²-test.
*Adjusted for socio-demographic variables shown in the table.
### Table 2: Association of betel quid chewing with smoking, body mass index, and central obesity in Bangladesh

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Betel quid chewing</th>
<th>p-value**</th>
<th>Unadjusted</th>
<th>OR</th>
<th>95% CI</th>
<th>Adjusted for Socio-demographic variables</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never*</td>
<td>5441</td>
<td>25.6</td>
<td></td>
<td>0.31</td>
<td>0.26 to 0.37</td>
<td>1.03</td>
<td>0.83 to 1.28</td>
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<tr>
<td>Occasional</td>
<td>144</td>
<td>9.7</td>
<td></td>
<td>8.18</td>
<td>7.44 to 8.98</td>
<td>3.09</td>
<td>2.71 to 3.53</td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>1866</td>
<td>73.8</td>
<td></td>
<td>1.73</td>
<td>1.62 to 1.84</td>
<td>1.30</td>
<td>1.17 to 1.44</td>
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* Reference group, CED- Chronic energy deficiency, OR- Odds Ratio, CI-Confidence Interval, **p-value by χ²-test, †adjusted for locality, age, sex, education, occupation, religion and marital status.
Table 3: Frequency of betel quid chewing per day in relation to the socio-demographic characteristics in Bangladesh

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<th>Characteristics</th>
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<th>p-value</th>
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*Reference Group, †Geometric mean, SD- Standard deviation, p-value by ^t-test, ¯one-way ANOVA, NS- Not significant
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*p-value by χ²-test, NS- Not significant.
Table 5: Daily expenditure (in Taka) on betel quid in relation to the socio-demographic characteristics in Bangladesh

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<td>p-value</td>
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<tr>
<td>Non-paid*</td>
<td>2.02</td>
<td>2.75</td>
<td>&lt;0.001^</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>2.29</td>
<td>1.75</td>
<td>-.098</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
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<tr>
<td>Manual labourer</td>
<td>3.21</td>
<td>2.96</td>
<td>.036</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>2.17</td>
<td>3.12</td>
<td>-.024</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Skilled labourer</td>
<td>3.18</td>
<td>4.22</td>
<td>.042</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Business</td>
<td>3.36</td>
<td>5.06</td>
<td>.068</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Service/ professionals</td>
<td>3.35</td>
<td>3.31</td>
<td>&lt;0.001^</td>
<td>.032</td>
<td>10.0</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

*Reference group, †Geometric mean, SD- Standard deviation, p-value by ^t-test, °one-way ANOVA, NS- Not significant
Discussion

Despite betel quid chewing being a risk factor for oral cancer, it is a popular habit in South Asia, South-East Asia and the South Pacific. The prevalence of 31% estimated in this study is similar to the earlier report of 30.3% prevalence by Rahman et al. Prevalence of betel quid chewing in Bangladesh lies in the middle of the 20%-40% prevalence found in India, Pakistan and Nepal over the last two decades and in the South Asian immigrants to the UK, where 42% of adults used betel quid.

Adding tobacco with betel quid is a common practice in the South-East Asian countries. In the current study, three-quarters of the betel quid chewers added tobacco which is slightly lower than the report (85.2%) by Rahman et al. In the current sample betel quid chewing frequency was 5.15 times per day, on average. These rates are much lower than Pakistan where the mean frequency of betel quid chewing varied from 6.5 to 11 in different ethnic groups. In the Solomon Islands, subjects who chewed higher amounts of betel quid per day (>5) showed significantly higher risks of oral and pharyngeal cancer than those who chewed less quids (<5). The cessation rates of betel quid chewing were associated with the decreasing daily consumption of betel quid. Hence, reduction of the daily amount, in a betel quid cessation programme, could be associated with future stopping habit.

Several factors influence betel quid chewing, including ethnicity, demographic and psychosocial factors, its accessibility and public policy. Personal habits are dictated by different social and cultural behaviours in both sexes. Four factors form the foundation for the popularity of betel quid chewing: Social acceptability, religious beliefs, perceived health benefits and addiction.

As there are no social restrictions, betel quid chewing, with added tobacco, has been a traditional practice for a long time among Bangladeshi women. There was no sex-difference in betel quid chewing in the current study although Rahman et al found that females used betel quid in higher proportions (34.6%) than males (26%); this might reflect sampling differences between the two surveys. In Karachi, an equal percentage (30%) of men and women chewed betel quid, while in Taiwan more males than females used it (14.4% versus 1.5% respectively) but in Cambodia, females (32.6%) outnumbered males (0.8%) in betel quid chewing and in Mumbai (India) 37.8% of men and 29.7% of women used betel quid. Even if women had a lower chewing behaviour, they were less likely to stop chewing than men. As regard to whether betel quid chewing cessation has an association with sex, ethnicity and type of quid, male chewer’s are the major focus in betel quid chewing prevention programmes.

No sex difference was found in frequency of betel quid chewing; the overall mean was 5.21 times/day which is slightly lower than the mean of 5.88 found by Khan et al. This study also found that a high proportion of male (77.7%) and female (75.8%) betel quid chewers also took tobacco which is in agreement with the finding of Rahman et al where the male and female who were taking tobacco with betel quid were 80.3% and 88.1% respectively. Males spent 7.3 times more than females (6.38 and 0.87 Takas, respectively) which is much greater than the difference found by the Bangladesh Bureau of Statistics study (5.25 and 2.62 Takas by males and females, respectively).

The findings of the current study were in agreement with Rahman et al in showing that the proportion of betel quid chewers increased with age and more than 50% of the middle-to elderly-aged persons took betel quid, which
was very high in comparison to Taiwan, where only 20% used it.\(^6\) Rahman \textit{et al} did not find any difference in chewing tobacco among betel quid users in different age groups, which is consistent with the current data.\(^8\) The frequency of betel quid chewing increased with age and remained similar in the middle-and elderly-age groups.

Urban residents were less likely to use betel quid than in the rural areas (19.1% versus 43.2%), but their frequency of chewing was higher (5.44 and 5.02 times/day for urban and rural areas respectively). Rahman \textit{et al} and Wen \textit{et al} also found a lower usage in urban than rural areas in Bangladesh\(^8\) and Taiwan\(^6\) respectively. Rahman \textit{et al} also showed that the prevalence of betel quid use decreased with improving socio-economic class of urban residents.\(^8\) The current study, however, showed no significant difference in tobacco chewing between urban and rural betel quid users (75.5% and 77.1% respectively) after adjusting for the other socio-demographic variables. No locality differences in chewing tobacco were found among males in a Bangladeshi study\(^16\) or in an Indian study involving both sexes.\(^18\)

Educational attainment was inversely associated with betel quid use in the current study which is consistent with the findings of a Taiwanese study.\(^6\) Education always plays a vital role in the health status of a country and also in the development of health behaviour of an individual.\(^19\) Our study also showed that manual labourers and farmers were more likely to chew betel quid. However, business persons also used betel quid frequently. Thus, male manual labourers appear to be the occupational group most at risk for the hazards of betel quid chewing as they are more likely to chew tobacco than other occupations.

Another important finding is that betel quid chewing is closely associated with religion. A study from Leicester, UK, reported that areca nut chewing was most common among first generation Asian immigrants with the highest prevalence among Jains (28%) and Muslims (23%) followed by Hindus (18%). In second generation Asian immigrants, this practice was highest among Muslims (17%) followed by Hindus (13%) and Jains (12%).\(^20\) Our study revealed that Hindus were more likely to chew betel quid with tobacco. Betel quid is regarded by many Indians as a fruit of divine origin. It is considered an auspicious ingredient in Hinduism and is used along with betel leaf in religious ceremonies, important social gatherings and weddings and when honouring individuals.\(^5\)

Seventh-Day Adventists in Solomon Islands were less likely to be betel quid chewers. This might be explained by the code of abstinence from betel quid use recommended by the Seventh-Day Adventists.\(^21\)

When betel quid with tobacco is consumed with alcohol and smoking, relative risk increases elevenfold.\(^22\) We found a significant association between smoking and betel quid use. Betel quid use rate was higher among current smokers than among never smokers but the rate was highest among ex-smokers. Probably smoking quitters took betel quid as a means of quitting tobacco smoking. Therefore, betel quid chewing should not be considered as an isolated issue, but should always be coupled with issues related to tobacco smoking. Effective policies in smoking prevention and smoking cessation may substantially reduce betel quid use. Reducing cigarette smoking served as an important first step in reducing betel quid chewing in Taiwan,\(^6\) thus, incorporating betel quid into tobacco control may provide a new paradigm to slow down the drastic increase in betel quid use in Bangladesh also. We did not find any association of betel quid with general or central obesity although a study in Taiwanese men found independent association with general and central obesity.\(^23\)
In conclusion, betel quid chewing was found to be a common habit in Bangladesh. Mature adults (40+ years) of low socio-economic status, i.e., rural residents, farmers and illiterate are more likely to chew betel quid. An anti-betel quid chewing programme is urgently warranted for current chewers. Education about betel quid chewing should be emphasized in the public prevention education. Regular screening for betel quid chewing may help prevent excess deaths in the future. As the habit is rooted in Bangladeshi tradition and culture, anthropological studies are indicated for designing appropriate educational campaigns.

Acknowledgements
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References
Betel quid chewing in Bangladeshi adults

Meerjady S Flora et al.


Antibiogram of \textit{S. enterica} serovar Typhi and \textit{S. enterica} serovar Paratyphi A: a multi-centre study from India

Indian Network for Surveillance of Antimicrobial Resistance Group$^a$

Background: Enteric fever continues to be a public health problem in many countries including India. Emergence of the multidrug resistant strains of \textit{S. enterica} serovar Typhi may render treatment with antibiotics ineffective. A multi-centre surveillance study was, therefore, conducted in India to monitor the time trends in antibiotic susceptibility patterns of \textit{S. enterica} serovar Typhi and \textit{S. enterica} serovar Paratyphi A in India.

Methods: All \textit{S. enterica} serovar Typhi and \textit{S. enterica} serovar Paratyphi A strains isolated from January 2008 to December 2010 in the 15 participating centres were included in the study. Each centre compiled their data in a predefined template which included data of the antimicrobial susceptibility pattern, location of the patient and specimen type. The data in the submitted templates was collated and analysed using a common protocol.

Results: A total of 3275 isolates of Salmonellae causing enteric fever were included in the study. There were 2511 \textit{S. enterica} serovar Typhi and 764 \textit{S. enterica} serovar Paratyphi A strains during the three-year study period. Resistance to nalidixic acid was seen in 83\% of the \textit{S. enterica} serovar Typhi and 93\% of \textit{S. enterica} serovar Paratyphi A strains. Majority of the strains were susceptible to third generation cephalosporins.

Conclusions: Enteric fever in India is caused by \textit{S. enterica} serovar Typhi and \textit{S. enterica} serovar Paratyphi A. Nalidixic acid resistance is high among both \textit{S. enterica} serovar Typhi and \textit{S. enterica} serovar Paratyphi A. Susceptibility to ampicillin, chloramphenicol and cotrimoxazole is high. Third generation cephalosporins continue to remain susceptible.

Key words: \textit{S. enterica} serovar Typhi, \textit{S. enterica} serovar Paratyphi A, antibiotics, India

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Key words: \textit{S. enterica} serovar Typhi, \textit{S. enterica} serovar Paratyphi A, antibiotics, India

Introduction

Enteric fever continues to remain a public health problem in many countries. In 2000, typhoid fever caused an estimated 21.7 million illnesses and 217 000 deaths, and paratyphoid fever caused an estimated 5.4 million illnesses worldwide.\textsuperscript{1} In Asia, Crump \textit{et al} reported a crude incidence of typhoid as 274 per 100 000 persons.\textsuperscript{1} \textit{Salmonella enterica} serotype Typhi and \textit{Salmonella enterica} serotype Paratyphi A are the main causes of enteric fever in India; \textit{S. enterica} serovar Typhi being predominant.\textsuperscript{2} In 1999, Sinha \textit{et al} found the incidence rate to be 9.8 per 1000 person years in an urban slum of North India.\textsuperscript{3} However, in 2008, Ochlain \textit{et al} who conducted their surveillance in an urban

\textsuperscript{a} Indian Network for Surveillance of Antimicrobial Resistance

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slum in Kolkata in eastern India, reported an incidence of 214.2 per 100 000/year.4

After the first reported outbreak of chloramphenicol resistant *S. enterica* serovar Typhi in 1972, there has been a steady increase in the number of multidrug resistant (MDR) strains of *S. enterica* serovar Typhi – resistance to ampicillin, chloramphenicol and trimethoprim- sulphamethoxazole - over the next two decades. With the increasing use of fluoroquinolones in the 1990s for treatment of enteric fever, there was a gradual decrease in MDR of *S. enterica* serovar Typhi with emergence of nalidixic acid resistant strains.

A network of microbiology laboratories (Indian Network for Surveillance of Antimicrobial Resistance) at premier medical colleges and hospitals in India was formed with support from the World Health Organization (Figure 1). The network aims to monitor and

Figure 1: INSAR sites India (alphabetically as per institutional name)

The sites marked with a red dot indicates those centres whose data is included in the study. All India Institute of Medical Sciences (AIIMS) - New Delhi, Apollo Health City - Hyderabad, BJ medical college (BJMC) - Pune, Chacha Nehru Bal Chikitsalaya (CNBC) - New Delhi, Chothram Hospital and Research Centre - Indore, Christian Medical College (CMC) - Vellore, Fortis Hospital - Mohali, Global Hospitals - Hyderabad, Government Medical College & Hospital (GMC) - Chandigarh, Government medical college (GMC) - Aurangabad, Gujarat Cancer and research Institute (GCRI) - Ahmedabad, Indraprastha Apollo Hospital - New Delhi, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) - Puducherry Manipal Hospital - Bangalore, PD Hinduja National Hospital & MRC (PDNH) - Mumbai, Postgraduate Institute of Medical Education & Research (PGIMER) - Chandigarh, Regional institute of medical sciences (RIMS) - ImpHAL, Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGI) - Lucknow, Stanley medical college (SMC) - Chennai.
review the antimicrobial resistance problem in India. Initially, few organisms of public health importance were chosen for monitoring the prevalence and antimicrobial resistance patterns. Therefore, *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A were chosen from amongst the Gram negative organisms. All participating laboratories shared their antimicrobial susceptibility data and provided technical support to other members. This study provides a national level understanding of the emerging trends of antimicrobial resistance among clinical isolates of *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A and provides a platform for initiating epidemiological studies of enteric fever.

**Methods**

This study was conducted over three years (January 2008 to December 2010) retrospectively. Each centre compiled their susceptibility data for *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A isolates for the study period in a defined template. The data collection template included patient’s location, source / specimen of isolation and the antibiotic susceptibility profiles. Blood cultures were done by the conventional microbiological techniques or automated systems in the participating centres. The identification of Salmonellae was done by the standard biochemical tests and confirmation was done by serotyping.

The antibiotic susceptibility testing was performed at different study sites by the Kirby Bauer’s’ disc diffusion technique and/or by MIC testing, using CLSI recommendations. One laboratory used the BSAC guidelines for antimicrobial testing and interpretations. The antibiotics tested included ampicillin (10 μg), co-trimoxazole (1.25/23.75 μg), ciprofloxacin (5 μg), nalidixic acid (30 μg), ceftriaxone (30 μg), and chloramphenicol (30 μg). Inoculum was prepared by making a direct saline suspension of isolated colonies selected from an 18- to 24-hour blood agar plate. Turbidity of the suspension was adjusted to achieve a turbidity equivalent to a 0.5 McFarland standard and five disks were applied on a 100mm Mueller Hinton agar plate as per CLSI guidelines / BSAC. *E. coli* ATCC 25922 was used as the quality control strain for disc diffusion.

**Results**

A total of 3275 isolates of Salmonellae causing enteric fever were included in the study. There were 2511 *S. enterica* serovar Typhi strains (430 in 2008, 694 in 2009 and 1387 in 2010) and 764 *S. enterica* serovar Paratyphi A strains (311, 217 and 236 in 2008, 2009 and 2010 respectively) during the study period. These strains were isolated predominantly from blood culture. Few isolates from pus (3), stool (14) and urine (8) also were also included in the study.

The antibiotic susceptibility (by CLSI guidelines) for *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A isolates for the study period are shown in Table 1 and Table 2. Nalidixic acid resistance was high in both *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A, being 82% and 93% respectively during the three-year period. Third generation cephalosporins were 100% susceptible in 2008. Resistance to third generation cephalosporins was seen in 3% of strains of *S. enterica* serovar Typhi in 2009 and in 1% *S. enterica* serovar Paratyphi A in 2010. Multidrug resistance (MDR) to ampicillin, chloramphenicol and cotrimoxazole in *S. enterica* serovar Typhi was observed in less than 5% isolates. The antibiogram for the isolates reported by BSAC guidelines is summarized in Table 3.
### Table 1: Antibiogram of *S. enterica* serovar Typhi. (% susceptible)

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Amp</th>
<th>Chl</th>
<th>Sxt</th>
<th>Ctri</th>
<th>Cip</th>
<th>NA</th>
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<tr>
<td>2008</td>
<td>430</td>
<td>95</td>
<td>96</td>
<td>96</td>
<td>100</td>
<td>99</td>
<td>23</td>
</tr>
<tr>
<td>2009</td>
<td>694</td>
<td>96</td>
<td>97</td>
<td>95</td>
<td>97</td>
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<td>2010</td>
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<td>89</td>
<td>95</td>
<td>94</td>
<td>100</td>
<td>59</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Amp-Ampicillin, Chl-Chloramphenicol, Sxt-Cotrimoxazole, Ctri-Ceftriaxone, Cip-Ciprofloxacin, NA-Nalidixic acid

### Table 2: Antibiogram of *S. enterica* serovar Paratyphi A. (% susceptible)

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Amp</th>
<th>Chl</th>
<th>Sxt</th>
<th>Ctri</th>
<th>Cip</th>
<th>NA</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td>311</td>
<td>99</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>2009</td>
<td>217</td>
<td>91</td>
<td>100</td>
<td>91</td>
<td>100</td>
<td>85</td>
<td>2.9</td>
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<tr>
<td>2010</td>
<td>236</td>
<td>95</td>
<td>100</td>
<td>97</td>
<td>99</td>
<td>71</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Amp-Ampicillin, Chl-Chloramphenicol, Sxt-Cotrimoxazole, Ctri-Ceftriaxone, Cip-Ciprofloxacin, NA-Nalidixic acid

### Table 3: Antibiogram of *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A by BSAC guidelines (% susceptible)

<table>
<thead>
<tr>
<th>Year</th>
<th>Isolate</th>
<th>N</th>
<th>Amp</th>
<th>Chl</th>
<th>Sxt</th>
<th>Ctri</th>
<th>Cip</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td><em>S. enterica</em> serovar Typhi</td>
<td>43</td>
<td>88</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>79</td>
<td>77</td>
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<tr>
<td>2010</td>
<td><em>S. enterica</em> serovar Typhi</td>
<td>55</td>
<td>85</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>2009</td>
<td><em>S. enterica</em> serovar Paratyphi A</td>
<td>22</td>
<td>68</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>2010</td>
<td><em>S. enterica</em> serovar Paratyphi A</td>
<td>18</td>
<td>33</td>
<td>56</td>
<td>44</td>
<td>100</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

Amp-Ampicillin, Chl-Chloramphenicol, Sxt-Cotrimoxazole, Ctri-Ceftriaxone, Cip-Ciprofloxacin, NA-Nalidixic acid
**Discussion**

Enteric fever continues to remain an important infection in endemic countries and to travelers to these areas. As observed in the present study, enteric fever in India is mainly caused by *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A. Nalidixic acid resistance is high among both *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A. Susceptibility to ampicillin, chloramphenicol and cotrimoxazole - traditional first line drugs for enteric fever treatment is good. Third generation cephalosporins continue to remain susceptible and are a useful choice for the treatment of enteric fever. The major strength of the study is that it had representations from 15 centres which used similar protocols for data collection. However, one limitation of this study is the fact that there was inadequate representation from eastern India.

In a study of six years (2000 to 2006) from north India, there were a predominance of *S. enterica* serovar Typhi (62%) , followed by 38% *S. enterica* serovar Paratyphi A.9 The study highlighted the emergence of *S. enterica* serovar Paratyphi A as the predominant serotype in 2003-2004 with resurgence of *S. enterica* serovar Typhi in the subsequent period in their study. MDR *S. enterica* serovar Typhi was 10.69% while 13.13% were MDR *S. enterica* serovar Paratyphi A. Another study from north India also reported high proportion of *S. enterica* serovar Paratyphi A with nalidixic acid resistance (92.5%).9 Interestingly, 90% of their isolates were sensitive to chloramphenicol. Another study from a tertiary care hospital in Delhi from 1999 to 2004, revealed a gradual decrease in MDR *S. enterica* serovar Typhi.10 However, MDR *S. enterica* serovar Paratyphi A increased from 3.5% in 1999 to 11.6% in 2004. The proportion of *S. enterica* serovar Paratyphi A rose from 20.3% in 1999 to 30.3% in 2004. The gradual increase in prevalence of *S. enterica* serovar Paratyphi A over the years could probably be due to the introduction of monovalent vaccine effective against *S. enterica* serovar Typhi only gradually replacing the bivalent TA vaccine.11 A recent study from eastern India showed multidrug resistance in 11.9% and 15.6% of *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A isolates respectively.2 The percentage of *S. enterica* serovar Typhi isolations were more than *S. enterica* serovar Paratyphi A. Similarly, we also had a larger number of *S. enterica* serovar Typhi isolates (77%) than *S. enterica* serovar Paratyphi A (23%).

Ray et al found that nalidixic acid (NA) susceptibility was a good marker for fluoroquinolone susceptibility but NA resistance had a poor predictive value for ciprofloxacin resistance.12 They suggested that NA resistant isolates should be tested for ciprofloxacin MIC before deciding a change in therapeutic regimen. Nalidixic acid resistant isolates of *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi A had higher MIC’s to fluoroquinolones as compared to the nalidixic acid susceptible ones.13 In a study from Puducherry, south India, there was a high rate of ciprofloxacin resistance (8%) observed in *S. enterica* serovar Typhi, with 78% isolates being NA resistant.14 They also reported a high rate of MDR *S. enterica* serovar Typhi (22%). Chitnis et al reported a gradually increasing MIC to ciprofloxacin from <=0.125 mg/L to > 1mg/L among the isolates of *S. enterica* serovar Typhi over the years 1988 to 2005.15 Concurrently MDR, which was seen in upto 90% isolates in 1990-91 had declined to 5.6% in 2005. In view of the increasing MIC’s of ciprofloxacin, there has been a suggestion to relook at the breakpoints and the zone diameters for reporting ciprofloxacin for *Salmonella*.16 As per BSAC guidelines 2011 for ciprofloxacin for *Salmonella*, it is recommended that isolates
with MIC ≥ 0.06 mg/L should be reported as resistant. In the present study, MIC ≥ 0.125 mg/L was interpreted as intermediate susceptible/resistant for the isolates reported by one laboratory as per BSAC guidelines 2010.7

In the present study, S. enterica serovar Typhi susceptibility to ampicillin, chloramphenicol and cotrimoxazole was 93%, 96% and 95% respectively. This is similar to a study done in south India where there was a significant increase in sensitivity to chloramphenicol (86%), ampicillin (84%) and cotrimoxazole (88%). MDR was seen in 12% cases in the same study.17 There is a marked reduction in the reduction of MDR isolates as compared to studies in early 2000.10 The high prevalence of MDR among Salmonella species had led to fluoroquinolones assuming a primary role in the therapy. Some investigators have noted increases in the prevalence of S. enterica serovar Typhi and S. enterica serovar Paratyphi A strains susceptible to traditional first-line antimicrobials coinciding with a switch to fluoroquinolones for the management of enteric fever.18

Azithromycin has been seen to be efficacious for the treatment of typhoid fever;19 however, there are reports of emergence of resistance to azithromycin.20 There are sporadic reports of third generation cephalosporin resistance in Salmonella. Gokul et al. reported an ACC-1 AmpC β-lactamase producing S. enterica serovar Typhi.21 However, third generation cephalosporins still continue to be a good option for the treatment of enteric fever.

To conclude, this study demonstrates the re-emergence of susceptibility to ampicillin, chloramphenicol and cotrimoxazole in Salmonella enterica serovar Typhi, a decline in MDR strains and a high resistance to nalidixic acid in India. Third generation cephalosporins seem to be effective therapeutic options.

Acknowledgement
This work and the INSAR group are supported by the World Health Organization.

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Antibiogram of S. typhi and S. paratyphi A in India

Indian Network for Surveillance of Antimicrobial Resistance Group

References

Injection practices in India
IPEN Study Group

Background: About 16 billion injections are administered each year worldwide, and at least half of them are unsafe. India contributes 25% to 30% of the global injection load. A majority of curative injections are unnecessary. The present study was undertaken to assess the burden of injections and prevalent injection practices in India.

Methods: A nationwide population-based cluster survey (1200 clusters; 24 021 subjects) at household level; along with observations, interview of prescribers (2402), and exit interview of the patients (12 012) at health facility level in the selected clusters was carried out - using probability proportionate to size (PPS) technique. Observations at health facility included generic observation (3592), observation of injection process (17 844), and observation of prescriber-client interaction (24 030).

Results: The frequency of injections was 2.9 (95%CI: 2.8-3.2) per person/year. Of the total injections, 62.9% (95%CI: 60.7-65.0) were unsafe. Injections administered for curative purpose constituted 82.5% and a large majority of these were prescribed for common symptoms like fever/cough/diarrhoea. Use of glass syringes was consistently associated with potential risk of blood-borne viral transmission. Satisfactory disposal of injection waste was observed at 61.3% (95%CI: 58.2-64.3) of the health facilities, and at 50.9% (95%CI: 46.7-55.2) of the immunization clinics. Significant differences were observed in the injection prescription pattern in public and private facilities, and in rural and urban areas.

Conclusions: Three billion injections were estimated to be administered annually in India; of them 1.89 billion were unsafe. Evidence suggests that the micro-level leadership for reducing injection overuse and making injections safer lies with the prescriber.

Key words: Injection, safety, practices, waste, rational use, India.

Introduction
Injections are among the most commonly used medical procedures with an estimated 16 billion administrations each year worldwide. An overwhelming majority (90%-95%) of these injections are administered for curative purposes. Estimates suggest that at least 50% of the world’s injections administered each year are unsafe, particularly in developing countries. Moreover, a majority of the curative injections have been judged to be unnecessary. People residing in developing regions receive 1.5 to 11.3 injections per person/year and up to 75% of them are given with unsterilized, reused equipments – the reuse being highest in South-East Asia Region.
A safe injection does no harm to the recipient, does not expose the healthcare worker to any risk, and does not result in waste that puts the community at risk.4 Faults in injection practices coupled with overuse of injections may expose all of them to several harms including life-threatening blood-borne viral (BBV) infections. Global estimates arrived at by using mathematical models have suggested that unsafe injections account for 32% of new hepatitis B virus (HBV) infections, 40% of new hepatitis C virus (HCV) infections and 5% of new HIV infections. This will pose a burden of 9.2 million disability adjusted life years (DALYs) between 2000 and 2030.5 In the developing countries, inadequate supplies and improper waste disposal has led to large-scale reuse of injection equipment without sterilization. In addition, the improperly disposed chlorinated plastic and sharps pose a threat to the environment.

Anecdotal evidence suggests that the overuse of injections is increasing.4 In India, studies documenting such changes are not available. However, broad trends can be observed from small studies indicating a rise from 1.2 injections/person/year in 1987 to 2.46 injections/person/year in 2001.6-7 A high proportion of injections given in India might be unsafe, mainly due to reuse of needles/syringes - which are also scavenged for resale, to confound the situation. The popularity of curative injections remains high due to various factors influencing the behaviour of prescribers/injection givers as well as clients. A large proportion of these injections are unnecessary.4,8-9 While addressing the need for a countrywide evidence on prevalent injection practices, the present study was undertaken in 2003-2004 to assess: the frequency of injections; proportion of unsafe injections; and injection-related waste disposal in government and private health facilities, and in rural and urban areas of India.

Methods
Study design
A nationwide population-based cluster survey (1200 clusters; 24 021 subjects) at the household level along with observations, interview of prescribers (2402), and exit interview of the patients (12 012) at health facility level in the selected clusters was carried out, using probability proportionate to size (PPS) technique. Observations at health facility included generic observations (3592), observation of injection administrations (17 844), and observation of prescriber-client interactions (24 030). The whole country was demarcated into 15 zones on the basis of socio-cultural and geographic factors. The sampling universe was a zone and each zone comprised of either a single state or a group of two to five small states (Figure 1). The clusters were drawn separately for urban and rural areas. The details of the sample size and plan are given in Table 1.

The survey commenced at a randomly selected household. Household members were listed and one individual was randomly selected and interviewed. Consecutive households were covered until 20 clients were interviewed. One government and one private health facility located in or nearest to the cluster were selected. If more than one private health facility existed in the cluster, the one which was reported to administer more injections was selected. For the immunization clinic, a nearby out-reach area/sub-centre/dispensary where routine immunization was done was selected. Exit interviews were conducted to neutralize Hawthorn effect during direct observations. Five consecutive patients coming out of both the public and private health facilities were interviewed among those who agreed to participate.
**Study tools**

The draft instruments were developed by a multidisciplinary central coordinating team, with inputs from programme managers in the Ministry of Health and Family Welfare, Government of India. The instruments, consisting of a mix of structured close-ended and semi-structured open-ended questions, were validated and piloted at eight sites across the country, and were finalized during the national protocol finalization workshop.

The factors that make an injection safe were studied in detail by senior investigators through direct observation of the injection administration. These were grouped under factors associated with injection equipment and its sterilization; and those associated with the technique of administering an injection. A checklist for safe/unsafe injections was developed for this assessment. This checklist was based on various criteria suggested by the World Health Organization (WHO). An injection was classified as unsafe if: it had

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**Figure 1: Number of injections per person/year according to study zones**

![Map of India showing number of injections per person/year in different zones.](image)
Table 1: Sample plan of the study for interviews and observations

<table>
<thead>
<tr>
<th>Zonal sample</th>
<th>Community Level</th>
<th>Health Facility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Clusters</td>
<td>Sample per cluster</td>
<td>Sample per zone</td>
</tr>
<tr>
<td>Community survey</td>
<td>80 (Rural-40, Urban-40)</td>
<td>20</td>
</tr>
<tr>
<td>Generic observation</td>
<td>80 (Rural-40, Urban-40)</td>
<td>3 (Government-1, Private-1, Immunization clinic-1)</td>
</tr>
<tr>
<td>Observation of injection process</td>
<td>80 (Rural-40, Urban-40)</td>
<td>15 (Government-5, Private-5, Immunization clinic-5)</td>
</tr>
<tr>
<td>Observation of client-prescriber interaction</td>
<td>80 (Rural-40, Urban-40)</td>
<td>30 (Government-10, Private-10)</td>
</tr>
<tr>
<td>Exit interview of patients</td>
<td>80 (Rural-40, Urban-40)</td>
<td>10 (Government-5, Private-5)</td>
</tr>
<tr>
<td>Prescriber’s interview</td>
<td>80 (Rural-40, Urban-40)</td>
<td>2 (Government-1, Private-1)</td>
</tr>
</tbody>
</table>

Potential to transmit blood-borne viruses (being given using inadequately sterilized syringe/needle and/or syringe/needle were reused for another patient) and/or it was administered using faulty technique (and could cause local infection and reaction).

Quality assurance
A uniform understanding of the study protocol, methods and instruments among the senior investigators and research associates was assured through a national protocol finalization workshop followed by 15 zonal workshops. Members of the Central Coordinating Team made quality assurance visits to 150 clusters (12.5%) covering all 15 zones. All Intelligent Character Recognition (ICR) sheets were screened for completeness and appropriate coding of responses. Range checks and logical runs were incorporated in the data management software to minimize errors.

Data analysis
Intelligent Character Recognition sheets were filled by the senior investigators, for each unit of community-based survey and facility-based observations and interviews, on a daily basis during data collection phase. The data were scanned and directly transferred to the computers from the ICR sheets using ABBYY Form Processing Solutions (Form Reader 4.0). Recognized data were first transferred to Excel spreadsheets for data cleaning. The survey feature of ‘STATA release 7.0’ was used for analysis of the whole data set. Magnitude of injections, proportion of unsafe injections,
awareness and perceptions regarding injection practices and inappropriate disposal of sharps waste were calculated for the individual zones and thereafter for the whole country by imputing weights for the population. The zone-wise estimates of urban and rural population were used according to the 2001 census. For health facility-based data, all-India estimates were derived by applying weightage for proportion of injections given at different health facilities (as determined during community survey).

Ethical issues
A prior written consent was obtained from all study participants. The consent forms were prepared in local languages and one copy was given to the interviewees for their records. For those unable to read, a person not connected with the study read out the consent form and assured that the contents were made explicitly clear.

Results
Based on the data obtained from the survey, we estimate that in the over one billion population of India, three billion injections were administered annually. Of these, 2.49 billion injections were given for curative purposes and 1.89 billion injections were unsafe. The private sector was contributing 2.1 billion injections to the total injections and 1.26 billion to the unsafe injections.

Frequency of injections
In the three months recall, 27.1% (95%CI: 25.9-28.3) of the subjects in the community survey reported to have received injection(s). The number of injections received per person-year was estimated to be 2.9 (95% CI: 2.8-3.2) (Figure 1). The frequency of injections was almost twice among infants (5.6; 95%CI: 5.0-6.2) as compared to older subjects (2.8; 95%CI: 2.6-3). Of all the injections, 17.5% (95%CI: 16.0-18.9) were for vaccination. Among infants, injections for vaccination were 63.2% (95%CI: 56.8-69.6) compared to 12.2% (95% CI: 10.9-13.4) among older subjects. More than three fourths (77.0%; 95%CI: 75.1-79.0) of curative injections were prescribed in the private facilities. Among preventive injections, two third injections (66%; 95%CI: 62.5-69.6) were given in the government sector.

Prescription pattern
On direct observation, 44.1% (95%CI: 42.9-45.6) of all outpatient clients were prescribed injections. A larger proportion of clients in the private health facilities received injections 45.9% (95% CI: 44.2-47.7) as compared to those attending government health facilities 38.5% (95%CI: 36.7-40.3). Non-formal prescribers were giving 12% to 15% more injections as compared to allopathic doctors. A similar trend was seen with exit interviews where nearly half of the respondents (48.1%; 95%CI: 46.3-49.9) had received injections, with a higher proportion in private facilities (50.6%; 95%CI: 48.5-52.7) as compared to government facilities (40.7%; 95%CI: 38.6-42.9).

Exit interviews revealed that the highest proportion of injection prescriptions were seen at the clinics of non-formal prescribers (57.5%), followed by Indigenous Systems of Medicine (ISM) (52.6%) and allopathic clinics (42.6%). This trend of prescribing injections, as assessed through direct observation of the client-prescriber interaction, was similar to that obtained from exit interviews (52.3%, 48.2% and 40.5% respectively). Exit interviews (51.1%; 95%CI: 48.9-53.3) as well as community survey (51.7%; 95%CI: 49.8-53.7) indicated that over half of the curative injections were prescribed for
symptoms of fever/cough/diarrhoea. A vast majority of prescribers (88.6%; 95%CI: 86.8-90.5) was of the opinion that injections gave psychological relief to the patients as they insisted on injections. Notwithstanding these perceptions, direct observations revealed that most of the times (70.6%), doctors took a decision about the prescription and the clients accepted it. Enquiries with clients underscored this, where a large proportion of clients (44.1% (95% CI: 42.7-45.6) accepted the doctor’s decision to administer injections even when these were perceived to be unnecessary. When clients who were insisting on an injection were questioned about why they prefer to receive injections, 73.8% (95%CI: 72.5-75.1) cited certain benefits of the injections over oral medicines (e.g. quick relief, more effective method of illness treatment).

**Unsafe injections**

Of all the injections administered in India, one third (31.6%) carried a potential risk of transmitting BBV. Unsafe injection due to faulty technique was observed in 53.1% of the observed administrations. Together, these two factors made nearly two thirds (62.9%) of the injections unsafe (Table 2). The proportion of unsafe injections was highest at the immunization clinics (74.0%) followed by government (68.7%) and private (59.9%) health facilities (Table 3).

The type of injection equipment (glass or plastic syringe) had a profound effect on the safety of injections, be it potential risk of BBV transmission; faulty injection technique or the overall unsafe injections (Table 2). Regression analysis showed that there was a linear but

### Table 2: Characteristics of unsafe injections in India (data in percent)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Overall unsafe injections</th>
<th>Unsafe injections with plastic syringe</th>
<th>Unsafe injections with glass syringe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injections carrying risk of blood borne virus transmission</td>
<td>31.6 (29.4-33.7)</td>
<td>18.2 (16.3-20.1)</td>
<td>70.7 (67.2-74.3)</td>
</tr>
<tr>
<td>Faulty technique</td>
<td>53.1 (50.8-55.4)</td>
<td>46.2 (43.5-48.9)</td>
<td>73 (69.9-76.1)</td>
</tr>
<tr>
<td>Overall</td>
<td>62.9 (60.7-65.0)</td>
<td>53.3 (50.6-55.9)</td>
<td>90.8 (88.8-92.8)</td>
</tr>
</tbody>
</table>

Figures in parentheses show 95% confidence interval.

### Table 3: Unsafe injections according to type of health facility and syringe use in India (data in percent)

<table>
<thead>
<tr>
<th>Type of health facility</th>
<th>Overall unsafe injections</th>
<th>Injections with plastic syringe</th>
<th>Injections carrying risk of blood-borne virus transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall</td>
</tr>
<tr>
<td>Government health facilities</td>
<td>68.7 (66.1-71.3)</td>
<td>62.7 (59.8-65.5)</td>
<td>35.4 (32.7-38.1)</td>
</tr>
<tr>
<td>Private health facilities</td>
<td>59.9 (56.9-62.8)</td>
<td>80.7 (78.2-83.2)</td>
<td>30.1 (27.3-32.9)</td>
</tr>
<tr>
<td>Immunization clinics</td>
<td>74.0 (71.4-76.6)</td>
<td>52.3 (49.1-55.5)</td>
<td>33.5 (30.5-36.5)</td>
</tr>
<tr>
<td>All India</td>
<td>62.9 (60.7-65.1)</td>
<td>74.6 (72.6-76.6)</td>
<td>31.6 (29.4-33.7)</td>
</tr>
</tbody>
</table>

Figures in parentheses show 95% confidence interval.
Injection practices in India

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In multivariate logistic analysis, use of glass syringes consistently emerged as the most important factor behind unsafe injections (OR 8.4); for risk of BBV transmission (OR 12.2); and for unsafe injection due to faulty techniques (OR 3.0). The likelihood of unsafe injection was marginally lower in urban areas as compared to rural areas. The risk of unsafe injection when administered at non-allopathic health facilities (ISM and non-formal prescribers) was over one and a half times as compared to that with allopathic prescribers (Table 4).

Written guidelines for sterilization were available at only 10.1% (95% CI: 8.8-11.4) of all health facilities across the country. More than half of the prescribers (55.6%; 95%CI: 51.7-59.5) reported an incorrect sterilization process. Sterilization equipment was available at 84.2% (95%CI: 81.4-87.1) of the government health facilities, 76.9% (95%CI: 73.9-80.0) of the immunization clinics and 57.7% (95%CI: 54.1-61.3) of private health facilities. Over three fourths (75.9%; 95%CI: 72.7-79.0) of the available sterilization equipment were functional.

The guidelines for waste disposal were available at only 14.2% (95%CI: 12.6-15.7) of the health facilities. Satisfactory facility-level disposal of injection waste was observed at 61.3% (95%CI: 58.2-64.3) of the health facilities; immunization clinics being the worst performers at 50.9%. Satisfactory terminal disposal was observed in less than half of the health facilities (44.8%; 95%CI: 41.9-47.7); 41.55% in private health facilities. A marked difference existed between the observed status and prescribers' perception about waste disposal at the health facility as well as at the terminal levels (Table 5). Direct observation at health facilities documented that the selling of

<table>
<thead>
<tr>
<th>Model</th>
<th>Independent variables</th>
<th>Overall (OR 95% CI)</th>
<th>p</th>
<th>Blood-borne virus transmission (OR 95% CI)</th>
<th>p</th>
<th>Faulty technique (OR 95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Glass syringe</td>
<td>8.4 (6.4-10.9)</td>
<td>&lt;0.001</td>
<td>12.2 (9.7-15.5)</td>
<td>&lt;0.001</td>
<td>3.0 (2.5-3.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Urban area</td>
<td>0.7 (0.6-0.8)</td>
<td>&lt;0.001</td>
<td>0.9 (0.7-1.1)</td>
<td>0.2</td>
<td>0.7 (0.6-0.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Private health facility</td>
<td>0.9 (0.8-1.1)</td>
<td>0.2</td>
<td>1.3 (1.1-1.6)</td>
<td>&lt;0.001</td>
<td>0.9 (0.8-1.1)</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Immunization clinic</td>
<td>1.1 (0.9-1.3)</td>
<td>0.1</td>
<td>0.6 (0.5-0.8)</td>
<td>&lt;0.001</td>
<td>1.3 (1.3-1.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Model 2</td>
<td>Glass syringe</td>
<td>8.6 (6.4-11.4)</td>
<td>&lt;0.001</td>
<td>12.5 (9.8-15.8)</td>
<td>&lt;0.001</td>
<td>3.0 (2.4-3.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Urban area</td>
<td>0.8 (0.6-0.9)</td>
<td>&lt;0.001</td>
<td>1.0 (0.8-1.3)</td>
<td>0.9</td>
<td>0.7 (0.6-0.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>ISM practitioner</td>
<td>1.5 (1.1-1.9)</td>
<td>&lt;0.001</td>
<td>1.7 (1.2-2.3)</td>
<td>&lt;0.001</td>
<td>1.3 (0.99-1.7)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Informally trained practitioner</td>
<td>1.6 (1.1-2.3)</td>
<td>0.01</td>
<td>1.9 (1.4-2.7)</td>
<td>&lt;0.001</td>
<td>1.4 (0.98-1.9)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

ISM – Indian system of medicine

Table 4: Risk of unsafe injections in India (multivariate logistic regression analysis)

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Table 5: Satisfactory injection-related waste disposal in India: direct observation versus prescriber’s perception (data in percent)

<table>
<thead>
<tr>
<th>Level of waste disposal</th>
<th>Government health facility</th>
<th>Private health facility</th>
<th>Immunization clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct observation</td>
<td>Prescriber’s perception</td>
<td>Direct observation</td>
</tr>
<tr>
<td>Health facility-level disposal</td>
<td>60.5 (56.7-64.2)</td>
<td>90.1 (87.8-92.5)</td>
<td>62.3 (58.6-65.9)</td>
</tr>
<tr>
<td>Terminal disposal</td>
<td>53.5 (49.0-57.2)</td>
<td>69.6 (66.1-73.0)</td>
<td>41.5 (37.9-45.2)</td>
</tr>
</tbody>
</table>

Figures in parentheses show 95% confidence interval.

Discussion
An overwhelming majority of injections in our study were given for therapeutic reasons. However, their proportionate share seems to be a little lower in India (82.7%) as compared to the global data (95%). The overall frequency of injections in our nationwide data was 2.9 injections per person/year. This is almost double of the average estimate for developing countries (1.5), though half of what has been observed in Cambodia (5.9). Estimates of injections per person/year in developing countries vary from 1.5 to 11.3. If we apply our data to total population, around 3 billion injections are administered annually in India; of which nearly 2.5 billion are curative injections, and roughly 2 billion injections are unsafe. Barring vaccines, the major share is borne by the private sector. Another indicator of the injection frequency in our data was that every second exit interviewee in the study had received injections. A similar trend has been reported from Cambodia where 47% of the total prescriptions included a therapeutic injection or infusion.

Of the total quantum of injections, around two third were found to be unsafe, which is on a higher side from the developing world estimate of nearly 50% injections being unsafe. Reuse...
Injection practices in India

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of syringes, with or without sterilization is a serious problem across countries in the developing regions, being highest in South-East Asia. Injections administered with unsterilized, reused equipment constitute 1.2% to 75.0%.3,5 Smaller studies from India have also reported widely prevalent reuse of syringes.12,13 The worrisome part was that this was highest at immunization clinics where 74.0% of the injections were either carrying a potential risk of BBV transmission or were administered with faulty technique. There was a wide gap between observed status and prescribers’ perception on waste disposal. The situation of terminal disposal of injection waste was worse. Rural-urban differences on injection safety may be explained by the higher use of glass syringes in rural areas, variations in the profile of prescribers, and training of the injection givers. Although basic issues related to the burden of injection, safety and waste disposal broadly remain the same for rural and urban areas, management of injection-related waste in remote villages and outreach clinics is going to pose a significant challenge logistically.

The main area of limitation in this study was that of the observations at health facility level. Hawthorn effect was likely to influence the injection prescribing and injection administering practices, resulting into underestimation of unsafe and irrational injections. The quantum of this error could not be estimated, although direction was possible to assess. To neutralize this, exit interviews of a separate group of clients coming out of the same health facilities were also conducted.

An appropriate and systematic global response to the threat of unsafe injections has been slow to emerge.14 The goal is not only to make the injection practices safe but also to reduce the overall quantum of injections administered to people by modifying the prescription practices – both in public and private sectors. We also need to include a large constituency of non-formal prescribers in our scope since they contribute a sizeable proportion of injection prescriptions.15 Starting from the formulation of a National Safe Injection Policy, these efforts would include behaviour change among health workers and clients; provision of uninterrupted supply of safe injection equipment; and establishment and maintenance of injection-related waste disposal mechanisms. India has recently seen substantive progress in some of these areas.16 Professional bodies have formulated their policies and plan of action, and a large nationwide grid of Model Injection Centres was established by the INCLEN Programme Evaluation Network, as a follow up to this study.17-19

One of the most positive translational developments prompted by this study has been the minimization of glass syringe usage. With extra effort and patience required to properly sterilize the glass syringes, particularly in crowded out-patient settings, most of the injections administered through glass syringes were unsafe. The government’s response to this evidence has been quick. As a policy, the Auto-Disable (AD) syringes are now being used universally in the national immunization programme and their uninterrupted supply is assured. In addition, it has also been made mandatory for all states to use AD syringes in all government hospitals and health centres. However, much needs to be done in several domains of injection safety - specifically in: (a) inducing and sustaining a culture of rational use of injections among prescribers through advocacy, communication and training; and (b) terminal disposal of injection-related waste. In this regard, the disposal of plastic waste is a big challenge in rural areas because of the economic viability of the rather unclear...
system of collection and terminal disposal of such waste in primary care settings.

Community survey as well as exit interviews indicated that over half of the curative injections were prescribed for common symptoms, e.g. fever, cough, or diarrhoea. This enforces the assertions made in reports from India and Bangladesh that most injections in healthcare settings are unnecessary. In the present study, a huge majority of prescribers was of the opinion that clients insist for injections since it gave them psychological relief. However, the evidence generated through direct observation was contrary to these perceptions. In most instances, doctors took a decision about the prescription and the clients accepted it. Enquiries with clients revealed that a large proportion of clients accept the doctor’s decision to administer injections even when these were perceived to be unnecessary.

The biggest irony is that a widely practiced health care intervention which has benefited the people so extensively in the last century is also turning into a health hazard and a threat to community health. Excessive recourse of prescribers to injections, when equally effective oral formulations are available or the medication is not required at all, is constantly aggravating this threat. It is not a question of onus, but the evidence suggests that the micro-level leadership for creating a professional as well as social milieu favourable to rational use of injections lies with the prescribers, particularly in the private sector which has an overwhelming influence over the huge domain of non-formal prescribers.

Acknowledgements

We thank the Ministry of Health and Family Welfare, Government of India and The World Bank for their financial support for this study.

\*IPEN Study Group

Injection practices in India

Injection practices in India IPEN Study Group


References
Funding health promotion and disease prevention programmes: an innovative financing experience from Thailand

Supreda Adulyanona

Abstract: Sustainable sources of funding for health programmes have been explored by many countries. In Thailand, the Health Promotion Foundation (ThaiHealth) was established in 2001 as an innovative state agency for funding health promotion from the 2% surcharge on alcohol and tobacco excise tax.

ThaiHealth is governed by a Board chaired by the Prime Minister. It is not part of the conventional health services. ThaiHealth explicitly pursues a “socio-cultural” rather than a “biomedical model” of health. It has fostered strategic partnerships with government, private sector, nongovernmental organizations, and communities to implement health promotion plans. In 2010, its budget was 3700 million bahts (119 million US dollars).

Since ThaiHealth plays a catalytic, coordinating, empowering and enabling role, its impact can only be assessed “collectively” with all partner organizations. ThaiHealth contributed to development of several policies that led to enactment of laws and building the capacity of organizations, communities and individuals in planning and carrying out health promotion activities. The “Collective impact” includes decline in smoking among the more-than-15-year-olds from 25.47% in 2001 to 20.7% in 2009; harmful alcohol drinkers from 9.1% in 2004 to 7.3% in 2009; death rate from vehicle accidents from 22.9 per 100 000 in 2003 to 16.82 per 100 000 in 2010.

The main factors leading to achievements of ThaiHealth are: flexibility, financial security and effective strategy. However, inadequate understanding among public and stakeholders about the philosophy, governance and operation of ThaiHealth is reckoned as a huge challenge.

Key words: Financing, health promotion, disease control, smoking, alcohol, Thailand.

Introduction

From “Health for All” to “Ottawa Charter”, “Jakarta Declaration” and “Bangkok Charter”, the concept of health promotion is shaping the service-based health education model into a socio-cultural model. The focus of contemporary health promotion is on broader social determinants of health. It requires “movements” to create and coordinate health promotion initiatives in health and related sectors for healthy behaviours, healthy policies, healthy environments and healthy systems.1

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Globally, noncommunicable diseases (NCDs) have emerged as the leading cause of disease burden. Several developing countries are also experiencing a rise in NCDs. Health promotion, having its focus on health-oriented approaches, can be used as a tool for preventing NCDs by diminishing the impact of major risk factors such as tobacco, alcohol, dietary imbalances, and physical inactivity.2

In spite of the increasing need, health promotion is conventionally given low priority in most countries, particularly in comparison with curative services. Therefore, instead of having health promotion budgets completely within the health ministry, innovative sources of predictable and sustainable funding for health promotion especially for NCDs prevention were explored and implemented by many countries during the past decades.3-5

The need for innovative health promotion financing system in Thailand

Thailand has transformed into a middle-income country. Consequently, the Thai burden of diseases has been gradually shifting to NCDs, injuries and mental illnesses.6 The transition to unhealthy lifestyles and health risks has been found to be linked with urbanization, internal migration and changes in social environment.7

In the light of the rising burden of NCDs, greater need for health promotion was felt in Thailand. Innovative exploration for health promotion financing started from the tobacco control drive. From 1988 to 1993, Thailand succeeded in developing policies and enacting laws for tobacco control. The advocacy for tax increase on tobacco for health reasons was successful in 1994. However, even though the revenue gained from tobacco excise tax increased, the financial support from the government for tobacco control was not only limited, but also showed a declining trend.

In 1995, the movement for sustainable finance for tobacco control led to a study on “health financing model from dedicated excise tax under the control of an autonomous agency established by the State”. After a long process of national policy development, the Thai Parliament enacted the Health Promotion Foundation Act in 2001 to establish Health Promotion Office as a state agency. This agency is not part of the Ministry of Public Health but is under the direct supervision of the Prime Minister. It funds health promotion-related activities from the 2% surcharge on alcohol and tobacco excise tax. The “surcharge” requires the tobacco and alcohol industries to pay 2% “additional tax” on top of the excise tax. The Thai Health Foundation (ThaiHealth) is the first organization of its kind in Asia that is apparently one of the outcomes of the health care reforms in Thailand.8 The Thai experience of setting up and operating the health promotion foundation, and the lessons learned from innovative funding of health promotion in Thailand could be useful to other countries.

The Thai Health Promotion Foundation: governance, mission and strategy 9, 10

The Health Promotion Foundation Act provides ThaiHealth with considerable autonomy as well as annual revenue, derived from the 2% additional excise tax on tobacco and alcohol. In 2010, the budget of ThaiHealth was 3700 million bahts (119 million US dollars).

ThaiHealth is governed by a Board of Governance as well as an Evaluation Board. It also uses a series of expert advisory committees. The Board of Governance has a multi-sectoral structure. It is chaired by the Prime Minister with Minister of Public Health
as the first Vice-Chairman and an independent expert as the Second Vice-Chairman. Board members comprise representatives from nine ministries and eight independent experts from various disciplines. Under the policy direction of the Board of Governance, health promotion implementation is executed by the Health Promotion Office, through a wide variety of networks and partners who develop and carry out a range of programmes and projects, to achieve the health targets. The Board of Evaluation has seven members who are selected from experts in health promotion, finance and evaluation. The responsibility of the Board of Evaluation is to execute overall performance evaluation of ThaiHealth leading to transparency and efficiency. According to the Act, ThaiHealth has to report annually to the Cabinet as well as to both houses of Parliament.

Adopting the comprehensive WHO paradigm of health, ThaiHealth explicitly pursues a “socio-cultural” rather than the “biomedical model” of health. This funding strategy was designed to financially support major strategic health promotion activities, particularly in the areas that are considered to be “hard-to-reach” by the conventional health system.

The mission of ThaiHealth, recently rephrased in 2011, is “to inspire, motivate, coordinate and empower individuals and organizations in all sectors for the enhancement of health promotive capability as well as healthy society and environment”.

With its supporting role, rather than replacing the existing bodies, and positioning itself as a catalyst rather than an implementer, ThaiHealth has fostered strategic partnerships with various sectors including government, private sector, nongovernmental organizations (NGOs) and communities. These partnerships are the key mechanism for driving health promotion implementation synchronously.

The missions of ThaiHealth were implemented through the master plan which currently comprises 14 plans. The plans were organized on issue-based, setting-based and system-based approaches. The issue-based plans include Tobacco Control; Alcohol Control; Traffic Injuries and Disaster Management; Physical Exercise and Sports for Health; Healthy Food and Diet; and Health Risk Factors Control. The setting-based plans cover Health of Disadvantaged Groups; Health Promotion in Community; Children, Youth and Family Health; and Health Promotion in Organizations. Health system based plans comprise Social Marketing and Communication; Health Promotion through Health Service Systems; and Supportive Systems and Mechanisms. Most ThaiHealth plans were proactively implemented through strategic partners rather than by funding project proposals. However, a plan for promoting open grants and innovative projects was specifically organized as a channel to open up opportunities for all.

ThaiHealth’s strategy has employed the concept of “Triangle that Moves the Mountain”, proposed by Professor (Dr) Prawase Wasi. To move the immovable “mountain”, symbolised for the extreme difficulty encountered in bringing about social change, this strategy indicates that strengthening the three interconnected angles of the triangle or sectors is necessary. Creating relevant knowledge that provides evidenced-based action and policy, facilitating social movement to raise public awareness and action, and fortifying the political authority’s involvement, must be connected together in order to effectively generate the holistic ability to solve difficult social and health problems.
ThaiHealth’s contribution to advancement of health promotion

The International Network of Health Promotion Foundations (INHPF) has indicated general advantages of health promotion foundations.14 ThaiHealth provides a dedicated infrastructure for health promotion, offering several advantages. It is able to: (i) Ensure a cohesive and focused approach to health promotion; (ii) Advocate for health promotion to government; (iii) Conduct trials, plan and implement long-term and innovative programmes; (iv) Secure funding for health promotion initiatives from political and other uncertainty; (v) Work flexibly and collaboratively across a range of sectors; (vi) Collect, collate and transfer knowledge on effective health promotion; and (vii) React quickly to emerging needs of current health issues.

Five years after its establishment, the Evaluation Board of ThaiHealth initiated a review to assess the progress in relation to its legislative mandate and direction. This assessment was based on available data and reports as well as on the stakeholders’ opinion. The reviewers led by Addy Carroll reported several key achievements of ThaiHealth (Box 1).15 The review also recommended some major strategic and executive improvements that later became the focus of ThaiHealth such as: (i) Improving the evaluation of effectiveness of health promotion at project, programme, strategic and overall organizational levels; (ii) Be more proactive in prioritizing more-at-risk or disadvantaged population groups and targeting health inequalities; (iii) Enhance partnership involvement with the local government; (iv) To more strategically discern plans for funding expansion; (v) Build and strengthen the capacity of staff, partners and related personnel.

**Box 1: Major achievements of the Thai Health Promotion Foundation**

- Brought together many units in society including public, private and community groups to mobilize energy and resources.
- Played a proactive role in advocating for policy and environmental change to improve health.
- Filled a void in dissemination of health information to the public.
- Created notable awareness about health and healthy behaviour among people.
- Mobilized and coordinated existing groups.
- Built capacity of many to promote health, e.g. teachers, doctors, nurses, community health workers.
- Placed health promotion on the community agenda - increased community understanding of the need to take care of own health through healthy lifestyles.
- Rapidly enhanced its profile and built good relationships with the media and key organizations that enabled ThaiHealth to be a powerful voice for health in Thailand.
- Used resources to raise awareness and on issues that had not been given prominence earlier, e.g. reduction of alcohol consumption.
- Established strong mass-media campaigns that were both proactive and aggressive.
In 2011, The Evaluation Board of ThaiHealth, supported by the World Health Organizations Regional Office for South-East Asia, again commissioned a Ten Year Review of ThaiHealth by an international committee chaired by Dr Rhonda Galbally – the founding Chief Executive Officer of VicHealth. The review team included international experts from WHO, World Bank, and Rockefeller Foundation. The aim is to assess the degree to which ThaiHealth has reached maturity that both enables it to withstand external contextual factors, while remaining open and relevant in the face of changing need and expectations. The final report of this review will be released in 2012.

“Collective outcomes and impacts” of health promotion in Thailand

Since ThaiHealth plays a catalytic, coordinating, empowering and enabling role, attribution cannot be given for any achievement to ThaiHealth alone without recognizing the contribution of its partners and other organizations. The so-called “collective impact” approach is one of the core values of the foundation. Some examples of recent “collective” achievements are mentioned below, including tobacco and alcohol control.

**Tobacco control**

There has clearly been an expansion in the number of active tobacco control partners including newly established institutions, i.e. Tobacco Control Research and Knowledge Management Centre and The National Quitline. The National Tobacco Control Committee has made continuous progress in many legislative missions, i.e. increasing the ban on smoking in public places including pubs and bars, open-air markets and restaurants; increasing the number of pictorial warnings on cigarette packs; requirement for tobacco companies to identify tobacco ingredients (substances that cause cancer) on the packs; not allowing companies to put messages such as “low-tar” or “light” on the packs; and banning any advertisement at the point of sale, etc. The no-smoking campaigns were active nationwide as well as among many specific groups of people creating the no-smoking-in-public culture, particularly in urban areas.

As far as outcomes are concerned, the decreasing trend in smoking is continuing in Thailand since 1992. In 2009, the smoking rate among the population aged more than 15 years old was 20.7% compared with 25.5% in 2001. It is noted that due to increase in the tobacco excise tax from 75% in 2001 to 85% in 2009, the income of ThaiHealth increased despite the declining trend in smoking rate.

**Alcohol control**

Alcohol consumption has increased significantly in Thailand. The recorded per capita adult consumption rose from 0.26 litres in 1961 to 8.47 litres of pure alcohol in 2001. A strategy similar to the tobacco control strategy has been employed in solving the problem of harmful use of alcohol by ThaiHealth since 2002. The three focal points of the “Triangle that moves the mountain” - the National Committee on Alcohol Control, the Centre for Alcohol Studies, and the Stopdrink Network, were the key generators of policy, knowledge and social mobilization. The sample of national policies were released including the Alcohol Control Act, the first comprehensive law on alcohol control in Thailand. The Centre for Alcohol Studies concluded that the number of national alcohol policies in Thailand rose from one policy per eight years between 1950-2001 to two policies per year during 2003-2008. Mass campaigns and community mobilizations have moved the whole nation.
Recently, the Health Examination Survey, the most comprehensive health survey in Thailand, showed that the rate of harmful alcohol drinkers decreased from 9.1% in 2004 to 7.3% in 2009 - a reduction of nearly 20%. This declining trend was supported by the Thai household expenditure for alcohol consumption that recorded a historic decline of 0.7% and 10.4% in 2009 and 2010 respectively, whereas an increasing trend had been noticed earlier for many decades.

The other examples of major policy developments include: liability to damage caused by unsafe product act; child toy control system; television programme rating; establishment of (independent) public broadcasting television from earmarked tobacco and alcohol excise tax; prohibition on speaking on mobile phone while driving without aid accessory; safe and clean internet café policy; and FDA prohibition of adding sugar into instant milk powder, etc. Other health outcomes observed in recent years included decline in the number of deaths from vehicle accidents from 22.9 per 100 000 in 2003 to 16.82 per 100 000 in 2010. The number of Thai people who exercised regularly increased from 29.0% in 2003 to 29.6% in 2007.

Recently, the initial report of a comprehensive economics research by the Health Innovation and Technology Assessment Programme (HITAP), Ministry of Public Health, on “the willingness to pay”, covering from 7311 households and derived by stratified three-stage sampling nationwide, showed that the amount of money that people are willing to pay for the five major plans of ThaiHealth (physical activity, tobacco control, road safety, food and nutrition, and alcohol control) ranged from 2.75 to 1.35 times the actual budget of ThaiHealth in these plans.

During the first decade, ThaiHealth significantly extended its areas of interests, in part due to the demands for effective policies and programmes to respond to emerging health problems across Thailand. For the ThaiHealth’s vision of the next decade, globalization and its complex implications for public health in Thailand was recognized as an important health determinant. Thus, international collaboration in health promotion became more crucial to diminish the negative consequences of globalization in ThaiHealth’s long-term plans.

One of the major international missions of ThaiHealth is to be the resource organization for establishment of the Health Promotion Foundation in the other countries. ThaiHealth’s engagement with the International Network in Health Promotion (INHPF) provides a collective global, regional and national advocacy for innovative health promotion financing.

Lessons learned
The three main factors leading to ThaiHealth’s early achievements in the health promotion arena are - flexibility, financial security, and effective strategy. The (public) autonomous status allows ThaiHealth to facilitate and coordinate with partners in various sectors. The funding mechanism, from a dedicated source (2% surcharge on tobacco and alcohol), could ensure financial security. Finally, ThaiHealth’s “Triangle that moves the mountain” strategy with a complementary and coordinating role, rather than that of replacing existing structure/agencies and capacity, is widely and positively accepted.

A big challenge for ThaiHealth, which is a very new concept of health promotion financing, is lack of public and stakeholders’ understanding of its philosophy, governance and operation. It faces inevitable threats such as securing political support to counter opposition from some industries and businesses. Critically, ThaiHealth is still on a learning curve as far as innovative health promotion management is concerned. Hence, capacity building of health promotion managers, advocates and

Funding health promotion and disease prevention programmes: an innovative financing experience from Thailand
Supreda Adulyanon

WHO South-East Asia Journal of Public Health 2012;1(2):201-207
experts, as well as its operational aspects need continuous improvement.11

References


Nipah virus outbreaks in Bangladesh: a deadly infectious disease

Mahmudur Rahman, Apurba Chakraborty

Abstract: During 2001-2011, multidisciplinary teams from the Institute of Epidemiology, Disease Control and Research (IEDCR) and International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) identified sporadic cases and 11 outbreaks of Nipah encephalitis. Three outbreaks were detected through sentinel surveillance; others were identified through event-based surveillance. A total of 196 cases of Nipah encephalitis, in outbreaks, clusters and as isolated cases were detected from 20 districts of Bangladesh; out of them 150 (77%) cases died. Drinking raw date palm sap and contact with a case were identified as the major risk factors for acquiring the disease. Combination of surveillance systems and multidisciplinary outbreak investigations can be an effective strategy not only for detection of emerging infectious diseases but also for identification of novel characteristics and risk factors for these diseases in resource-poor settings.

Keywords: Nipah virus, outbreak, surveillance, transmission, communicable disease, Bangladesh.

Introduction

Nipah is a recently detected viral zoonotic disease caused by Nipah virus originating from a new genus - the Henipa virus.1, 2 Pteropus bats are the zoonotic host of the virus and pigs are the likely amplifying host.2, 3 The virus was first identified in Nipah village of Malaysia in 1998,2, 4 since then three other countries have reported human cases of Nipah virus infection, including Bangladesh.5-7 The Institute of Epidemiology, Disease Control and Research (IEDCR), a government mandated institution, conducted disease surveillance and outbreak investigations for Nipah encephalitis in Bangladesh. We present a review of the methods used for detecting these cases and their novel characteristics and risk factors through outbreak investigations during 2001-2011.

Methods

We reviewed IEDCR strategies and guidelines from its records to explore the mechanism for detection of Nipah cases and clusters. We also reviewed the method of hospital-based Nipah surveillance jointly conducted by IEDCR and the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). Outbreak investigation reports were studied to identify the sources of information through which these outbreaks were detected. The Nipah surveillance database was used to describe the demographic and clinical characteristics of the identified Nipah cases. Published reports...
on Nipah encephalitis in Bangladesh and unpublished outbreak investigation reports were reviewed to identify the risk factors for Nipah encephalitis in Bangladesh.

**Results**

To detect disease outbreaks, IEDCR conducts both 'event-based surveillance' and 'surveillance for specific disease or conditions'. Up to April 2010, as part of the event-based surveillance, IEDCR conducted unstructured monitoring of newspapers and television channels for reports of suspected disease outbreaks. In April 2010, IEDCR started a more structured surveillance of suspected disease outbreak reports in 10 national newspapers and eight national television channels. Any reported cluster or outbreak of known illness and even report of a single death from unknown disease is captured through this surveillance method. In addition to the media surveillance, IEDCR has two hotline numbers for healthcare providers to report disease outbreaks. Through district and sub-district rapid response teams, IEDCR verifies the existence of any outbreak and conducts investigation.

To identify outbreaks of encephalitis through enhanced surveillance networks and to identify risk factors for transmission of Nipah encephalitis, IEDCR in collaboration with the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) has been conducting surveillance for Nipah encephalitis in Bangladesh since 2006. Initially, this surveillance programme started in 10 hospitals. Currently, the surveillance is functioning in five hospitals in northwestern and central Bangladesh. Clinicians of sentinel hospitals identify and list all encephalitis cases presenting in the surveillance hospitals. A case of encephalitis is defined as any person with history of acute onset of fever or axillary temperature of >38.5°C and evidence of acute brain pathology manifested by altered mental status or new onset of seizure or neurological deficit. Any cluster of encephalitis cases, defined by two encephalitis cases within 21 days of each other and within half an hour walking distance from each other, identified through the sentinel hospitals are investigated by a trained team of epidemiologists from IEDCR and icddr,b.

As part of the cluster investigation the IEDCR and icddr,b team conducts search for encephalitis cases in the community adjacent to the cluster and carries out epidemiological research to identify risk factors. In case of outbreaks of encephalitis that are detected through event-based surveillance or sentinel surveillance, a team of epidemiologists, veterinarians and anthropologists conduct outbreak investigations. These investigations include identification of alive or deceased human cases suspected of having Nipah encephalitis, identification of possible animal sources of the infection, assessment of environmental contamination, and study of possible behavioural factors contributing to the outbreak and case control study to identify possible risk factors. For each case of Nipah encephalitis, four age-matched neighbourhood controls are selected for case control study. Exposure histories of both cases and controls within 30 days prior to the onset of illness are collected.

In case of any encephalitis cluster or outbreak, investigation teams collect blood from the suspected encephalitis cases and samples are sent to IEDCR. Initially, samples were sent to Centers for Disease Control and Prevention, USA (CDC) for testing. Later in 2007, a Nipah laboratory was set up at IEDCR for safe specimen handling and testing. Virologists of IEDCR conduct enzyme-linked immunosorbent assay to identify IgM and IgG antibodies against Nipah virus.
In Bangladesh, Nipah outbreak was first confirmed in 2003, when a team from Centers for Disease Control and Prevention, Atlanta, USA (CDC), icddr,b and the Government of Bangladesh retrospectively investigated two outbreaks of suspected encephalitis with human deaths which had occurred in Meherpur district in 2001 and in Naogaon in 2003. Including these two, 11 outbreaks of Nipah encephalitis have been detected in Bangladesh since 2001. Five of these outbreaks were detected from newspaper reports of human deaths from unknown illness, three were reported by sentinel hospitals, one was reported from a private hospital and others were reported by the civil surgeon of a district. During this period, 196 cases of Nipah encephalitis were detected from 20 districts of Bangladesh in outbreaks, clusters and as isolated cases; out of these 150 (77%) cases died.

The Nipah cases were mostly distributed in the northwestern and central part of Bangladesh. Outbreaks occurred during December to May, which coincides with the winter season in Bangladesh. Cases were distributed in all age groups. Median age was 25 years (range: 0.5-75 years) and 124 (63%) cases were males. Median duration from onset of illness to death was six days (range: 1-47 days). In the course of illness, 123 (63%) Nipah encephalitis cases developed acute respiratory distress syndrome (Table 1).

Drinking raw date palm sap collected during winter months, which is a delicacy in rural Bangladesh, was first identified as a risk factor for Nipah infection in an outbreak in Tangail in 2005. This has also been identified as a risk factor in three more outbreaks so far. Several sporadic cases have also reported history of drinking raw date palm sap within 30 days before the onset of illness. Close contacts with a sick person or his/her secretions and contact with sick animals were the other two risk factors identified through case control studies in different outbreak investigations (Table 2).

*Pteropus* bats were found to be positive for Nipah antibodies in different outbreak areas. A zoonotic investigation team of icddr,b identified the way bats contaminate the shaved surface of the date palm trees (from where the sap is collected) using infrared camera.

**Discussion**

A combination of an ‘event-based’ and ‘sentinel’ surveillance system has been a successful strategy in Bangladesh for detecting recurrent outbreaks of Nipah.

<table>
<thead>
<tr>
<th>Clinical characteristic</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>196 (100)</td>
</tr>
<tr>
<td>Altered mental status</td>
<td>169 (86)</td>
</tr>
<tr>
<td>Severe weakness/lethargy</td>
<td>142 (72)</td>
</tr>
<tr>
<td>Headache</td>
<td>131 (67)</td>
</tr>
<tr>
<td>Acute respiratory distress syndrome</td>
<td>123 (63)</td>
</tr>
<tr>
<td>Cough</td>
<td>108 (55)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>105 (54)</td>
</tr>
<tr>
<td>Myalgia</td>
<td>81 (41)</td>
</tr>
<tr>
<td>Convulsions</td>
<td>59 (30)</td>
</tr>
</tbody>
</table>
encephalitis. Multidisciplinary collaborative investigation of the outbreaks identified the clinical characteristics, risk factors and mode of transmission of this highly fatal zoonotic disease.

Over 50 species of Pteropus bats, the natural reservoir of Nipah virus, live in South and South-East Asian countries. After the large outbreak of Nipah encephalitis in Malaysia, only three outbreaks have been reported from countries other than Bangladesh, one in Singapore and two in India. Therefore, it is important to know whether specific environmental or host factors are responsible for recurrent transmission of Nipah virus to humans in Bangladesh or whether virus detections are the result of an efficient surveillance system. Although Bangladesh, like many other low-income countries, lacks an integrated disease surveillance system, the combination of event-based surveillance system with a sentinel surveillance system for encephalitis has possibly increased the likelihood of identifying Nipah cases in Bangladesh in comparison to some other countries in the region, which lack a strong surveillance for encephalitis.

While more than 95% of the Nipah cases in Malaysia had a history of contact with pigs, in only one of the 11 Bangladesh outbreaks a close proximity to pig herds was identified as a risk factor. Identification of the drinking of raw date palm sap, a unique cultural practice in rural Bangladesh and possibly in the neighbouring Indian states, as a risk factor for acquiring Nipah infection in Bangladesh and the validation of the plausibility of contamination of date palm sap with Nipah virus from Pteropus bats through separate zoonotic investigation highlights the importance of a multidisciplinary approach in investigating outbreaks of zoonotic diseases.

### Table 2: Risk factors identified through case control studies in Nipah outbreaks of Bangladesh

<table>
<thead>
<tr>
<th>Year</th>
<th>District</th>
<th>Risk factors</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Meherpur</td>
<td>Contact with a sick cow⁷</td>
<td>7.9</td>
<td>2.2 - 27.7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Caring or living with a case⁷</td>
<td>4.8</td>
<td>1.23 - 18.8</td>
<td>-</td>
</tr>
<tr>
<td>2003</td>
<td>Naogaon</td>
<td>Close proximity with pig herds¹⁰</td>
<td>6.1</td>
<td>1.3 - 27.8</td>
<td>0.007</td>
</tr>
<tr>
<td>2004</td>
<td>Rajbari</td>
<td>Climbing trees¹³</td>
<td>8.2</td>
<td>1.25 - ∞</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact with Nipah patient¹³</td>
<td>21.4</td>
<td>2.78 - 966.1</td>
<td>-</td>
</tr>
<tr>
<td>2004</td>
<td>Faridpur</td>
<td>Touching a Nipah patient¹⁴</td>
<td>5.6</td>
<td>1.79 - 17.24</td>
<td>0.003</td>
</tr>
<tr>
<td>2005</td>
<td>Tangail</td>
<td>Drinking raw date palm juice⁸</td>
<td>7.9</td>
<td>1.6 - 38</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2007</td>
<td>Thakurgaon</td>
<td>Remaining in the same room with Nipah patient¹⁶</td>
<td>Undefined</td>
<td>-</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2007</td>
<td>Kushtia</td>
<td>Physical contact with a Nipah patient¹⁵</td>
<td>Undefined</td>
<td>-</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2008</td>
<td>Manikganj and Rajbari</td>
<td>Drinking raw date palm juice</td>
<td>18</td>
<td>2.2 - ∞</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>2010</td>
<td>Faridpur</td>
<td>Drinking raw date palm juice</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>Lalmonirhat</td>
<td>Drinking raw date palm juice</td>
<td>17</td>
<td>4 - 70</td>
<td>≤0.001</td>
</tr>
</tbody>
</table>
Nipah outbreaks in Bangladesh have presented some features distinctly different than the outbreak in Malaysia. In Bangladesh, a higher proportion of Nipah cases suffered from respiratory symptoms than in Malaysia. Also, the case fatality ratio was higher in Bangladesh, which may be related to the lack of access of Bangladeshi cases to intensive care facilities. Like in other diseases caused by paramyxoviruses, such as measles, mumps, respiratory syncytial virus infection, parainfluenza, person-to-person transmission was a common mode of transmission in Bangladeshi Nipah cases, but this mode of transmission was not common in Nipah encephalitis cases in Malaysia. Therefore, future investigations should focus on exploring the reasons for variable presentation and different modes of transmission of Nipah virus in different settings.

To conclude, Nipah encephalitis, a fatal zoonotic disease, recurrently claims lives in Bangladesh following the initial reports of outbreaks in other countries. A combination of event-based and sentinel surveillance systems is an innovative strategy to detect encephalitis outbreaks which has been successful in detecting Nipah outbreaks in Bangladesh. Multidisciplinary outbreak investigations can be an important tool in exploring novel characteristics and risk factors of emerging infectious zoonotic diseases in resource-poor settings.

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Early detection of chronic diseases and their risk factors: a women empowerment model from Kerala, India

Safraj Shahul Hameeda

Identification of risk factors through screening is an important tool in the fight against chronic diseases. We have used a unique model, named Saantwanam (to console) in Malayalam language, for health screening in Kerala, India.

Under the Saantwanam programme, government selects suitable women care-givers who are trained and equipped by a nongovernmental organization through loans from a public sector bank. After training, care-givers deliver screening services by measuring the weight and height, and blood pressure, glucose and cholesterol levels of people concerned in their local communities at a reasonable fee-for-service that provides a source of income to them. All care-givers are trained to counsel on healthy living, i.e. appropriate diet, exercise and unhealthy habits such as tobacco consumption. When cases are detected they are referred to local physicians and later on followed up by care-givers at their residence.

In the last five years, the Saantwanam programme has screened more than 300 000 people for various diseases and risk factors. They have been counselled to avail of health-care services. The Saantwanam model does not cause additional expenditure to the government for early detection of chronic diseases and their risk factors. Moreover, it ensures that the care-givers are rewarded for their effort. However, before large-scale implementation of this model, measurement of baseline risk factors in a sample population should be done so that their impact can be measured at a later date. The cost-effectiveness of the model also needs to be determined.

Key words: Health, screening, chronic diseases, empowerment, women, India.

Introduction

Recent studies report that chronic diseases have displaced communicable diseases as the leading cause of death and disability in India.1, 2 Chronic diseases are estimated to have caused a cumulative loss of 16.68 billion rupees to the Indian Gross Domestic Product (GDP) between 2005 and 2016.3 Large financial costs pose significant difficulties for assessment of the prevalence, and provision of treatment services for chronic diseases in a large developing country like India. Identification of risk factors through screening is an important tool in the fight against chronic diseases.

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Among the Indian states, Kerala is at the most advanced stage of an epidemiologic transition that has brought about a dramatic change in the disease profile. Kerala, with a population of over 31 million in 2000 has the longest life expectancy and the lowest infant mortality rate in India. The Kerala model of development, characterized by a high level of human development and a low level of economic growth, has been much discussed in academic circles, most notably by Amartya Sen.

Now lifestyle diseases are the major cause of death in Kerala. The burden of deaths from cardiovascular diseases now exceeds that of industrialized countries. However, necessary reorientation of a public health strategy that focuses on chronic diseases has not yet taken place. This has resulted in high prevalence of many chronic diseases and risk factors in Kerala. Therefore, a unique public-private partnership model of health screening, which relies on entrepreneurship, has been developed in Kerala.

**Saantwanam, a home-based health screening programme**

*Saantwanam* means “console” in Malayalam, the local language in Kerala. *Saantwanam* was conceived by Health Action by People (HAP), a nongovernmental organization (NGO) based in Kerala, which is devoted to public health research. The Saantwanam programme is run in partnership with the State Bank of India, the largest public sector bank in India, and *Kudumbashree*, the poverty alleviation wing of Kerala government.

The aims of the Saantwanam programme are to: (1) identify adults with one or more risk factors for chronic diseases and refer them to physicians for advice; (2) help patients with risk factors or disease to monitor their condition regularly, and help reduce complications; and (3) provide health education to people. These aims are achieved through creation of a network of “home care-givers” – young educated women, who are trained in the science of health screening. Trained “home care-givers” reach out to every home in their locality where individuals are screened for the presence of major risk factors and diseases. Those who have risk factors or are already suffering from diseases and are under treatment are monitored regularly to assess the progress of treatment. These services are provided for a fee at an affordable cost. Thus a member of the *Saantwanam* programme or “care-givers” involved in household screening and monitoring earns a decent income by providing the envisaged services.

*Kudumbashree*, a government of Kerala enterprise, is entrusted with the task of identifying and selecting deserving candidates from among the eligible population using the following eligibility criteria. The “care-giver” candidate shall (i) ideally belong to a below-poverty line family; (ii) be nominated by the “local self government” and *Kudumbashree*; (iii) have a minimum of high school education; (iv) have a valid two-wheeler driving licence or would obtain one after completing the training; and (v) undergo a one-week residential training in health-screening methods.

A five-day training programme for selected candidates is organized by HAP. The training provided by epidemiologists and physicians consists of theory and practice sessions. Screening methods and common disease conditions in Kerala are taught during the theory sessions. Practical training on measurement techniques and safe handling and disposal of waste are also provided. A certificate of successful completion of training is provided along with an instruction booklet.
After completing the training the care-givers who possess a two-wheeler driving licence are provided assistance by Kudumbashree to obtain bank loans and other financial subsidies. On receipt of application, the State Bank of India provides collateral-free loans up to Indian rupees 50 000 (US$1250). Once the necessary financial assistance is secured the amount is used for obtaining the necessary equipment (see Box 1).

The success of the programme depends on access to the services. Mobility and outreach are ensured through the provision of a motor bike/scooter and a mobile telephone. All equipment used in the Saantwanam programme conforms to the standards recommended by the World Health Organization.

**Methods**

The care-givers of the Saantwanam programme, at the household level, measure and take readings for height, weight, body mass index (BMI), body fat, blood pressure, blood glucose, cholesterol, triglycerides, urine sugar and albumin. All measurements are carried out using standardized methods for which care-givers are trained. The equipment is also standardized and calibrated periodically.

Height is measured using a custom-built anthropometric rod that can be easily carried by the care-giver. The subjects are asked to stand close to the wall and their height measured using the adjustable anthropometric rod. The BMI is calculated from the height and the weight measurements using a calibrated electronic weighing machine. The blood pressure is measured after making the subject sit down, and the procedure is carried out in a standardized manner that is explained to care-givers during their initial training. Random capillary-blood-glucose level is measured using the standardized glucometer and a repeat test is advised for those showing high values. All subjects with higher-than-normal values are advised to consult physicians of their choice in public or private sector. All initial tests including lipid measurements are done at random; subsequent tests, if required, are carried out after fasting. Sterilized, disposable needles and swabs are used for finger-prick blood collection. Care-givers provide the test results in a standardized form with indicated healthy ranges.

Care-givers are required to visit the households in their area at least once a month. All data collected by care-givers are transferred

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**Box 1: Equipment used by Saantwanam care-givers in Kerala, India**

- Abbott optium sensor glucometer
- Omron digital blood pressure monitor
- Roche Accutrend GCT machines for cholesterol and triglycerides
- Omron body fat monitor
- Tanita weighing balance
- Anthropometric rod
- Electronic calculator
- Nokia mobile telephone
- Glucose strips, swabs and lancets
- Two-wheeler (motorcycle or scooter)
to HAP where they are stored and analysed. Care-givers also have telephonic access to physicians involved with the programme. Any doubts and concerns that the subjects might have during the screening are addressed by connecting the patient to the physician over the mobile phone. As mobile phones are part of a corporate user group, the care-givers do not incur any expenses for calls within the network.

The cost of equipment and training material is estimated at US$ 1250 per care-giver. The equipment is purchased and distributed by HAP directly from the manufacturers. The equipment is also warranted by the manufacturer. The breakdown time is limited to one working day since HAP provides replacements. All consumables are bought by HAP directly from the manufacturers. These are provided to care-givers at prices significantly lower than the prevailing market price. The consumables are couriered to care-givers within a day of receiving the order. After completing six months the caregivers are required to pay a fee of US$ 12.50 per month to HAP for covering the administrative costs. Caregivers charge a reasonable fee for service, which is a source of some revenue for them. At the same time, this model makes the services affordable to the public. The fees charged for services by care-givers is presented in Table 1.

### Results

The project was launched on 8 October 2005. Out of the 561 participants who attended a series of 13 training programmes conducted till May 2008, 239 were inducted as Saantwanam care-givers. Fifty-nine care-givers have since discontinued. The Saantwanam programme currently covers both urban and rural areas in all districts of Kerala. More than 300 000 people have been screened so far for diabetes, hypertension and hyper cholesterolemia as part of the programme. If family members are also included more than one million adults have been exposed to individual-level health education provided by the care-givers since the start of the programme. The number of tests done and the revenue generated as

### Table 1: Fees charged by Saantwanam care-givers for their services in Kerala, India

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Fee (US currency)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose</td>
<td>62 cents</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>25 cents</td>
</tr>
<tr>
<td>Body mass index</td>
<td>25 cents</td>
</tr>
<tr>
<td>Serum cholesterol</td>
<td>1.5 dollars</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>1.5 dollar</td>
</tr>
<tr>
<td>Urine sugar and albumin</td>
<td>13 cents</td>
</tr>
</tbody>
</table>

*One US$ = 40 Indian rupees
part of the programme is shown in Table 2. About 50,000 new cases of diabetes were detected and referred to local physicians. It is important that the quality of diagnosis and care provided by care-givers is monitored regularly. Five supervisors conduct spot checks and households are also contacted to provide feedback on programmes. Moreover, regular re-training programmes are conducted to ensure that care-givers’ knowledge and skills remain current and relevant.

**Discussion**

Community participation is the hallmark of the *Saantwanam* programme right from the selection of care-givers. The training component is supported by the government of Kerala. Care-givers are then deployed in their own communities. All care-givers are trained to provide counselling on healthy living that includes appropriate diet and exercise as well as unhealthy habits including tobacco consumption. When cases are detected they are referred to local physicians. Patients diagnosed with hypertension/diabetes are followed up in the community by care-givers and their routine blood tests are carried out at their residence. The care-givers being part of local women’s self-help groups regularly meet with the local government officials to discuss health-related issues in the community. As a result of these discussions, screenings of people in marginalized communities undertaken by care-givers, are now subsidized by the *panchayat* - an elected body of local self-governance. The project is now considered by local governments as part of the health system, thus, ensuring long-term sustainability.

Community-based health programmes have been shown to increase awareness, help identify patients at high risk, as well as community-based interventions, and increase adherence to chronic disease screening. A large-scale multipronged diabetes awareness programme provided through community involvement as part of the Prevention Awareness Counselling and Evaluation (PACE) project in Chennai, reported that such programmes are effective in heightening the

**Table 2: Number of tests performed and sales revenue generated by *Saantwanam* care-givers from 2005-2011 in Kerala, India**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Number of tests*</th>
<th>Sales revenue (US dollars)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose</td>
<td>332400</td>
<td>207750</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>30500</td>
<td>45750</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>500000</td>
<td>125000</td>
</tr>
<tr>
<td>Body mass index (BMI)</td>
<td>300000</td>
<td>50000</td>
</tr>
</tbody>
</table>

*Blood glucose and cholesterol measurements calculated from the number of glucose and cholesterol strips bought by care-givers and blood pressure and BMI based on the data provided by care-givers.

**Sale revenue refers to the fee-for-service received by care-givers.
Early detection of chronic diseases and their risk factors

Safraj Shahul Hameed

awareness among many different segments of the population. A study from the United States of America reported that community-based screening can be used as a method for identifying the high percentage of patients at risk for diabetes or with undiagnosed diabetes in an inner-city immigrant/mixed-ethnic population. The Bootheel Heart Health Project reported that even with modest resources, community-based interventions show promise in reducing self-reported risk for cardiovascular disease within a relatively brief period. A qualitative study done on why community health workers called “promotoras” increased adherence to chronic disease screening among women along the United States-Mexico border, reported that community health workers can play a crucial role in the health care team, and that both clients and clinicians recommended working with them to increase adherence to chronic disease screening.

The Saantwanam programme holds opportunity for scaling up and there is scope for further improvement. Health education using books, pamphlets, posters and video are planned for the coming year. However, before any large-scale implementation, the baseline risk factors in the population should be measured so that their impact can be assessed at a later date. One of the limitations of this project is that we did not have the baseline data on risk factors. The selection of suitable candidates is important for the success of the programme. Most caregivers who discontinued working, reported on subsequent interviews that they were not clear about the type of work involved. The nature of the work involved should be explained clearly at the time of selection. The use of portable electronic equipment instead of paper forms could facilitate the capture and storage of patient data by making the process easier and safer.

There is a definite potential to include more diagnostic tests and services like first aid, wound dressing and cancer screening, etc. Incorporation of WHO Package of essential noncommunicable disease interventions (WHO-PEN) protocols in the training programmes can help assess the risk of death from cardiovascular diseases in 10 years. These protocols have been developed taking into consideration limitations in low-resource settings where even referrals can be very difficult and delayed due to lack of transport and accessibility. Suitably trained caregivers might be able to prevent or manage noncommunicable NCDs locally and at the first-contact point with the patient.

Organizations and individuals in other parts of the world can use this model with suitable variations to provide health-screening services and to generate employment for women. This model involves no additional expenditure to the government while at the same time ensuring that the individuals involved are rewarded for their effort.

References

Early detection of chronic diseases and their risk factors


Hospital or home? Scripting a high point in the history of TB care and control

Mukund Uplekar & Mario Raviglione

"A concurrent comparison of home and sanatorium treatment of pulmonary tuberculosis in South India" – popularly referred to as the Madras Study, revolutionized the public health approach to tackling TB.1 It "liberated" treatment of TB, which was confined to sanatoria and hospitals, to health centres and homes, making it available to the masses who needed it most. The study is unique in many respects. The 93-page long article with an appendix of ten radiographs of patients treated in the “home” series of the study covered only two of the seven key objectives! The study helped initiate a lasting and what later proved to be a highly productive collaboration among the Indian Council of Medical Research (ICMR), the British Medical Research Council (MRC) and the World Health Organization (WHO). The MRC seconded Dr Wallace Fox, who coordinated the study, to WHO. The study engaged 100 staff – 40 from Madras government and 60 employed by the ICMR. Distinctively, it began with setting up of a Centre specifically for the study – Tuberculosis Chemotherapy Centre, which successfully completed the study and continued to exist thereafter, albeit with a different name – the Tuberculosis Research Centre, to produce some more landmark studies especially chemotherapy trials, which also informed subsequent global TB control policies.

What prompted setting up this landmark study? The provision of TB care at that time was largely restricted to TB specialists who managed their patients in specialized hospital units and sanatoria. Hospitalization also facilitated treatment supervision and patient follow-up. The specialist physicians often doubted the feasibility and effectiveness of ambulatory treatment as it would not guarantee treatment adherence, allow disease transmission to the households and the community, and potentially increase the risk of development of drug-resistance. However, providing hospitalized treatment to all the TB patients was beyond the capacity of most resource-poor countries which carried a high burden of the disease. At the time of the study, India had an estimated 1.5 million infectious TB cases and only 23 000 TB beds in sanatoria and hospitals. A majority of these facilities were run by private entities and mainly served the rich patients who could afford them. Early anti-tuberculosis drugs producing good results had arrived, and a policy decision choosing between home-based treatment and hospital-based treatment had to be taken. Dr C. G. Pandit, the then Director of ICMR, had emphasized “...in a country where for a long time to come adequate facilities for the isolation and treatment of the active case of tuberculosis is not practicable, the importance of providing adequate treatment in the..."
patients’ homes cannot be overemphasized. There is reason to believe that by a controlled use of chemotherapeutic agents, it may be possible to evolve a method of treatment under home conditions which can break the chain of person to person infection and render an infectious person non-infectious. The study has now been undertaken...”.2 And indeed the study did transform forever, the way TB was treated worldwide. Isn’t it an irony that similar questions are being posed today for the treatment of multidrug-resistant and extensively drug-resistant TB?3

The study compared the effect of standard TB treatment at that time – isoniazid (INH) and para-amino salicylic acid (PAS) for a period of 12 months – in two groups of patients in a controlled clinical trial. One group was treated under good conditions in a sanatorium according to the existing standards and the other under ordinary conditions at homes of the patients. The sanatorium-treated patients, despite prompt nursing care, good accommodation, adequate bed rest, and balanced diet, did not fare any better than the patients treated in their own, overcrowded homes, had limited rest and a poor diet. Importantly, in spite of random allocation, the home series had more severe disease than the sanatorium series. It is worthwhile mentioning some other momentous findings of the study1

(1) quiescence of the disease at one year and relapses in the subsequent four years showed no differences between home and sanatorium patients;4

(2) a five-year follow up of close family contacts did not show any special risk for contacts of patients treated in homes;5

(3) treatment in sanatorium was no safeguard against irregularity of drug intake. A significant unexpected finding was that sanatorium treatment posed greater social problems such as difficulties in making patients stay for a long period and disruption of family life.

The interim findings of the study were immediately reviewed in the seventh report (1960) of the WHO expert committee on TB. The committee noted that countries with a large TB problem and limited resources should use their scarce resources for setting up programmes supporting domiciliary use of anti-TB drugs rather than for construction of hospitals. However, it was only after all the results of the follow-up of patients were available, that the WHO expert committee, in its eighth report in 1964, recommended unambiguously that “all financial resources and manpower available for TB control in developing countries be confined to organizing efficient ambulatory services and not to constructing new beds. TB beds, where they already exist, should be integrated into the ambulatory and domiciliary services so as to ensure their most rational use”. The global uptake of WHO recommendations was not as swift as expected. Seven years later, Dr Halfdan Mahler, pointed out in his article - the tuberculosis programmes in the developing countries - another public health classic, the incorrect advice that developing countries continued to receive “in recent months”, including “it is bad public health practice to treat a case of infectious tuberculosis at home”.6 In fact, hospitalization of TB patients, for the initial two months or longer remained a common practice in most African countries until recently. Probably because the study was a demonstration in an Indian setting, its findings were eventually taken up more quickly in Asian countries. More recently, a WHO-assisted multi-country project and other studies have demonstrated feasibility, effectiveness and cost-effectiveness of community-based TB care in Africa.7,8
This truly remarkable study sowed the seeds for the DOTS strategy launched by WHO in the mid-1990s which reactivated the dormant and disappearing TB programmes. A critical demonstration of this study was that although irregular drug intake was significantly more among home-treated patients, hospitalization was not a guarantee for regular drug intake unless the patient was actually seen swallowing every dose. Without labelling it, the study prompted the need for what became known as “directly observed treatment (DOT)” decades later. In fact, it was also Dr Wallace Fox who first discussed in-depth the need for direct observation of treatment in another article. Summarising the experiences in diverse non-tuberculous conditions including rheumatic fever, myxoedema, epilepsy and leprosy, he observed that self-administration of drugs presents problems in tuberculosis also, and more importantly, “these problems are not confined to ‘underdeveloped’ countries”. In order to investigate the ideal form of chemotherapy for the home treatment of pulmonary TB, he pointed out the need to “investigate regimens given daily or intermittently under direct observation”. DOT incorporating Dr Fox’s own words “direct observation” thus became the central plank of the five-point DOTS strategy that promoted globally close supervision of treatment as a means to ensure cure. Key components of subsequent global TB control strategies have been alluded by listing some of the essential requirements of a domiciliary TB diagnosis and treatment programme in the concluding statement: “…adequate supply of anti-tuberculosis drugs, enough staff, including a public health nurse and a social worker, transport, a small number of hospital beds for special cases, an efficient appointment system, a system of surprise checks on the cooperation of the patients in taking their medicines, reliable smear examination of sputum for tubercle bacilli, and a welfare fund for especially needy patients”.

The issue of community-based versus hospital-based care has again come into sharp focus in scaling up programmatic management of drug-resistant TB (PMDT). Albeit based on limited evidence yet, WHO guidelines on PMDT suggest that community-based care provided by trained lay and community health workers can achieve comparable results and may help in decreasing nosocomial spread of drug-resistant disease. WHO now promotes a comprehensive approach to TB care and control: the Stop TB Strategy. This approach, built on the DOTS strategy, emphasizes patient-centred care. It recommends that patient supervision should be humane and integrate personal support and counselling. The Stop TB Strategy also underscores the importance of community engagement in TB care. This is a call to communities to contribute to their own health in the spirit of the Alma-Ata Declaration of Health for All. It supports patient participation in community-based and home-based care schemes. The rights-based approach guarantees cost-effective access to care while safeguarding patients in their own community. This policy recommendation would not have been possible without a clear demonstration that ambulatory care is as safe and effective as the hospital-based care.

In conclusion, the Madras study is among the most influential in the history of TB care and control. Together with subsequent chemotherapy trials, also conducted at the then Tuberculosis Chemotherapy Centre, it proved that modern chemotherapy regimens cured virtually all TB cases. Those who still doubt domiciliary treatment of multidrug resistant TB will likely be contradicted by the evidence that is now accumulating. The Madras study will always inspire and inform
policies that advocate reaching patients where they are and caring for them.

References

Voices

Mobile phones for community health workers of Bihar empower adolescent girls

Derek Treatman*, Mohini Bhavsar*, Vikram Kumar* & Neal Lesh*

Ruby, a 16-year-old girl who has recently entered puberty, sits next to an Accredited Social Health Activist (ASHA), named Sangeeta, who lives in Ruby’s village Kalua in Bihar and provides basic health services and education as a volunteer for India’s National Rural Health Mission (NRHM). Sangeeta had recently finished a three-day training on using a new mobile phone application called CommCare as a job-aid tool for counselling adolescent girls and women on menstrual hygiene, sexually transmitted diseases, and family planning methods.

Ruby gives her name, age, and a few other personal details for Sangeeta’s record. Sangeeta then begins the first lesson on menstrual hygiene. Played through the mobile phone’s loudspeaker, Ruby hears general information and a few common myths about menstruation from recorded audio messages on the phone.

“Some people believe that during a woman’s menstrual period she is impure and is unfit to do common household chores or cook. Would you agree or disagree?” the phone asks.

“Disagree!” Ruby says with conviction.

Sangeeta smiles and records the answer in the phone, which then responds, “That is absolutely correct! A woman’s menstrual cycle is a natural physiological process signifying maturation of reproductive organs,” and continues to say that women need not consider themselves impure.

Ruby has previously received education on topics like reproductive health, which today is uncommon for a young woman of her socioeconomic status in Bihar. Although these topics are far from breaching the school curriculum here, programmes run by local nongovernmental organizations (NGOs) enable women like Ruby to attend a few days of formal instruction to get the basic information they need to make choices about their health, their families, and their future.

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Although Ruby has already learned about female anatomy and menstruation, she explains that there is something new that she heard today from Sangeeta’s mobile application.

“When a girl begins to menstruate, she needs to think about the possibility of pregnancy and using contraceptives, that she must not become pregnant because her pelvis is not strong enough. Adolescent girls who become pregnant can sometimes die or have a miscarriage,” Ruby explains.

Through a mobile phone, this instruction can be given informally in one’s own home, and personally, by a local health worker whom one knows and trusts. Information can also be given in a series of staggered, short lessons, allowing a health worker to focus on one topic at a time. Group training and classroom instruction, although highly beneficial, condenses a lot of information into a very short amount of time but does not allow the same level of intimacy or individual engagement.

Ruby continues, “I know that this information is important. My friends who are younger and those older, if they don’t know, I will explain it to them. They are embarrassed and say, ‘how could I possibly speak to my mother?’ or ‘how could I ask my auntie?’ But I can explain it to them.”

Ruby’s home is just off a national highway that runs between Delhi and Kolkata, which means she has easy access to things like school and the local health centre. After school she travels by bicycle to nearby villages further into the interior of Bihar to tutor girls her age that don’t have access to any formal education.

“People don’t know anything there,” she says. “They don’t have books, or training, or anything. If I don’t give them coaching, how will they learn?” Ruby speaks with a sense of urgency and responsibility perhaps uncommon for someone her age. We are delighted when she suggests using mobile phones to spread these messages further into the interior. She has echoed the very cause which brought us to India in the first place, and we are humbled to hear her say it.

Ruby has told her father that she will not marry until she is 21 years old, that for now she wants to study. Never before in a village of Northern India have we encountered such an emphatic and candid young woman; one who takes such sensitive information to heart and acts upon it, for herself and others. Sangeeta explains that she was married when she was 15 years old and had her third child by the time she was 20. As a growing, young woman, Ruby has turned to Sangeeta today as at many other times, for advice and support on matters such as marriage.

Working in rural health development programmes in India, it is easy to mistake adolescent girls as helpless or disempowered. As outsiders in a villager’s home, women are often reserved and make infrequent eye contact. The sensitive topics of this intervention make conversation even more difficult, but Ruby reminds us not to generalize. She is the outspoken voice of impoverished adolescent girls who lack education but know of its importance. Unafraid to seek this knowledge on her own, she has become an advocate for young women in her village and others around it.
**Recent WHO publications**

**Strategic Framework for Elimination of Human Rabies Transmitted by Dogs in the South-East Asia Region**


Dog bites are the primary source of human infection in rabies-endemic countries and account for 96% of rabies cases in the South-East Asia Region. Elimination of human rabies is dependent on elimination of dog rabies. Some countries have a comprehensive rabies control programme but it is a neglected area in others. New innovative tools and techniques have been developed in recent years to improve dog vaccination coverage, dog population management and accessibility of modern rabies vaccines. Considering the importance of consolidating achievements in rabies control in Member countries, the WHO Regional Office for South-East Asia has developed a regional strategy for elimination of human rabies transmitted by dogs in the Region. The strategy aims to eliminate human rabies through progressive control of dog rabies and human rabies prophylaxis in rabies-endemic countries and to maintain the rabies free status in rabies-free areas of the South-East Asia Region by 2020.

**Quality Assurance in Bacteriology and Immunology**

Third Edition


There is an increasing dependence on clinical and public health laboratories for better patient management and also for preventing the spread of emerging pathogens. With rapid and significant growth of laboratories at all levels of health care, it has become mandatory to check results to make them reliable and cost-effective, as well as comparable with those obtained by international laboratories. The International Standards Organization (ISO) has provided several guidelines and standards for achieving quality in laboratory results.

These guidelines dwell upon the basic concepts of quality assurance in microbiology and also describe essential practices and steps of ensuring quality in various activities that a microbiology laboratory is expected to undertake in its support to primary health care system in a biosafe environment and in accordance with ISO. Following these guidelines will help in delivery of reliable, cost-effective and timely laboratory results and support clinical and public health actions.
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