PRIORITY AREA 9: ENVIRONMENTAL AND OCCUPATIONAL HEALTH

Topics

An Assessment for Drinking Water Quality (A Case Study of Dhungedhara at Kathmandu Valley) 2001

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Background

Stone taps, locally called 'Dhungedhara" were used as the only means for drinking and other domestic uses before the city water supply system established. High population growth in Kathmandu valley is increasing sort-supply drinking water for all the people. Leachate from solid waste, sewerage, waste dumping and leakage from drainage system can also be given credit for this contamination. However due to inadequate quantity of city water supply, being even severe in dry seasons, people are driven towards stone taps without even knowing the quality of water. Public water supply is not reliable enough. In this context water from natural springs (Dhungedhara) has a very significant contribution in providing water to urban communities but the quantity and quality of such springs seems to be deteriorating day by day. The main objective of this research was to study the general condition of Dhungedhara in Kathmandu valley and assess the quantity and quality of public Dhungedhara in relevance to the public health.

Methods

Water samples from three stone taps in Kathmandu valley were taken based on taps being extensively used for domestic purposes. One sample each from three different stone taps was collected. The samples were analyzed in the laboratory. Views of different people were collected and incorporated. Laboratory test results were analyzed thoroughly and compared with World Health Organization standards and suitability for drinking purpose.

Results

The observed values of all the tested parameters were found to be within the limit of World Health Organization guideline values except pH value in the sample from Budhnagar which was not found to be significant.

Conclusions

The sources of these taps should be preserved and protected from pollution. A wide public awareness program should be launched including campaign against

using polluted water, its impact on health. The health program should be incorporated with it.

Situation Analysis of Environmental Health in Nepal (2002)

Jha HB

Background

Environmental health incorporates environmental issues affecting public health. The subject though important to the planners, policy makers, government and related institutions, was not given due weightage until the introduction of Nepal Environment Policy and Action Plan (NEPAP) in 1993. Increased population, uncontrolled urbanization, vehicle emission, industrialization, land degradation and biodiversity loss are some of the important factors responsible for the degradation of air, water, land and noise quality. Environmental problem is common both in rural and urban areas. But it is conspicuous more in urban areas, mainly in Kathmandu valley. As a result, the human health is affected. The biodiversity is affected to such an extent that a number of species have become extinct and the lives of many others are endangered. This study intended to conduct situational analysis of environmental health sector so that it could contribute towards developing plans and programs to mitigate the problems.

Methods

Both primary and secondary sources of materials have been used for collection of data. The primary data have been collected through interview with key resource persons and field visit. Data collected from primary and secondary sources were compiled, processed and analyzed.

Results

The Ministry of Population and Environment and Ministry of Health have developed policies, guidelines and standards in related field but they are not adequate particularly in environmental health sector. In the environmental sector, the ambient air pollution level mostly in urban areas has been affected due to the presence of parameters including particulate matter, carbon monoxide, carbon dioxide, sulphur dioxide and lead. Indoor air pollution largely by biomass has

proved hazardous to public health due to the concentration of PM_{10} and other such factors. Additionally water quality is affected mainly due to the contamination of river water, underground water and surface water through the discharge of effluent of polluting industries and untreated sewerage in water. High level of bacteriological contamination of water largely caused by faecal contamination is a serious problem in Kathmandu. In the Terai, arsenic contamination is a matter of concern in certain pockets. Land is getting polluted through the haphazard use and misuse of chemicals and pesticides, household hazardous wastes, municipal solid wastes and hospital wastes. Changing environment has caused several health problems.

Conclusions

The environmental health hasn't received adequate attention despite its need for better public health. Focus should be given towards development of skilled manpower, laboratory and equipment, information and database management and researches in order to improve the institutional capability of the environmental health institutions in Nepal.

Action-Oriented Study on Water Quality and Water Borne Diseases in Bungamati VDC, Lalitpur District Nepal (2003)

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Background

Water pollution is one of the serious public health issues in Nepal. It is estimated that one third of the total deaths of children under five years of age in rural area is due to water-borne diseases including cholera, typhoid, dysentery and gastro-entities. The water related diseases lie among the top ten diseases in the country. Yet the vital connection between water and health is given little emphasis in government policy. This was an action oriented research study on water quality and water related diseases in Kathmandu valley.

Methods

The study was conducted in Bungmati VDC of Lalitpur district. The total sample size was 110 households constituting 72, 23 and 15 for Bungmati, Chundevi and Phasidol respectively. The study has been primarily based on primary data. The study region comprised different water sources such wells, stone spouts, ponds, public taps and rivers with their respective number of 5, 2, 5, 6 and 2. The quality of drinking water has been tested for 20 sample sites.

Results

The findings showed that majority of households found to have cleaned their drinking water sources once a year and that the water used by the communities found to be contaminated either at source or consumption points. As a result incidence of diarrhoea appeared the common health problem among the sample

households in the study region. Yet majority of households found to be unaware with the real cause of diarrhoea. The community perception towards environmental sanitation and personal hygiene is very poor. Not all households do have latrine in their houses and therefore the people of the households with no toilets use nearby field or the river bank for defecation. Two-third of the sampled households has used proper hand washing practices after defecation. Not all households have used slipper or shoes while going out including toilet.

Conclusions

Regular monitoring of water quality at frequent intervals and awareness programs towards conservation of surrounding environment and personal hygiene to the local communities should be made more effective in the study region by the concerned agencies. Open defecation habit must be controlled through making available, affordable toilet scheme to the communities. Solar disinfection appeared to be appropriate as well as effective method of water disinfection in the study region.

Keywords: environmental sanitation; personal hygiene; water-borne diseases; water quality.

A Survey of Hospital Waste Management in Bir Hospital, Patan Hospital and Tribhuvan University Teaching Hospital (2003)

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Background

Most of the health care sector in Nepal practice improper waste management. Spread of infectious organisms through various means from medical waste pollute the environment and increase the risk of silent epidemics of infectious diseases like viral hepatitis, typhoid, pneumonia, AIDS etc. This study therefore was carried out with the objective of finding out the current practice of hospital waste management in three major hospitals of Kathmandu.

Methods

The study was carried out in Bir Hospital, Patan Hospital and Tribhuwan University Teaching Hospital. Specific wards were chosen from three hospitals to characterize medical waste for a month. In this study, survey method was applied as a technique of investigation and information were collected through direct observation, questionnaires and interviews. Data was collected during the period of February-September 2003. The study adopted a model to make a comparative analysis of waste management in three hospitals. Review and analysis of available literature/documents pertaining to the study from former research projects and sample survey especially with reference to medical waste management were also carried out.

Results

The two of the three hospitals namely Patan Hospital and Tribhuwan University Teaching Hospital have integrated approach of waste management while Bir hospital has poor hospital waste management. There is no central authority to watch and to monitor the management practices of hospital waste, so hospital authorities are treating waste carelessly. The waste generated from orthopedic ward of Bir hospital contained general waste 82.3%, hazardous waste 15.8% and sharps 1.9% by weight. The laboratory of Patan hospital had high recording of hazardous and sharp waste as compared to other departments. Both hazardous and general wastes were collected in same bucket in Bir hospital. Among the three hospitals only Patan hospital had auditing and recording system of generated waste done by the house-keeping department. Investigation showed that a high proportion of waste handlers were exposed to the risks associated with medical waste handling. Significant number of staffs from Bir hospital didn't wear protective clothing and equipment in the process of waste management. Staffs involved in waste management are highly unaware of the risk associated with health care waste. Patan and Tribhuwan University Teaching Hospital have working infection control committee. It was seen that among the three hospitals, Patan hospital has the best waste management practices and Bir hospital has the worst.

Conclusions

Public awareness through mass media, proper hygiene education to scavengers, compulsory staff training for waste management and legislation to regulate hospital waste management system will change the problems encountered with current practices of hospital waste management.

Assessment of Noise Pollution and Development of Criteria for its Prevention and Control (2003)

Background

Modern technology has created many environmental pollutants of which noise is an immediate and identifiable example. During the last few years, a wave of the environmental consciousness and concern is being developed in Nepal. Therefore a field level monitoring of sound pressure level was conducted by Nepal Health Research Council in five major urban cities of Nepal.

Methods

This study was carried out in Kathmandu, Bhaktapur, Lalitpur, Kirtipur and Janakpur-five major urban cities of Nepal. These cities were categorized into five major areas based on international criteria; a. high traffic area, b. commercial cum residential area, c. commercial cum tourist area, d. new residential area and e. old residential area. Two or more than two sample sites were chosen for each setting. Similarly an ambient noise level was monitored in the industrial area like Balaju industrial State and Patan Industrial State. There were altogether 169 samples monitored in 38 sample sites. Data supporting L_{eq}, L_{max}, L_{dn} was used to evaluate sound pressure level in different settings. A survey was administered through questionnaire in order to obtain public opinion regarding environmental noise and

its effects on human health. The audiometric test was also carried out in certain survey area to determine the audiometry sensitivity of the individual.

Results

Among the high traffic areas, the highest L_{eq} was observed in Suryabinayak of Bhaktapur (81 dBA) during night hours and Kupondole of Lalitpur (79dBA) during office hours. The highest L_{dn} value of 74.36 dBA was observed in high traffic area and the lowest was observed at new residential area of 62 dBA. Monitoring results from the industrial area shoed that all values obtained in sites was above US standards. 285 of the sampling sites have exceeded the Indian standards. Results have shown that 14.75% from the category of non-exposed group and 39.34% from exposed group had noise induced hearing loss (minimum to severe). Health examination of samples showed that among the non-exposed group only 2% out of total sample had cardiovascular and genitourinary tract disease. in exposed group 5% of the entire sample had cardiovascular disease, 3% respiratory disease, 25 genitourinary disease and 7% intestinal tract disease. It was found that the risk of getting noise induced haring loss of exposed category is 4.250 times higher than that of the non-exposed group. The traffic noise (above 70 dBA) is found mainly the dominant factor for higher noise level.

Conclusions

Noise pollution is emerging as an environmental problem in majority of areas selected for monitoring. The noise pollution has also caused medical problems. The people staying in noisy areas especially above 70 dBA must take precautionary measures in order to avoid noise induced hearing loss.

Keywords: human health; monitoring; noise induced hearing loss; noise pollution; urban cities.

Assessment of Ambient Air Quality in Selected Urban Areas of Nepal (2004)

Ambient Air Quality Study Team

Background

Air pollution is growing problem in the world. In urban areas, air pollution is caused due to the increasing use of fossil fuels. Studies have shown that air pollution has a proven linkage with the human health damage. According to recent estimate on increase on daily mortality, on a global scale 4 to 8 percent of premature deaths around the globe are due to exposure to particulate matters. It is estimated that air pollution in South Asian cities causes nearly 100,000 premature deaths per year and over a billion work days of lost or reduced productivity.

Methods

In case of air quality data, monitoring in two cities outside Kathmandu valley was conducted for two different seasons. In case of Kathmandu there was presence of air quality monitoring system so data was used for analysis. World Health

Organization's recent guideline to assess burden of disease due to outdoor air pollution was used to assess the health impacts due to air pollution.

Results

The Total Suspended particulate (TSP) and Particulate matter of size less than 10 micron (PM_{10}) levels in the ambient air at Birgunj exceeded several times of the national standard. Average PM_{10} level in Bhanuchok, Ranighat and Addarchnagar were found 380µg/m^3, 358µg/m^3 and 220µg/m^3 respectively. However Birgunj was found to be least polluted with all kinds of gaseous pollutants. Observed levels of NOx, SOx and CO in all locations of this city were found very low than the recommended safe level. In case of Pokhara, the observed average level of Total Suspended particulate and PM_{10} except station Hallchok, Lakeside was also found higher than the National Ambient Air Quality Standards (NAAQS) level. Like Birgunj, gaseous pollutants were found very low than the set National Ambient Air Quality Standards limit. Annual average of PM_{10} in Kathmandu's air from March 2003 to February 2004 was calculated to be 132.88µg.m^3. The most polluted monitoring site was found to be Putalisadak with annual average of PM_{10} to be 209.01µg/m^3. The yearly trend of Chronic Obstructive Pulmonary Diseases (COPD) in the public hospitals of Kathmandu showed increment in the number of patients. In case of Kathmandu valley, the attributable burden due to current PM_{10} concentration against the baseline concentration of 10µg/m^3 was found to be 1926 cases of premature mortality per year. Similarly the number of cases of premature mortality for short term exposure to current PM_{10} concentration in Kathmandu valley which could be avoided if the government could reduce the ambient PM_{10} concentration to national standard was calculated to be 212 cases of premature mortality per year.

Conclusions

There is an urgent need to extend the regular air quality monitoring programme in other cities of Nepal and assess the impact due to it. Air pollution in Kathmandu valley, especially the particulate matter has been a serious threat to human health. Therefore while addressing the problem of air pollution, the cost of human health should also be kept in mind by the policymakers.

Keywords: ambient air; monitoring; particulate matter; quality; urban areas.

Situation Analysis of Indoor Air Pollution and Development of Guidelines for Indoor Air Quality Assessment and House Building for Health (2004)

Background

Indoor air pollution in developing world from bio-mass smoke is considered to be a significant source of public health hazard, particularly to the poor and vulnerable women and children. About 50 % of the world's population is estimated to use solid bio-fuels like animal dung, crop residues, wood and coal for cooking daily meals and heating homes and exposure from bio-mass smoke is estimated to cause a global death toll of 2.5 million every year equivalent to 4 to 5 % of total global deaths. In fact, the emerging data from recent studies indicate that risk-wise, it ranks only below malnutrition and poor quality of water/sanitation. In the context

of Nepal, census 2001 report shows that 80 % of households depend upon solid bio-fuels for domestic uses. The total death from pneumonia alone is reported to be 4429 during the last 12 months preceding 2001 census (4.14 % of the total deaths). Similarly, the total deaths from asthma / bronchitis are reported to be 7170 (6.71%). According to Nepal Demography and Health survey, 2001, the prevalence of Acute Respiratory Infection (ARI) for children below 5 years old is found to be 23 %. The below 5 years population is 12.1 % of the total population.

Methods

The surveyed and studied household size is altogether 98, 58 from hills and 40 from terai inclusive of both rural and urban areas. The respondent size, mainly women who cook, is 168 in number, who went through medical examination and questionnaire interviews. Smoke / PM10 as well as CO were measured in each kitchen during cooking time. Other gaseous emissions (SO2, NO2, HCHO) were measured in kitchens during cooking time on campaign basis only. Measurements of PM10, gaseous concentrations were carried out in indoor and outdoor ambient air as and when necessary. On the basis of data / information obtained from above, indoor and outdoor air pollutions were estimated; smoke / PM10 exposures experienced by the respondents under various environmental settings were calculated; and the health outcomes assessed using various statistical tools. The basis for comparative risk assessment with respect to various diseases / symptoms is the binary fuel uses in the studied kitchens, namely, solid bio-fuel users and the users of cleaner fuels like gas and kerosene.

Results

The smoke pollution is found to be the highest in kitchens having traditional clay stoves and using solid bio-fuels (dung, crop residue and wood) while cooking where the mean PM10 concentration level is found to be 2418 µg/m3 (average of 62 readings). Under similar ventilation and other household conditions, the mean smoke / PM10 concentration level in kitchens using cleaner fuels (kerosene, LPG, biogas) is found to be 792 µg/m3 (26 readings) which is about 3 times low. ¾ Under above conditions, the daily integrated PM10 exposure index level is estimated to be 15.58 mghr/m3 for those exposed to solid bio-fuel smoke and 10.15 mg-hr/m3 for those exposed to cleaner fuels. ¾ While comparing smoke /

PM10 pollution by eco-regions for solid bio-fuel users, the hill kitchens seem to be more polluted (Mean PM10, 2545 µg/m3) as compared to kitchens from plains (Mean PM10, 2186 µg/m3). Similarly, area-wise also, rural kitchens are more polluted (Mean PM10, 2427 µg/m3) compared to urban kitchens (2124 µg/m3). As has been observed in other countries, solid bio-fuels are the main sources of indoor air pollution for both hills and plains and also rural and urban homes of Nepal. Prevalence of Chronic Obstructive Pulmonary Disease (COPD) and LRI among unprocessed fuel users was found to be 16.8% compared to only 7% for those using processed fuels. 24.8% of the respondents using unprocessed fuels reported having breathlessness and wheezing and 14.4% reported having all respiratory symptoms. Statistically significant Odds Ratio (3.85) with 95% confidence interval, 1.11 – 13.84 was detected for chronic respiratory diseases. Similarly, statistically significant Odds Ratios with 95% confidence level were found for respiratory symptoms, namely Cough (3.71), Phlegm (3.08), Breathlessness (3.71) and Wheezing (5.39). The values show that Non-smokers have relatively higher odds ratio than smokers (5.21 for non-smokers and 1.52 for smokers) regarding COPD/Asthma taken jointly. The values show that for individuals aged below 40, the odds ratio is higher as compared to those aged 40 or above (3.04 for aged below 40 and 2.19 for aged 40 or above) regarding COPD/Asthma jointly

Conclusions

Indoor Air Pollution in Nepalese houses is real. The principal pollutant, smoke particulate originates from freshly combusted biomass. The ensuing smoke exposure conditions are unacceptable by any human standards and therefore, severe health effect attributable to indoor kitchen air seems indisputable. A wide range of interventions are available to reduce indoor air pollution, for instance, Changes in Energy Technology, such as, switching from bio-mass fuels to cleaner fuels like SKO / Cooking gas, Conclusion X Improving the design and construction of locally made traditional stoves by the use of chimney, fume hoods etc., and Changes in the living environment such as, improving the state of kitchen ventilation and raising awareness among the local people about the seriousness of the kitchen air pollution and building up participatory approach in the efforts made to reduce indoor air pollution.

The Risk of HIV Infection due to Occupational Exposure among Health Care Workers in the Hospitals of Kathmandu and Pokhara: A Hospital Based Study (2004)

Shrestha DP

Background

The incidence of HIV/AIDS is increasing in an alarming manner. There are more than 40 million cases worldwide. In Nepal alone it is estimated that there are about 60,000 cases. Regardless of numerous activities of information, education and communication, there is still high level of social stigma and fear towards this disease. There is reluctance or avoidance from the part of the health care workers in taking care of HIV/AIDS patients, mainly due to fear of transmission. There is real, although low, risk of HIV transmission due to occupational exposure. This study will determine the risk of HIV infection due to occupational exposure in health care workers of hospitals of Kathmandu and Pokhara.

Methods

It was a cross-sectional descriptive study carried out in Tribhuwan University Teaching Hospital, Bir Hospital, Western Regional Hospital and B and B hospital. The study population was the health care workers of the hospitals selected by simple random sampling. The data was collected through questionnaire and observation. Altogether 200 health workers were interviewed. The collected data was analyzed using Statistical Package for Social Science 10.

Results

More than 79% of the health workers were exposed to blood or bloody fluids of the patients by prick, cut, splash and touch within the period of 1 month in the hospitals where they worked. The risk of HIv transmission per health worker per year due to percutaneous exposure was 0.006%. The health workers were not aware of the magnitude of HIV problems as only one third of the health workers knew the estimated number of HIV/AIDS patients worldwide and Nepal. The majority of health workers, 8 out of 10 have taken care of HIV patients. 64.5% of the health workers said that inadequate personal protective practices were the most important risk factor in the transmission of HIV in the workplace. Four out of ten health workers agreed that the health workers perception of fear of contracting

AIDS is an important factor due to which the health worker may avoid giving health care.

Conclusions

Interventions are necessary in every aspect of the disease and proper management of the disease is one of the most important for the effective control and prevention of HIV/AIDS.

Final Report on Consensus Building on Applicability of an Appropriate Waste Disposal System within Health Care Institutions of Pokhara Sub Metropolitan City (2005)

Puakural R, Bijukachhe B, Vaidya B, Singh L

Background

Healthcare facilities have improved in Nepal over the last decade. Although the healthcare establishments provide healthcare services to the people, it generates solid waste, which is harmful to public health and environment due to its infectious and hazardous nature. Usually it consist sharps, human or animal tissues/body parts body fluids and other infectious materials. Out of the total healthcare waste only 20% is hazardous and rest of the 80% is ordinary that is similar to waste generated from households or offices. Most of the health care institutions in Nepal are not practicing the waste segregation, due to less awareness about the subject and lack of treatment options for different types of wastes. So hazardous wastes were being mixed with ordinary waste making total waste hazardous. This has created difficulty in management of the entire waste stream. This type of mismanagement of healthcare waste can effect environment and the socio-economical aspect of the community. This can spread infectious diseases like HIV/AIDS, Hepatitis B, Tuberculosis etc, and also can cause public and occupational health hazard.

Methods

Available national and international literatures on healthcare waste management have been studied in search of required information. For first field visit structured pre-questionnaires were prepared. For second field visit, different checklists and structured questionnaires were developed. These are two methods adopted for this study. First the list of health care institutions in Pokhara sub-metropolitan city was collected then a site-specific survey was conducted in the selected health care institutions. 4 government hospitals, 9 private, 2 teaching, and various polyclinics and clinics were identified. First site-specific survey was conducted only in eleven health care institutions (1 Government, 1 NGO, 1 INGO, 1 teaching, 1 community, 4 private and 2 clinics). The selection was conducted on the basis of location and capacity. The team also made a general observation of Landfill site and

Wastewater treatment plant. Group discussions and key person interview with structured pre-questionnaires was conducted to gather the required information. The segregated wastes were weighed by using spring balance. From the collected data simple average and percentage have been calculated and analyzed. The necessary data were presented in tabular and diagrammatic form. Data gathered during first field visit were used as baseline information for second field visit. Photographs taken during the field visits were included in the report to show the current status of health care institutions in Pokhara Sub-Metropolitan City.

Results

Among the 5 health care institutions, proper waste segregation was found only in Abhiyan and Green Pasture Hospital. On the basis of analysis done in Pokhara Sub-Metropolitan City, composition of health care waste measured in health care institutions was found to be 2% sharps, 12% hazardous, and 86% non-hazardous. Waste collection system was quite satisfactory but the problem was lack of disinfection of collection container. Due to the ignorance of staff the wastes were mixed during collection even if it was segregated properly at the point of generation. The collected wastes were transported manually at all the health care institutions. Only Manipal hospital was using tractor to transport organic waste and ash from incinerator to site near Effluent Treatment Plant (ETP) for burial. Most of the health care institutions lacked effective central storage system for the healthcare waste. Some health care institutions had provision of short time storage and but mostly openly stored. Health care institutions were adopting both chemical and thermal treatment methods to treat waste. Incinerator, Autoclave, Liquid Sterilizer, Sterilizer, Microwave etc. were used as thermal treatment technology for disinfecting reusable instruments. The health care wastes were disposed either by the health care institutions themselves or by the municipality. Both of them don't have safe disposal method. Occupational health safety was not given due attention by the health care institutions. Moreover the waste handlers themselves were unaware about their health. Though some health care institutions provided gloves, masks and aprons, waste handlers were not found properly used during their working hour.

Conclusions

Integrated waste management system and centralized waste management system were suggested for the overall healthcare waste management. As individual effort is not enough for sound management of health care workers, equal contribution from all the government, non-government and private organizations as well as media is very essential.

Keywords: health care institutions; health care waste; waste disposal system; waste management system.

Operationalization of Environmental Health Impact Assessment (EHIA) Guidelines through the Formation of a National Streering Committee (NSC) 2005

Devkota B, Shrestha S

Background

Nepal Health Research Council (NHRC), a leading health research agency, has come up with the development of the environmental health since 1999 as one of its operational strategies to encompass major health problems of the country. Over the last decade, in the process of implementation of Environmental Impact Assessment (EIA) of Nepal, the consequences of projects on human health have been inadequately addressed and integrated into the Environmental Impact Assessment process. Most of the development works are human centered and therefore human health should be given high priority. With due consideration of this fact, Nepal Health Research Council has prepared a National Environmental Health Impact Assessment (EHIA) Guidelines as a sectoral guideline for the health sector to fill up this gap and institutionalize the integration of Environmental Health Impact Assessment into the existing Environmental Impact Assessment process.

Methods

National consultants conducted series of meetings with dignitaries of the state Minister of Health, Health Secretary, Focal point (Environmental Health), Joint Secretary of other concerned ministries and Member Secretary of Nepal Health Research Council. The National Consultants prepared The Terms of Reference (TOR) for National Steering Committee and for conducting its meetings. Then Ministry of Health and Population upon request of Nepal Health Research Council

corresponded with these ministries and agencies to nominate their representative for National Steering Committee. National Consultants prepared the drafts of all correspondence and carried out follow up of the correspondences as and when required.

Results

The first outcome of the activity was the formation of a high level H-member National Steering Committee of Environmental Health Impact Assessment represented by Joint Secretary level officials and senior experts from different ministries and other agencies under the chairmanship of Health and Population Secretary. Secondly all members and experts were highlighted on Environmental Health Impact Assessment guidelines and its significance in existing Environmental Impact Assessment process in Nepal. The National Steering Committee also emphasized on the importance of representation of public health experts from Ministry of Health and Population in review committee board of Environmental Impact Assessment at Ministry of Environment, Science and Technology. Finally the Environmental Health Impact Assessment guideline was endorsed by the second National Steering Committee held under the chairmanship of Secretary at Ministry of Health and Population.

Conclusions

The continuation of National Steering Committee to review the Environmental Health Impact Assessment guidelines is felt very essential. At the same time the leading role of effective enforcement of Ministry of Health and Population in the amendment and application of Environmental Health Impact Assessment guidelines is thus recommendable.

Keywords: environmental health impact assessment; environmental impact assessment; guidelines; national steering committee.

Final Report on Occupational Health Risk due to Small Scale/Household Industries with More Focus towards Children within Kathmandu Valley (2006)

Joshi SK, Dahal P

Background

Making working conditions safe and healthy is in the interest of workers, employers and Governments, as well as the public at large. Although it seems simple and obvious, this idea has not yet gained meaningful universal recognition. Hundreds of millions of people throughout the world are employed today in conditions that breed ill health and/or are unsafe. In many jobs workers are exposed to a combination of potential hazards. Both research and legislation usually considers factors in isolation and we currently have little knowledge of the impact of combinations of factors on health and performance efficiency. This study was addressing the issue of combined effects of occupational health hazards with reviewing the literature, conducting appropriate secondary analyses of existing databases, collecting new data on accidents at work, and carrying out studies of the effects of combinations of potential stressors on physiological functioning and performance efficiency. The study focused on children (under 16 years) who were vulnerable to various social, physical and psychological impacts of their works; and there was a need to identify the occupational hazards to which children were

exposed in various sectors of employment. Adequate steps should be taken to protect these children from these occupational health hazards.

Methods

A procedural Guideline has been identified to analyze occupational health risks in small scale and household industries in Nepal. Workplace Occupational Health Assessment was done in ten small scale/household industries under operation within the Kathmandu Valley. Around 545 structured questionnaires were used to gather data on socioeconomic status and previous occupational history of the employees working in those industries. Thorough medical examination of around 135 child workers was done using a structured questionnaire to find out the health effects due to occupational hazards.

Results

The occupational health and safety practices in small scale/house hold industries in Kathmandu has been found to be insignificant, out of the ten industries only few industries have been practicing some occupational health and safety practices, the overall scenario is quite vulnerable. The occupational health and safety service in Nepal is still in the developmental stage. Majority of the workers in those industries were working on a low salary and with daily drinking habits. Out of ten industries, six have employed child labours and the working conditions range from bad to terrible. Out of total 545 workers present in the industries under study, altogether 135 (24.8%) were child workers. And, significantly higher proportion of child workers (97%) was illiterate compared to 3% of children with primary level education. Among 135 child workers, 23 (17%) were girls. Except for lower respiratory tract infection (LRI), the prevalence of all diseases has been found to be significant. The highest prevalence was found to be 53.3 % for ear problem where as 49.6% and 38.5% were suffering from others and upper respiratory tract infection (URI) respectively. Also 37% of the respondents had nose problems.

Conclusions

We must focus on appropriate strategies to reach our objective of eliminating child labour. Ratifying international conventions or introducing new legislation is not the answer to the problem. We must identify the strategies to prevent children from working, to withdraw more children from employment and to sustain such

withdrawals. If we fail or delay our task to launch appropriate programs, the situation of working children will never be solved.

Development of Procedures and the Assessment of EBD of Local Levels due to Major Environmental Risk Factors (2006)

Khanal RH

Background

There is direct relationship between environment and health. The magnitude of health problems is increasing day by day due to the exposure of various types of environmental risk factors. Among them, two of the major environmental risk factors under investigation are ambient air pollution and bacterial contamination of water supplies in Kathmandu Valley. The study has been conducted to assess how much serious is the impact of the two risk factors on environmental burden of disease in the valley.

Methods

Available data has been compiled from different secondary sources needed for Environmental Burden of Disease (EBD) calculations. The reference period for data compilation has been 2003 and 2004. The sources for demographic data

compilation are Central Bureau of Statistics (CBS), Ministry of Health (MOH), Ministry of Population and Environment (MOPE). The assessment of exposure to the given environmental risk factors has been accomplished by compilation different exposure data relating ambient air pollution, bacterial contamination of water supplies and temperature for the study population Daily time series data has been collected for exposure-response modeling in the case of ambient air pollution. For bacterial contamination of water supplies, monthly data has been compiled. In order to build exposure – response models, data on health effects which are assumed to be linked to the given environmental risk factors, namely ambient air pollution and bacterial contamination in water supplies in this particular Environmental Burden of Disease study was collected from the leading hospitals in Kathmandu Valley. Data from daily hospital records was used to develop models to compute Environmental Burden of Disease due to ambient air pollution except for Lung cancer morbidity where monthly data was used. In order to develop models to calculate Environmental Burden of Disease due to bacterial contamination of water supplies, monthly health data on health outcomes based upon morbidity and exposure was utilized. Meanwhile for mortality due to bacterial contamination of water supplies, census household survey data, 2001 was used. The household data provided information on access to water supply and sanitation facility and deaths related to bacterial contamination one year prior to the census survey.

Results

Positive associations were detected between the health effects and environmental exposures regarding the given risk factors. More than 20% of the health effects can be attributed to ambient air pollution regarding PM_{10} as the air pollution parameter for all the health effects considered except in the case of all cause mortality for which 7.9% can be attributed. More than 70% of the health effects can be attributed to bacterial contamination of water supplies regarding water borne morbidities. About 85% of the diahrreoal deaths and about 48% of the enteric fever deaths can be attributed to unsafe water supply and sanitation.

Conclusions

The extent of health effects from exposure to ambient particulate air pollution and water pollution are found to be substantial in Kathmandu Valley. The results therefore obviously raise health concerns to all valley inhabitants from these risk factors. The attributable disease burdens are found to be high for all the health effects taken into consideration in the present Environmental Burden of Disease study. Even though efforts have been made in the direction of reducing the particulate level and bacteriological contamination of water supplies in Kathmandu Valley, the valley's urban air and drinking water are still polluted. Therefore, this is a matter of serious concern to all of us and further steps will be required to reduce these contaminations in the valley.

Keywords: ambient air pollution; environment; environmental burden of disease; exposure-response model; health; risk factors.

Follow-up Study on Adoption of National Health Care Waste Management Guidelines at Health Care Intuition at Kathmandu (2005)

Poudel K, Acharya A, Pokharel S

Background

Health-care waste (HCW) also called, as clinical waste is a reservoir of potentially harmful microorganisms, which can infect hospital patients, health-care workers and the general public. It comprises of 10 - 25 percent of total Health Care Waste generated. Nepal Health Research Council (NHRC) with support of World Health Organization (WHO) has developed a "National Health Care Waste Management

Guideline" in 2002, and circulated it in different Health Care Institutions. With the objective to monitor and evaluate Health care waste management practices, to recommend specific needs/modifications, and follow-up report on adoption of National Health Care Waste Management Guidelines at health care institution this study was conducted on five different health care institutions at Kathmandu.

Methods

The study respondents comprised of the health care waste management personnel (waste handlers, sweepers, and waste transporters), housekeeping in-charge, matron, attending nurse at wards, medical director, and other experts who have been involved in the health care waste management in selected hospitals. It also focused on the different organization that take part on health care waste management such as Kathmandu Municipality City (KMC), Nepal Health Research Council (NHRC), Ministry of Local Development (MLD), Solid Waste Management and Resource Mobilization Centre (SWMRMC), World Health Organization (WHO), Ministry of Health and Population (MoHP), Department of Health Services (DHS).

Results

On monitoring and evaluation, Patan hospital and Tribhuwan University Teaching Hospital (TUTH) set a good example on waste minimization, Segregation, Labeling, Color Coding, Storage, Treatments and Disposal Practices among surveyed hospitals. Though each hospital has assigned colour-coding system for different types of waste, it has not been strictly practiced and lacks uniformity. Training in form of practical rather than verbal has led to decrease in overall rate of infection in all the cases. Illiteracy of the patients as well as visitors was found to be a profound factor, which has created difficulty in generating awareness among the visitors. 6 Improper disposal of health care waste has lead to increase in higher health risk to public. Municipality responsible for management of the health care waste is treating all type of health care waste as municipal waste and finally disposes it by land filling. Hospital also is equally responsible for mixing of infectious with general waste in municipal containers in few of the surveyed hospital. Legislation concerning wastewater treatment and land filling was also lacking. At present, Nepal has no rigorous laws or regulation, which is enforced in the field of health care waste. It was discovered that improved Heath Care Waste

Management Systems have only recently been introduced in a small number of health care institution and private hospitals since the circulation of the guidelines.

Conclusions

The study indicates that there is a need to improve the handling and disposal methods of hospital waste for almost all the available medical facilities along with final treatment. Public awareness through mass media, proper hygiene education to the scavengers, mandatory staff education in waste segregation, and legislation to regulate hospital waste management systems will change the traditional habits of different groups of people involved in this sector. Development of specific standards would bring out clarity and encourage private sector to engage in Heath Care Waste Management Systems services. Address on the shortcomings obtained from monitoring committee regarding health care waste was a key factor lacking which can be easily solved.

Keywords: follow up study; guidelines; health care institutions; health care waste management; health care workers.

Fomulation of a Comprehensive National Strategy and Action-Plan to Attenuate Major Environment and Occupational Health Risks Pertinent in Urban Setting (2006)

Jha HB, Barakoti H, Adhikari HK, Magar Thapa S

Background

In Nepal, the planners and policy makers started realizing the importance of environmental and occupational health risk issues basically from the Sixth Plan (1980- 85). However, there is no sign of any meaningful change in environmental and occupational health risks in the urban areas. This is also due to the fact that major environmental and occupational health risk factors had not been identified in the country and there was also a lack of strategic action plan to address such issues. Hence, the present study was carried out to: (a) Identify the major environmental and occupational health risk factors in urban settings; (b) Prepare strategic action-plan to attenuate public health risks caused by major environmental and occupational health and safety situations within the urban settings; and (c) Disseminate the prepared strategic action plan by organizing a dissemination workshop.

Methods

Both the secondary and primary source materials were used for data collection. The secondary source information was collected from various publications of government and non-governmental agencies, international organizations and different other sources. Similarly, the primary source data were collected partly by interviewing the key resource persons and partly through observations made on the state of environmental and occupational health risks in four urban settings of the country, including in Kathmandu, Biratnagar, Birgunj and Nepalgunj. Data, thus, collected through the secondary and primary sources were analyzed and were put in tabular form to make them presentable.

Results

It was found that the protection of environment was essential for the growth of Gross Domestic Production (GDP), sustainable development of the national economy and poverty alleviation. Hence, the environmental and health policies, rules and regulations, and health guidelines and standards were developed for the improvement of environmental health situation in Nepal. Yet the environmental problems related to air, land, water and noise pollution are most precarious in urban areas like in Kathmandu, Biratnagar, Birgunj and Nepalgunj for their adverse effect on the health of the people. Considering this, a strategic action plan framework was developed and implemented.

Conclusions

Considering the adverse effects of environmental problems on the health of the people in urban areas, a strategic action plan was developed and implemented to control the pollution level in the urban settings and urban health risks.

Keywords: environment; environmental problems; occupational; strategic action plan; health risks; urban.

Development of Profile of Toxic Waste Products in Nepal (2006)

Shrestha IL

Introduction

Toxic wastes are produced by various activities and phenomena particularly in the industrial/commercial sector and the inventory/profile development of toxic wastes can be taken as an essential step towards reduction and eventual elimination of such releases in to various environmental compartments. But development of such profiles at national/regional levels is a meticulous task requiring diligent efforts and the knowledge on various processes involved, to work out quantitative expressions of different releases.

Study objectives/scope of study

To document and finalize a step-wise procedure to assess profile of toxic waste products of different origins in Nepalese context and to field apply the finalized procedure to develop a profile of toxic waste products

Main Elements in Step-wise Profile Development Procedure

A protocol of inventory assembly has been provided (UNEP toolkit), applicable for dioxin quantification in particular, in waste releases. The main elements included Identification of source categories producing toxic wastes, Quantification of toxic waste releases in each source category, Assessing activity rates (or waste releases) regional/national and Development of profile of the toxic waste products in Nepal or the district.

Methodology

Profile development of the toxic waste products has been attempted by the use of data/information gathered from the secondary sources as well as by the use of data/information obtained from questionnaire survey works.

Compilation and Classification of data/information obtained from field visits

The data/information obtained from the field visits have been classified district-wise and by the industry types. The data relevant to profile/inventory development have been put in to appropriate columns: name of the industry/establishment; general outline of the manufacturing processes; the type of products/annual production; inputs: raw materials, chemicals. Fuels etc.; waste streams: emission

to air, solids (residues, ash, sludge); wastewater; remarks (annual working days, pollution control measures, waste treatments etc).

Finalization of Profile Development of Toxic Waste Products in Nepal

In finalizing the profiles of toxic waste products, efforts have been made to integrate data/information obtained from primary sources (questionnaire survey results) with data from secondary sources (literature survey). Toxic waste profiles both at national and district levels (5 districts) have been developed from available data,

Conclusions

It should be borne in mind that because of the data gaps encountered at almost every stage of the step-wise procedures followed during this profile development (stated elsewhere in this report), the quantities of waste releases for toxic waste products calculated and presented at national and district levels, can only be considered as indicative of the states of environmental pollution under the prevailing conditions.

Keywords: district; national; profile development; quantity; toxic wastes.

Evaluation Study of Health Impacts Due to Arsenic Contamination in the Selected Communities of Terai Regions in Nepal (2006)

Pathak LR

Background

Arsenic contamination in drinking water has been one of the biggest epidemics of the global concern including Bangladesh, India and Nepal. The long term continued exposure to arsenic leads to Arsenicosis, which has no definite medical cure. Thus, assessment of the socio-economic dimensions of the arsenic hazard becomes a first step toward preventive measure. The main objective of the study is to evaluate the health impacts of arsenic contamination on human health through drinking water

Methods

The study sites were selected on the basis of high vulnerability and low uncertainty level namely Ramgram and Lahan Municipality and Swathi, Hakpara, Santpur, Dumariya VDCs of Nawalparasi, Siraha and Rautahat districts respectively. The tools and techniques applied were the Questionnaires, Direct Observation, Focused Group Discussion, Interview and Computer software programming.

Results

In the present study, 312 people were selected from 312 risk households who used to drink water from arsenic contaminated tube wells. The overall percentage of risk tube well (>50 ppb as level) in selected areas was found to be 12.3%. 84(3.0%) in Lahan Municipality, 101(34.6%) in Hakpara VDC, 629(44.4%) in Ramgram Municipality, 23(14.7%) in Swathi VDC, 39(2.7%) in Santapur VDC and 29(2.4%) in Dumariya VDC. The total number of population at risk was found out to be 11204. The overall knowledge of Arsenic among these risk household were found to be low (42%, totally unaware).. Assessing knowledge of communities whether they are informed of harmful effects of arsenic in drinking water, it was found out that about half of the respondents (49%, 152 out of 310) were aware. More than two third of the health workers were aware of arsenic in the affected study area (84.3%). The

most interesting part of the result is that none of the health workers are found to be dealing with the Arsenicosis patients.

Conclusions

An immediate unified water resources POLICY with integrated PLANNING and MANAGEMENT is needed. Breadth and depth of household information on Arsenic contamination, its seriousness, and technology options available need to be expanded for which empowerment of local communities can be the potential option of solution of the problem. Health workers need to be trained to provide counseling, assurance and mental support using WHO guide book (manual) on detection, management and surveillance

Keywords: arsenic contamination; evaluation study; health impacts; terai region.

A Rapid Assessment Study on Health Care Waste Management in Nepal (2007)

Nepal Health Research Council, Ramshah Path, Kathmandu, Nepal.

Background

Health care institutes generate large amount of diverse wastes. With the steady increase in the number of health care institutions in Nepal, the amount of health care waste generate is also increasing. It was estimated that the total amount of health care risk waste generated by health care facilities in Nepal in 2001 was 20,18, 450 kg per year (with 0.5 kg/patient/day). In addition to increasing quantity, the composition of health care waste is also rapidly changing affecting its sound management. However, the majority of health care institutions in Nepal do not practice safe waste handling, storage and disposal methods. So far, there is no separate mechanism for the treatment of health care waste. This study is being conducted with an objective to assess the current status of the health care waste management activities and prepare a basis to enable medical establishments to comply with guidance and legislation on health care waste management in Nepal.

Methods

A steering committee comprising of key stakeholders was formulated for making this study participatory. The earlier studies, national legislations, guidelines, plans and programmers related to health care waste management in Nepal were thoroughly reviewed. Twenty four health institutions were purposively selected for the study. A semi-structured questionnaire and an observation checklist were developed to collect primary data from the selected institutions. The key persons identified on discussion with the chief were interviewed individually and/or in group using the pre-tested semi-structured questionnaire. Relevant action oriented photographs were taken. The quantitative data generated from the field study were first entered in excel sheet. Then Statistical Package for Social Science -13

was used to analyze the data and generate relevant information. The information from consultation meeting was summarized manually. The literature reviewed were scripted and summarized qualitatively.

Results

There was no practice of waste quantification in health care institutions in Nepal. Among the surveyed institutions, only 33.4% was found to follow guidelines. Mainly housekeeping department and chief of the health care institutions were termed as responsible body for the management of health care wastes. Management committee was present in only 25% of the surveyed health care institutions. Fifty percent of the institutions coordinated with municipality for health care waste management. All practiced reuse among the surveyed institutions. Almost all institutions were aware that waste should be segregated but it was not properly implemented. The common problem mentioned for no successful implementation of waste was lack of monitoring system. Use of transportation was very limited i.e. 33%. Incineration was present only in 25% of the health care institutions. Autoclave was present in all institutions whereas safe burial was practiced in 45.8% institutions. In most of the health care institutions, the sanitary staff did not use personal protective measures.

Conclusions

There needs to be a national policy on health care waste management. A central authorized body is necessary for management of health care waste.

Keywords: health care institutions; health care waste; health care waste management.

Prevalence Study of Arsenicosis Symptomatic Patients in Ramgram Municipality, Nawalparasi, Nepal (2008)

Adhikari HJ, Ghimire TR

Background

Arsenic contamination in drinking water has been a global concern. It has affected many countries of the world including India and Bangladesh. The Terai region of Nepal has similar geography to these countries and similar practice of extraction of groundwater for drinking. So, contamination of ground water with arsenic and prevalence of arsenicosis might be similar. The disease is chronic in nature and most of the time the patients do not have any symptom until they are detected through a screening survey. This study tries to diagnose arsenic case by common dermatological manifestations called melanosis and keratosis in combination with a history of consuming arsenic contaminated water. The general objective of the study was to find out the prevalence of arsenicosis symptomatic patients among the risk households in Ramgram Municipality, Nawalparasi, Nepal.

Methods

The study was conducted from 26th June, 2007 to 28th July, 2007. This was a cross-sectional and descriptive study. Households exposed to 50 ppb to 350 ppb of arsenic concentration in drinking water were selected on the basis of blanket testing data of Department of Water Supply and Sewerage (2006). The tools applied were the questionnaires, direct observation, and interview. The Algorithm Chart produced by WHO, 2005 was followed for identifying arsenicosis

symptomatic patients. Arsenic contents in hair and nail samples were determined by Atomic Absorption Spectrometer in Environment and Public Health Organization laboratory, Kathmandu. Data were analyzed by means of tables and diagrams, prevalence rate and percentage rate.

Results

Out of 866 populations studied, 28 people (3.2%) showed the symptoms of arsenicosis. The prevalence was 4.5% (17/379) in males and 2.3% (11/487) in females. The maximum prevalence of arsenicosis patients (8.8%) was in ward number 6; whereas, the maximum number of patients (14) was in ward number 8. The maximum prevalence of arsenicosis symptom was that of melanosis on trunks (71.4%) followed by Keratosis on palm (11.1%) and then by Keratosis on sole (7.4%). The maximum numbers of patients (14) showed mild or initial state of arsenicosis. Majority of the arsenicosis symptomatic patients (82.1%, 23/28) replied that television, radio, newspapers, local students and educators were the good sources of knowledge about arsenic. Maximum numbers of patients (53.6%, 15/28) demanded for the maintenance of Kanchan filters and distribution of anti-arsenicosis drugs. Among the two hair and three nail samples from 5 patients, all these samples showed the arsenic concentration more than 2 mg/Kg.

Conclusions

Maintenance of Kanchan Filters, further testing of skin by dermatologists, and distribution of free anti-arsenicosis drugs, beginning of rehabilitation program and providing training of distinguishing arsenicosis and non-arsenicosis to the local educated people are some of the efforts to be made from the side of the government and non-governmental organizations

Keywords: arsenicosis; prevalence; Ramgram municipality; symptomatic patients.

Prevalence Survey of Arsenicosis in Kailali and Bardiya Districts of Nepal (2008)

Adhikari SP, Chhetri Khadka MK

Background

Arsenic has been known for years to be a very poisonous element and arsenicosis is one of the burning issues in Nepal today. In lowlands of Nepal, the Arsenic concentration in the pumped "drinking" water have shown to be of such a magnitude that the population in these areas, by switching from surface water to groundwater, can be said to have come from the frying-pan into the fire. This study, therefore, was conducted to find out the prevalence of arsenicosis and its association with other socio-economic factors among the risk population in the different communities of Kailali and Bardiya district.

Methods

The study was conducted in Thapapur and Sadepani VDCs of Kailali district and Mohamadpur and Jamuni VDCs of Bardiya district. This comprehensive project adopted questionnaire survey and examination of skin laison by the experts using WHO flow chart algorithm as its major study methods. Literatures cited on different

books, Journals, reports, dissertations and available on the electronic media were reviewed to gather additional and required information to support the primary data. Most of the data were analyzed using Statistical Package for the Social (SPSS) tool. Appropriate tests of different and multivariate exploratory analysis were carried out.

Results

The impact of arsenic problem in study area is significant with the overall prevalence of arsenicosis as 2.12% in Kailali district and 2.66% in Bardiya district. Gender has apparent effect on the prevalence of arsenicosis indicating much higher symptoms among males than in females. The people from older age group are affected significantly to a far greater extent than people from younger age group and a virtually negligible prevalence among those less than 15 years old. The people from poor socioeconomic group are affected significantly to a far greater extent than people from non-poor socioeconomic group.

Conclusions

Since major causes of arsenicosis problem are poverty, illiteracy and lack of mitigating and monitoring measures, arsenic mitigation programmes should target the arsenic exposed malnourished poor population as a priority.

Keywords: arsenicosis; Bardiya; prevalence; Kailali; survey.

Indoor Air Pollution and its Health Impact on People of Malikarjun Village Development Community, Darchula district (A case study) 2008

Joshi HD, Pandeya R, Dhakal B, Joshi SD

Background

Indoor air pollution in Nepal is causing deleterious effects for its people, living in the rural households, who have to depend on the low quality of energies. Kitchen pollution, in these households, is so high that the frequencies of respiratory diseases are prevalent. With this condition, it is no surprise that, Acute Respiratory Infection (ARI), in Nepal, is the second leading morbidity in 2006/2007. This study is intended to link the kitchen characteristics and exposure duration of locals (especially children and their mother) with the disease prevalence.

Methods

The study was carried out in Malikarjun VDC of Darchula district. Sample size for household and respondent was taken to be 62 and 225 respectively. Two stage sampling was adopted for selection of household and purposive sampling method for selection of respondents. This study was a field-oriented program supported by medical checkup, measurement of kitchen characteristics and household survey, measurement of respiratory functions, episode identification of Acute Respiratory Infection in children below two years of age, informal discussion and key informant interview.

Results

The result confirmed that exposure duration, smoking habit and indoor environment of the households are causing different types of diseases in the VDC including respiratory disorders in the adults and prevalence of Acute Respiratory Infection in the children up to two years of age. Further, it was found that the use of clean energy was minimal in the households and all kitchens were characterized by the presence of smoke because of the use of low quality energy sources including fuel wood and lack of proper ventilation system. In addition, the area of the kitchen and doors in them were not up to the recommended level.

Conclusions

The study was able to determine that the prevalence of diseases in the households was the result of indoor air pollution initiated by the use of low quality energy and poor kitchen characteristics. Therefore, promoting the efficient energy systems in the households as well as remanufacturing of the kitchen and the building with proper ventilation is needed.

Keywords: acute respiratory infection; children; clean energy; exposure duration; indoor air pollution; kitchen pollution.

Assessment of the Environmental Conditions Associated with Emerging Vector Borne Disease Dengue and Recommended Corrective actions for Prevention in Nepal (2009)

Dengue Fever/Dengue Hemorrhagic Fever is now endemic in more than 100 countries and threatens the health of about 40% of the world's population (2.5 billion), particularly in tropical and subtropical regions and predominantly in urban and peri-urban areas. Over 1.2 million cases were reported to WHO in 1998, the greatest number ever for a single year. There are an estimated 50 million infections annually, including 400,000 cases of Dengue Hemorrhagic Fever. Because dengue infections have the potential of rapid spread leading to acute public health problems, special attention is required to be paid for its surveillance, prevention and control.

It has been found that 55% urban population lacks waste management facility, 46% lack sanitation facility, 47 % are deprived of piped drinking water supply. Urban poor and squatters are increasing. This situation is due to population increase and unmanaged planning. Inadequate physical infrastructure, inadequate waste management, pollution, encroachment of public land and resources, decreased of agricultural land and haphazard expansion of urban dwellers, slum and squatters will further aggravate the urban environment causing health related problems such as water-born and vector-based fever such as Dengue. Planned cities presents compact, efficient land-use, better access to infrastructure and services, efficient resource use, less pollution and minimum waste. A well planned city virtually eliminates the artificial water logging areas and poorly accessible but uncovered dark places.

Increase in population and unmanaged planning have led to various environmental conditions which in turn have led to the emergence of various vector borne diseases like Dengue. It is therefore necessary to maintain a planned city that will ensure efficient resource use, less pollution and access to infrastructure and services.

Assessment of Indoor Air Pollution (IAP) Related Disease Burden Especially Amongst Children in Dhading District (2009)

Background

Acute Respiratory Infection is a very important public health problem because of climate, terrain, literacy, poverty and living condition of the people. It is a cause of death globally causing approximately 19% of all deaths before the age of 5 years, according to a World Health Organization estimates. Indoor air pollution from biomass fuels, which is strongly poverty related has been regarded as an important risk factor for Acute Respiratory Infection morbidity and mortality. An estimated 24% of the global disease burden and 23% of all deaths can be attributed to environmental factors. This study was carried out to estimate the environmental burden of diseases due to Acute Lower Respiratory Infection in Under 5 children due to indoor smoke in Dhading district.

Methods

The study site was conducted in Dhading district among children aged 50 months from October-December, 2008. The sampling method applied was multistage cluster sampling technique. The primary data was collected by using structured questionnaire. The secondary data was collected using recording format. Data was entered in MS-Excel but analysis was done in Statistical Package for Social Science.

Results

The majority of mother of children were illiterate (55%) and their occupation was agriculture. Most of the households (87%) use biomass fuel (dung, charcoal, wood, or crop residues) / coal followed by clean fuel such as kerosene/ LPG/ Bio-gas/ Electric Heater and most of them use indoor stove (73%). Out of total 1800 study population of children, 27.72 % were accompanied by mother during cooking and 40.39% were accompanied only sometimes. Most of the cases of Pneumonia was treated in Health Post/Sub-Health Post (47.90%) followed by private clinic (29.48%). Most of the child contacted with pneumonia within last one year were pneumonia (83%) followed by severe pneumonia (11%). During the survey, one case of death was reported. Population of children exposed to Solid Fuel Users was found 41,313 in Dhading District. The incidence rate of Acute Lower Respiratory

Infection was found 1.25 per annum per person. The Years of Life Lost with 3% discounting and uniform age weights was calculated 762 and the Years of Life Lost in Disability with 3% discounting and uniform age weights was calculated 522. Hence, Disability Adjusted Life Years was calculated 1284. About 50 % cases of Acute Lower Respiratory Infection were attributed by indoor smoke in Dhading district. Attributable burden of Acute Lower Respiratory Infection in Under 5 children from Solid Fuel Users was 637.

Conclusions

The population at risk must be reduced. For, this instead of traditional stoves, improved cooking stoves must be used and should be in gradual shift from Solid Fuel Users to clean fuel.

Keywords: children under five years of age; indoor air pollution; pneumonia; solid fuel users.

Development of Sentinel Sites for Arsenicosis Surveillance and Assessment of Prevalence of Arsenicosis in Nepal (2009)

Background

Globally, Arsenicosis also referred as Arsenism, is an important non-communicable diseases resulting from the ingestion of groundwater containing unsafe level of arsenic. Arsenicosis is appeared as a public health problem in Terai region of Nepal. The main objective of this study is to develop sentinel sites for Arsenicosis surveillance and assessment of prevalence of Arsenicosis in Nepal.

Methods

The methodology included formation of steering committee, organization of consultative workshop and development of sentinel sites. The reported data from local dermatologists were entered into Excel sheet and were analyzed in Statistical Package for Social Science version 13 in windows.

Results

Arsenicosis id developed due to chronic exposure of arsenic above the safe dose. Out of 69 patients, 29 cases were found to be suspected arsenicosis and among them, 29 were probable arsenicosis with both melanoma and keratosis. The analysis of arsenicosis by sex revealed that more cases were male than female. Similarly the analysis showed that the arsenicosis cases were found in older age than earlier. Most of arsenicosis were the residence of Parsa and Bara districts. The arsenicosis cases were also from India.

Conclusions

More arsenicosis cases were reported from male group and from older age. The trainings for both paramedics of periphery level as well as training to dermatologists of referral center is very important. There is an urgent need to develop sentinel sites in arsenic hot spots. There is also need of laboratory facilities for confirmation of probable case.

A Report on a Case Control Study of Arsenic Toxicity to Pregnant Women in Nawalparasi District, Nepal through Biological Monitoring (2009)

Shrestha J[1]

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Background

Elevated arsenic level in drinking water has become a public health threat in many developing countries. The prevalence of arsenicosis due to long term arsenic exposure was reported to be 2.2% in the Terai. Chronic exposure to inorganic arsenic causes characteristics skin manifestations such as keratosis and melanosis. Arsenic readily crosses the placental barrier and thus affects the fetal development. Few human studies have been conducted and indicate adverse effects on reproductive outcomes and child health due to high arsenic exposure. This research compares the health of pregnant women in high arsenic contaminated community of Ramgram municipality with arsenic free pregnant women in Dhulikhel/Banepa municipality mainly through biological monitoring.

Methods

This is a case control study where pregnant women are chosen from a high arsenic drinking water location and an arsenic free drinking water location. Sixty pregnant women participated in the study, forty for case study and twenty for the control study group. Among the sixty pregnant women, thirty are selected for biological sample analysis. The biological sample analysis includes hair and urine sample which gives the chronic and acute arsenic exposure respectively. A family history survey of each pregnant woman was conducted. In addition, arsenic exposure

assessment, pregnancy outcomes for each participant and a physical evaluation of arsenicosis symptoms is also conducted.

Results

About 95% of the women in case study groups have no knowledge about arsenic although they live in arsenic endemic areas. However, 30% of the women in control groups have some knowledge about arsenic. The difference in mean hair and urine arsenic concentration in both groups of women is highly significant (p,0.01) indicating the arsenic concentration is highest in exposed groups. Regression analysis between the hair and urine arsenic concentration with drinking water arsenic concentration is also statistically significant ($p<0.05$). One way ANOVA analysis done between the mean hair and urine arsenic concentration with literacy status does affect the hair and urine arsenic concentration among the women in case study ($p>0.05$). But a statistically significant ($p<0.05$) relationship is observed between the mean hair and urine arsenic concentration with the arsenic exposure level. The mean hair arsenic concentration was high among the pregnant women with previous residing place in arsenic free areas and India but the relationship was not statistically significant ($p>0.05$). The relationship between the exposure period arsenic intake with body mass index and hair arsenic concentration was found to be statistically significant ($p<0.05$). The study also shows that the prevalence of arsenicosis symptoms is 30% among the pregnant women in case study. Among pregnant women surveyed in case study, 12.5% of the pregnancy outcomes resulted in the death of the infant.

Conclusions

Mass screening of the pregnant women for arsenic toxicity should be done through urine sample analysis for arsenic concentration. Deeper tube wells for arsenic free water should be installed at least one or two in each village so that the people can use it for drinking and cooking.

Keywords: arsenic; arsenicosis; arsenic intake; body mass index; biological samples; case study; chronic and acute arsenic exposure; control study; exposed groups; exposure period.

Determination of Breeding Habitats and Seasonal Prevalence of Larvae of *Aedes aegypti* (L) and Other Possible Vector of Dengue in Kathmandu Valley (2009)

Gautam I

Background

Dengue Fever/Dengue Hemorrhagic Fever occurs primarily in tropical and subtropical areas of the world, prevalent in over 100 countries and threatens the health of approximately 100 million cases of Dengue Fever, 500,000 cases of Dengue Hemorrhagic Fever, and several thousand deaths occur annually worldwide. During the past decades, dengue virus has emerged in southern Asia; Dengue Fever/Dengue Hemorrhagic Fever epidemics have occurred in Bhutan, India, Maldives, Bangladesh, and Pakistan. The incidence of dengue has been increasing in recent years in densely populated areas in Nepal. Dengue viruses are

transmitted from viremic to susceptible human beings by various mosquitoes of the subgenus Stegomyia, notably day-biting mosquitoes *Aedes aegypti* and *Aedes albopictus*, vectors throughout tropical and sub-tropical areas.

Methods

In this study, house-to-house surveys of larval breeding places and larval prevalence were conducted covering all three districts of Kathmandu valley during April, May, June, July, August, September and October in 2009. The sample sites included Koteshwar, Manahara, Gongabu-Balaju, Tokha, Jorpati and Kalanki (Kathmandu district), Tikathali, Lokanthali, Kaushaltar, Thimi, Darbar square and Bode (Bhaktapur district). Satdobato, Thalchkhel, Mahalaxmisthan, Dhobighat, Sanepa, Bagalamukhi, Dholahiti, Chibahal, Thecho, Chapagaon, Badegaon, and Godawari (Lalitpur district) of Kathmandu valley. Collection sites were selected in both town and rural residential areas. Nine major Water-filled containers discarded tires, metal /plastic drums, plastic buckets, flower pots, mud pots, cement tank, metal containers, plastic pots and miscellaneous small, discarded items such as tin cans, jars and plastic food containers were searched for the presence or absence of Aedes larvae and/or pupae. Adult Aedes mosquitoes were examined with the help of aspirators and flash-lights. All live mosquito larvae and pupae collected were reared until adult emergence and identified. Primary end points of this study were the Breteau index and the house index; the secondary end point was the container index. Larval survey techniques were used to obtain the House Index, Container Index and Breteau Index. The container preferences of Aedes mosquitoes were assessed by calculation of breeding preference ratio (BPR).

Results

The highest House Index, Container Index and Breteau Index recorded for *Aedes aegypti* were 4.42, 3.63 and 9.73 respectively in October, and 9.91, 12.45 and 31.40 respectively for *Aedes albopictus* in September, 2009 (Kathmandu district) whereas, for *Aedes aegypti* in Lalitpur district were 5.50, 4.06 and 12.80 respectively in October, 2009. For *Aedes albopictus*, the highest House Index, Container Index and Breteau Index recorded for *Aedes albopictus* in Lalitpur district were 15.64 in August, 9.83 and 25.30 in September, 2009. The highest breeding preference ratio recorded for *Aedes aegypti* and *Aedes albopictus* in Kathmandu

district were 1.89 and 1.89 in August, 2009. Similarly, the highest breeding preference ratio recorded for *Aedes aegypti* and *Aedes albopictus* in Lalitpur district were 1.69. It was observed that discarded tires lying outdoors were the preferred breeding habitats. No breeding of *Aedes aegypti* was observed in other containers during this seven months survey. However, breeding of *Aedes albopictus* was also observed in metal drum in Mangal bazar and in metal container in Gwarko of Lalitpur district .

Conclusions

Aedes aegypti and *Aedes albopictus* are established within the urban agglomeration of Basundhara, Gongabu-Balaju area of Kathmadu district and Satdobato-Gwarko, Thalchikhel, Mahalaxmithannad Sanepa area in Lalitpur district showing larval indices. Alternative strategies are needed which can be implemented through participation continuous participation of people in the community and which compliment the efforts of the vector control teams. The Aedes aegypti control programme is needed to make people aware of the threat poses to their health, and to educate them on how they can reduce this threat by either eliminating the potential breeding habitats which harbour the mosquito larvae or by preventing mosquitoes from having access to water-holding containers for egg-laying that are used in or around houses.

Keywords: *Aedes aegypti*; breeding habitat; Dengue; larvae; seasonal prevalence.

Seasonal Distribution of *Culex tritaeniorhynchus* Giles (Diptera: Culicidae), the Vector of Japanese Encephalitis in Kathmandu Valley (2009)

Tamrakar AS

Background

Japanese encephalitis (JE) is common mosquito-borne viral encephalitis found in Asia, and is widespread throughout Asia. It is principally a disease of rural agricultural areas and primarily a zoonotic disease infecting mainly vertebrate animals, e.g. pigs, birds, horses etc. Pigs, wading birds and ducks have been incriminated as important vertebrate amplifying hosts for Japanese encephalitis virus due to viremia in them. Man is involved in transmission cycle as an accidental host and plays no role in perpetuating the virus. The disease was first recorded in Nepal in 1978 as an epidemic in Rupandehi district of the Western Development Region (WDR) and Morang of the Eastern region (EDR). At present the disease is endemic in 24 districts. Japanese encephalitis was confirmed in 40 residents of the Kathmandu valley, including 30 cases that had no history of travel outside the valley during the incubation period. However, there is little information on the occurrence of this disease in the densely populated Kathmandu valley. The species *Culex tritaeniorhynchus* is suspected to be the principal vector of Japanese encephalitis in Nepal as the species is abundantly found in the rice field ecosystem of the endemic areas during the transmission season and Japanese encephalitis virus isolates have been obtained from a pool of *Culex tritaeniorhynchus* females. No study so far has been carried out regarding seasonal distribution of *Culex tritaeniorhynchus* in Kathmandu valley.

Methods

Entomological studies were conducted in Kathmandu, Lalitpur and Bhaktapur district of Kathmandu valley, in order to determine the abundance and seasonal distribution of *Culex tritaeniorhynchus*. Emphasis was given to select the villages located on the river side, pond, agro-field ecosystem areas and presence of cattle on the areas. During the study period altogether 4 man hours were spent searching mosquitoes in 16 houses by two collectors in Balkot (Bhaktapur district), Gothatar and Nepaltar (Kathmandu district) and Godavari (Lalitpur district) of Kathmandu valley in indoor and outdoor hand collection to collect adult mosquitoes resting inside the houses. Adult mosquitoes were captured using mouth aspirators, animal baited net trap and CDC light trap. Different breeding places like paddy field, puddles, ponds, river bed, swamps, drain etc. were searched for larvae of *Culex* mosquitoes in Balkot, Gothatar, Nepaltar and Godavari

taking dips. Collections were carried out in sequence daily along the block from the start house between 6:00 AM and 10:00 AM.

Results

Of the total 37018 adults and 10071, larvae *Culex quinquefaciatus*, the principal filarial vector, was the most commonly captured culicine mosquito (81.83% adult and 83.82% larvae) in Kathmandu valley followed by *Cx. fuscocephala* (adult 6.91% and larvae 6.02 %), *Culex tritaeniorhynchus* (2.24 % adult and 3.27% larvae), *Cx. vishnui* (1.58 % adult), *Cx. pseudovishnui* (1.06 % adult and 1.57% larvae). The least density was found to be for *Cx. gelidus* (0.45% adult) and *Cx. vishnui* (0.23% larvae). Other associated culicine mosquitoes recorded were *Culex hutchinsonie*, *Cx. edwardsii*, *Culex barraudi* and *Armigeres spp*. in different months. Vector control is largely achieved through the use of chemical pesticides and still playing an important role. Mosquitoes have developed resistance to many pesticides, whereas the predators are still highly susceptible. The biological insecticide such as Bacillus *thuringiensis* serotype H-14 (B.t. H- 14) can be applied through community participation. Rice cultivation in study areas has a marked effect on *Culex* mosquito species diversity. In the periphery of the city, there are a number of ponds, infested with aquatic floating weeds supporting mosquitoes. So the reduction in mosquito densities is to be realized through larval management. Mosquitoes in these ponds can be controlled by physical removal of weeds and fishes, nematode parasite, *Toxorhynchites*, a non-biting predatory mosquito can be used if necessary to control tree hole breeding mosquitoes. The local community can be motivated to remove or empty the receptacles around the premises.

Conclusions

Culex quinqefasciatus is not only the vector of filariasis but also a serious nuisance. Health education would promote the type of low-cost sanitation that doesnot favour mosquito breeding.

Keywords: *Culex tritaeniorhynchus*; Japanese encephalitis; seasonal distribution; vector.

Assessment of Drinking Water Quality at Myagdi District, Western Nepal (2010)

Aryal J, Sapkota N, Gautan B

Background

In Nepal drinking water quality is appeared as a great public health concern because is major risk factor for high incidence of diarrheal diseases in Nepal. Water pollution is important and serious issue due to haphazard urbanization and industrialization. The principal reasons of the chemical and bacteriological pollution of drinking water are due to inadequate sanitation, dumping of wastes, poor drainage system and irregular supply of drinking water in the pipeline. Besides that the contamination may be either due to the failure of the disinfections of the raw water at the treatment plant or because of the infiltration of contaminated water (sewage) through cross connection and leakage points. All natural water sources, such as wells, stone spouts and ponds are neither treated nor protected properly. The quality of water has deteriorated due to poor management and no monitoring of water quality. The primary goal of this research is to analyze the drinking water quality parameters physicochemical & microbiological in order to ensure that the water is safe for drinking.

Methods

In the present study, a total of 84 water samples were collected from 11 sources, 5 reservoirs and 68 taps water were collected from 9 different wards of Arthunge, VDC and tested physio-chemical and microbiological parameters.

Results

The physical and chemical analysis performed on water samples indicates clearly that water does not have any significant effect on physico-chemical characteristics of water except pH, because all parameters remains nearly constant over the experimental period. After testing the physicochemical parameters of water were satisfactory. Most of the parameters checked were found in safe limit except pH

and Arsenic. The water samples 54 % have found Arsenic concentration exceeded the permissible level given by WHO (0.01 mg/L), but according to National Drinking Water Quality Standards-2062 all water samples were near constant with permissible level (0.05 mg/L). The statistical analysis through paired t-test revealed that physic-chemical parameters of drinking water for Tap water samples in winter (January, 2010) and summer (June, 2010) was not differ significantly at 5% level of significance. Microbial analysis performed on water sample was not safe for drinking purpose. There were a number of coliform present in most of samples but there was absence of E. coli. While most of the tested waters were found to be higher number of coliform organism especially in tap water which was not safe for drinking. The microbiological contamination was not great in source and reservoirs were unlikely to represent a public health concern. But in tap water it was found that about 71% of water samples found very high risk due to present of coliform organism. All of samples water tested complied fully with National Drinking Water Quality Standards-2062.

Conclusions

There should be regular monitoring of bacteriological quality of water in order to ensure safe drinking water. Diarrheal diseases may be outcome due to unsafe drinking water. Ministry of Health and Population should develop effective strategy to undertake public health concern ensuring better water quality.

Keywords: drinking water quality; microbial analysis; microbiological; parameters; physicochemical.

Nepal Environmental Health Action Plan 2011 (2011)

Background

Environmental health is a multi sector activity which covers numbers of environmental related sector linking with public health. In the context of Nepal, Environmental Health problems covers Water, Waste water, Sanitation, Solid waste, Health care Waste, Indoor/Outdoor Air, Food safety, Road Safety, Chemical safety and Healthy setting and Climate Change. In order to develop the synergy among the partners working in the field of environment and health to promote environmental health in Nepal, it is aimed to develop Nepal Environmental Health Action Plan (NEHAP). Nepal Environmental Health Action Plan is a broader conceptual action plan which provides mandate as well as guidance to all of the environmental health related sectors. Environmental health is a multi sector activity which covers numbers of environmental related sector linking with public health.

Methods

In order to achieve the objectives and obtain the major outcomes of the study, both the primary and secondary data were collected from relevant sources. Most of the data collected were mainly from the secondary sources by visiting concerned organizations/ministries and browsing information from the websites of all concerned organizations. The primary data were collected from the key informant using the method of interview. In order to make the work easier, national experts who have occupied key position in the thematic area were selected and requested

to prepare the thematic papers. These thematic papers were finally synthesized to produce draft Nepal Environmental Health Action Plan (NEHAP). Then consultative meeting with stakeholders and experts at Nepal Health Research Council was organized to prepare the final Nepal Environmental Health Action Plan.

Proposed Action Plan

The proposed Environmental Health Action Plan for Nepal is bases on identified gaps and required conditions/standards.

Keywords: action plan; environmental health; Nepal.

Identification of Public Health Problems Resulting from Climate Change and Preparation of Guidelines for its Prevention in Nepal (2011)

Background

The varying effect of climate change has its impact on the economic, social and cultural development of the country. Displacement of the people from multiple extreme climatic conditions has urged the emergency of developing the best adaptation and mitigation measures to minimize the effects of climate change to the development of nation. Health is another specific sector that has the direct impact resulting from climate change. The study was carried out to identify the public health problems resulting from climate change and also the preparation of guidelines to prevent the public health problems from climate change in the context of Nepal.

Methods

An exploratory descriptive study was carried out and retrospective data analysis was made collecting climatic data and health facility data of malaria and diarrheal diseases from Health Management Information System and DHM. Time series analysis is made to show the relationship between the climatic events (temperature, rainfall) with the occurrence of diarrhea and malaria. Qualitative information was gathered through Focus Group Discussion and In-depth interview with the health workers and local community to explore the effects of climate change on the health of the people. Ten districts were selected for the study out of

which time series analysis was made in six districts (two districts each from terai, hill and mountain were analyzed in average having the similar geographical distribution) covering the three ecological regions because of limited data in other study districts.

Results

Regression analysis in terai region shows that with rise of minimum temperature diarrheal and malaria disease seems to be increasing whereas diarrhoeal disease seems to be decreasing in rise of rainfall. Similarly in hilly region with rise in the maximum temperature malaria cases decreases and increase with rise of minimum temperature. Increase in rainfall also shows the increase in diarrheal numbers. Himalayan region time series analysis shows that rise in minimum temperature trend of malaria cases also increases and diarrheal disease also increases with rising rainfall. Nepal Government do not have specific policies on climate change and health but newly formed plan such as Nepal Health section Implementation Plan 2010-2015 have address issues related to climate change and health in its five years periodic programs of health of sector and three years interim approach paper 2010-2013 has also tried make the development work climate resilient. The qualitative data collected from the health professionals and community people shows that impact related to climate change are emerging and vary from east to west and south to north because of micro-climatic variation within the country. The prevalence of water borne diseases such as diarrhea, typhoid, dysentery, enteric fever, viral fever, skin diseases has increased which are also associated with poor quality and quantity of available water and low sanitation coverage and hygiene.

Conclusions

The recording and reporting system of climate sensitive diseases should be strengthened at health facility level; entomological study should be carried from where indigenous malaria cases are reported and in other suspected new places too. The water supply and sanitation coverage need to increase and should ensure the quality of supplied drinking water implementing water quality surveillance. Public health are the most sensitive and important indicator of the nation development and thus to safeguard it comprehensive policy and programs also should be brought forth.

Study of Population Density of *Culex quinquefasciatus*, (Diptera: Culicidae), Vector of Filariasis in Bhaktapur District, Nepal (2011)

Byanju R

Background

Lymphatic filariasis, the most important disease of human in terms of morbidity and mortality and a leading cause of permanent disability worldwide is considered globally as a Neglected Tropical Disease. Three factors are primarily responsible for increasing disease transmission: urbanization, some urban centers making conditions ideal for transmission of domestic mosquito borne disease and consistent increase in air travel by man. Due to these conditions chances of spread different vector borne diseases, including filariasis is high.

Methods

The present study was carried out from April- August 2011 in two sites viz Thapa Gaun of Jhaukhel VDC and Lama Tole of Nagarkot VDC, the sites being selected on the basis of altitudinal variation. 5 months research lead to the collection of total

3800 mosquitoes of different species (1479 from Thapa Gaun, Jhaukhel and 1196 from Lama Tole, Nagarkot). The laboratory identification resulted altogether 909 *Cx. quinquefasciatus* from indoor and outdoor collection, of which, 508 (55.89%) were from Jhaukhel and 401 (44.11%) were from Nagarkot. Similarly animal baited net trap collection included 1125 samples i.e. 346 from Jhaukhel and 779 from Nagarkot. On identification of the collected samples, it was found all total of 520 *Cx. quinquefasciatus* viz. 84 and 436 from Jhaukhel and Nagarkot respectively.

Results

Regarding indoor and outdoor collection, the highest density of the filarial vector was observed to be during July for both of the selected sites (26.09 for Nagarkot and 15.75 for Jhaukhel), while the least density was found to be in the month of April(0.165 for Jhaukhel and 0 for Nagarkot). Indoor density of *Cx. quinquefasciatus* was relatively higher than outdoor density which includes 54.75 indoor density and 17.25 outdoor density for Jhaukhel and 44.63 indoor density and 11 outdoor density for Nagarkot collection. Density of the vector in the human residence was lesser than in cattle viz. for Jhaukhel it was 19.25 for human collection and 90.25 for cattle collection and for Nagarkot it was calculated to be 26.75 for human and 62.5 for cattle. The population density of the vector was higher in the morning than in the evening viz. 54.67 for morning and 26.5 for evening of Jhaukhel and 33.5 morning density and 33.34 the evening density. Abdominal status showed increase number of full fed (670) than unfed (211) and gravid (28) which included 391full fed, 99 unfed and 18 gravid from Jhaukhel and 279 full fed, 112 unfed and 10 gravid from Nagarkot which were relatively higher in indoor than in outdoor. Temperature and density were found to be associated with the density of filarial vector. The highest resting density for Jhaukhel and Nagarkot were observed in the month of May (7.73) and June (7.01) respectively while percentage abundance showed the peak value on July for both sites (12.75 for Jhaukhel and 26.17 for Nagarkot). Female *Cx. quinquefasciatus* were found to be relatively higher (875) than male (34). Out of total samples collected from animal bait net (520) the highest number was obtained during July for both sites (493 for Nagarkot and 60 for Jhaukhel). Unlike on July, no any samples were recorded from animal bait on the month of April.

Conclusions

The present study concludes the presence of *Cx. quinquefasciatus* in both sites (Thapa Gaun of Jhaukhel and Lama Tole of Nagarkot) and the change in density was observed according to month and seasonal variability.

Keywords: *Culex quinquefasciatus*; filariasis; population density; seasonal variability; vector.

Estimating the Burden of Diarrheal Disease caused by Water and Sanitation (2011)

Background

There is direct relationship between human being, environment and health. The magnitude of health problem is increasing day by day due to various environmental risk factors. Diarrhea is the major health problem in most of the developing countries, and a major significant environment sensitive disease. It is estimated that about 94% of the diarrheal burden is attributable to environment, and is associated with risk factors such as unsafe drinking water, poor sanitation

and hygiene. The purpose of this current study is to estimate and calculate scenario based diarrheal diseases burden related to water sanitation and hygiene.

Methods

This was a cross sectional, descriptive and comparative study in which 360 households were selected from six different scenarios on the basis of water sources and availability of toilet from terai, hill and mountain regions. All the populations of the selected household of selected communities were the study population. Non-probability (purposive method) technique was used as a method of sampling. Structured Questionnaire was used to collect the data from the household level using one to one interview method. The data was entered using Microsoft Excel Program. The analysis of the data was done by using Statistical Package for Social Science 16.0.

Results

Out of the total diarrheal cases of 132 in the entire scenario the highest proportion is seen high (25%) in scenario spring without toilet, and the lowest (9%) is seen in scenario tap water with toilet. Mean number of days suffered from diarrheal disease and no of episodes was high with scenario having spring water without toilet viz. 7.61 days and 2.03 respectively, and lowest diarrheal episodes was found in scenario having tap water with toilet (1.23). Hygiene and sanitation practice of the community people was found good in all the scenario with more than 90 per cent responding that they wash hand after defecation and before eating food. Most of the people do not make any treatment of water for drinking purpose, only very few percentages of respondents said that they treat water at household before consumption. Years lived with disability was found to be highest, 18.10 per hundred thousand in the scenario spring water without toilet, and least value of Years lived with disability was computed 2.39 in the situation of tap water with toilet facility available. Premature Mortality (YLLs) was not revealed in study sample from the selected communities. While the odds of risk of acquiring diarrheal disease for the scenario (spring without toilet) was nearly four times higher than the reference scenario- tap water with toilet facility which was statistically significant as well.

Conclusions

Disease burden and risk of the disease is seen high among those people who don't have toilet and consume water from spring or tube well. Appropriate awareness program targeted to high diarrheal disease burden areas should be conducted henceforth to cut short the diarrheal disease transmission and prevent the risk of acquiring it.

Keywords: diarrheal disease; disease burden; water and sanitation.

A Study on the *Plasmodium vivax* Relapse Pattern and Identification of Dominant Genotype in Far-Western Nepal (2011)

Background

Malaria is a major public health problem in Nepal. Out of 27.3 million populations of the country, 22.5 million people still live in malarias endemic areas. In Nepal, around 70 percent of the total populations are believed to be at risk to malaria. Since 1950, chloroquine was used as first line drug, but sulfadoxine-pyrimethamine (SP) was introduced after the emergence of *P. falciparum* resistant to chloroquine, and later established it as the first line drug for the treatment of microscopically confirmed uncomplicated *P. falciparum* malaria. However, the Government of Nepal has recommended 5 days treatment 7 with primaquin for vivax malaria. But the standard treatment with primaquin requires 14 days to prevent relapse except in those cases with Glucose-6-phosphate dehydrogenase (G6PD) deficiency, and in infants and pregnant women. Finding of different studies show that the relapse rate in *P. vivax* malaria is highly variable, ranging between 2% to 44% even after treating them with chloroquine. And the relapse mainly occurred during the first three months after the first attack. The present study is an attempt to understand the rate of relapses in Nepalese context to elucidate their transmission dynamics for planning vector control strategies and chemotherapeutic measures in *P. vivax* foci.

Methods

Altogether, six health centers were chosen from the Kailali and Kanchanpur district; three from each district. The respective health centers were selected on the basis of maximum number of malaria positive cases reported preceding year. The study tried to find out the relapse pattern of *P. vivax* for the period of six months from December 2010 to May 2011. All patients of age group more than 6 months to 65 years of age during the study period of the study area were considered eligible for the study. Initially, demographic profile of the patients was recorded. Later clinical examination, axillary temperature measurement, blood slide examination was done to screen the patient. A record book was kept in which all the relevant information regarding age, sex, address, temperature, blood film etc. of the screened cases was entered. The demographic and other data were entered in Ms-Excel 2007 and analyzed in Statistical Package for Social Science software 13.0 version.

Results

Age-group 21- 30 years had the highest distribution with 34 percent participation. Twenty nine percent and 17 percent of the patient belonged to the age-group 10 to 20 and 31 to 40 years respectively. Only 4 percent cases were observed in the age group 60 above years. In our study, 81 percent were male and 19 percent were female. Out of total malaria blood samples, 23 cases (17%) were relapsed during six months period. Random Fragment Length Polymorphism (RFLP) is a method used in distinguishing between selected genotypes within a species. Random Fragment Length Polymorphism was carried out on 100 *P. vivax* species identified in Nepali malarial cases. The study looked into distinguishing two major genotypes of *P. vivax* namely VK210 and VK247 within the *P. vivax* species which have been identified in South Asian cases, especially in neighboring India. Results of 100 samples showed a net success rate in positive identification of 84% samples whereby all the isolates were found to be VK210 genotype.

Conclusions

Extending the study in other endemic districts of Terai belt of Nepal taking representative samples can reflect the true picture of the genetic heterogeneity of *P. vivax* in entire Nepal which can help understand the detailed malarial epidemiology in Nepal

Keywords: genotypes; health centers; malaria; *Plasmodium vivax*; relapse pattern.

Assessment of Impacts of Particulate Air Pollutants on Respiratory Health of School Children in Kathmandu Valley (2012)

Background

Vehicular emissions as well as other pollutants degrading air quality is a global concern today. This is one of the greatest challenges and key environmental issue in Asia-Pacific region, with the growth of the megacities. The adverse health impacts resulting from small increases in concentrations of the worst pollutant, particulate matter (PM), are quite significant. These effects are especially severe in infants and children. The effect of particulate matter in the health of the people is one of the most important impact of air pollution that have been identified as the key problem as shown from various studies in developed countries. The impact of air pollutants and its adverse effect on children's health could be harmful till their adulthood. Developed countries are concerned about outdoor air pollution more than they do for indoor air pollution. Developing countries like Nepal are at double jeopardy; as the problem of outdoor as well as indoor air pollution is growing fast. As most lung alveoli are formed postnatal, changes in the lungs continue through adolescence and the developing lungs of children are more vulnerable to the adverse effects of air pollution than adult lungs. As child health is an essential indicator for the overall assessment of country health status, this study is expected to provide a basis to understand the effect of air pollutants on human health.

Methods

The study had two components: i) baseline survey and ii) health impact assessment both following quantitative methods and carried out in one year from July 2011 to June 2012. A baseline survey was conducted in 7 schools of different locations in Kathmandu valley among 1184 children using a structured questionnaire, modified ISAAC (The International Study of Asthma and Allergies in Childhood) questionnaire. For the second component correlational study was done to assess the health impact in two schools among 137 students out of 507. After the baseline survey St. Xavier's school (urban roadside) and Santaneshwor Vidya Mandir (Semi urban residential) were taken for the second component where children of age between 10 to 15 years were assessed daily for their lung function

by measuring morning peak expiratory flow rate. Meanwhile, data for particulate matter (PM 2.5) was also recorded daily for both schools by viii using a personal monitor (dust trak). Weather data was achieved from the Department of Hydrology and Meteorology. Data obtained from these procedures were entered in Microsoft Excel and analyzed using Statistical Package for Social Science 16.0 version

Results

Nearly 70 percent of the children from St. Xavier's school (school 1) and 85 percent of the children from Santaneshwor Vidya Mandir (school 2) were in the age group 13 to 15 years. Rest of them in both the schools was from the age group of 10 to 12 years. Male children were nearly 60 % in both the schools. The mean age of the children was almost similar just above 13 without any significant difference. Mean height and weight of the children were significantly different in the two schools. The mean concentration of Particulate Matter 2.5 was 203.14($\pm$75.01) and 137.69 ($\pm$44.52) in school 1 and 2 respectively and the difference is statistically significant (p =0.04). The mean Peak Expiratory Flow Rate was higher for school 1 with statistically significant difference (p < 0.05, 95% CI 39.61 – 126.17). The mean Peak Expiratory Flow Rate level between the two sexes of school 1 was significantly different (p=0.01, 95% CI 10.52- 80.36), the value being higher for the male children. The Peak Expiratory Flow Rate level of the total students of school 1 is found to be varying on certain days with the changing levels of Particulate Matter concentration which was seen to be varying between the values of 100μg/m3 and nearly 340μg/m3. The Peak Expiratory Flow Rate levels of younger (10-12 years) children seem to be correlating with the changes in Particulate Matter 2.5 concentrations in the initial days and later days of the assessment. Similarly, the Peak Expiratory Flow Rate levels of female children also seem to be correlating with the variation in daily Particulate Matter concentrations on few days. The daily Peak Expiratory Flow Rate levels of 20 students taken from the semi urban school is in the inverse relationship with the changes in Particulate Matter concentrations for most of the days in later half except for few days.

Conclusions

There is an association of lung function with the particulate matter in the atmosphere. It shows that the impact is more pronounced in the younger age

groups and female children. Hence, the intervention needs to be focused to protect the most vulnerable groups from the increasing pollutants. The cross sectional component of this study conducted in the larger group as a baseline study before the impact assessment study hints that the burden of fine particles on the respiratory health could be huge and thus requires further investigation.

Study on Vector Borne Diseases and Climate Change along an Altitudinal Transect in Nepal (2013)

Environmental Health Research Unit, Nepal Health Research Council, Ramshah Path, Kathmandu, Nepal.

Background

The effect of climate change is obvious. There is global consensus that the entire global community is increasingly imperiled by environmental threats like landslide, extreme weather or unseasonal weather conditions, floods, droughts, epidemics and killer heat waves beyond anything we have ever experienced. These catastrophes are self-generated. Despite the ubiquitous associations to humanity, environmental issues are still not high on the national agenda. The objective of this study is to assess the effect of climate change on the vector borne diseases along an altitudinal transects and recommend guideline to develop action plan for its prevention and control in Nepal.

Methods

The methodology of study was the mixing of descriptive retrospective and cross sectional study. Three different ecological regions with respect to their altitude from all the development regions of Nepal were selected for the study ranging from height below 500m, 500- 1500m and above 1500m. Both the qualitative and quantitative method was used for data collection. In-depth and key informant's interviews were carried out with the health professionals and policy makers. Focus Group Discussion was carried out with the homogeneous and heterogeneous groups of female community health volunteers, local people and health workers.

Questionnaire survey was also conducted with the elders aged above 60 years for Knowledge, Attitude and Practice survey. Climate data on temperature and precipitation was collected from Department of Hydrology and Meteorology. Time series log linear regression analysis was done to assess the relationship between climatic factors and vector-borne diseases. Judgmental and multistage random sampling technique was used. Fifteen Primary Health Care Centers were selected from five development region, three from each region based on altitudinal transect. Twenty seven wards were selected for Knowledge, Attitude and Practice study from western region.

Results

Most of the health workers had some knowledge about climate change and they were known about it compared to community people who don't even heard the term "Climate Change". Most of the health workers were focusing on the need of strengthening of the existing health programs. They even said that the current health programs at the district level are not sufficient and need to be expanded with the availability of proper service and manpower. Health workers from Himalayan region also felt the importance of vector control officer in these regions as well because they presume that the problems of vector are alarming and they are at risk of malaria. Knowledge, Attitude and Practice surveys were conducted in three districts of different ecological regions from terai, hill and mountain. Only 1.73% of the respondents from terai, 28% from hill and 19.18 % from mountain region have knowledge about climate change. Their major source of information about the climate change was radio which is local radio stations. Time series analysis was also carried out between climatic parameters and malaria. Temperature (maximum and minimum), humidity and rainfall were taken as independent variables and malaria as dependent variable and were analyzed in the three cross section of Nepal from terai to mountain region. Occurrence of malaria was significantly associated with rainfall ($p<0.032$) and morning humidity ($p<0.007$) and other parameters were found insignificant in terai region. While in hill region, no significant association has been found between malaria and rainfall, even humidity, maximum and minimum temperature. Malaria was found significant

with morning humidity (p<0.01). From both the topographical zone (terai and hill) showed significant association of humidity and malaria.

Conclusions

Relative humidity is major climatic determinants for the occurrence of malaria, which is highly dependent on seasonality and rainfall. Malaria was not found in mountain region, so no association could be ascertained in this region

Keywords: climate change; health programs; health workers; malaria; vector control; vector borne diseases.

Assessing the Biomedical Waste Management Practice among the Health Care Institution of Nepal (2013)

Background

Health care waste (HCW) includes all the waste generated by health care institutions (HCIs), research facilities and medical laboratories during diagnosis, treatment or immunization of human beings or animals or in research activities. Policy maker must be known about the management practices in health care institution and waste generation. Thus this study aimed at providing the baseline information on health care waste management in different health care settings and to assess the present scenario so that evidence based decisions can be made by different stakeholders at central, regional and peripheral levels.

Methods

The methodology for data collection of this research includes face to face interview, observation and key informant interview. A structured questionnaire was designed to collect information addressing the generation of different medical wastes. The collected data with the close ended questionnaire were analyzed,

mainly with simple descriptive statistics while the qualitative mode of analysis was mainly in narrative form.

Results

It was clearly seen that 35% of the institutions followed the health care waste management guidelines 2065, 45% of the institutions followed self-developed protocol, 155 of the health care institutions did not follow any guidelines, whereas 5% of the health care institutions followed Nepal Health Care Waste Management Guidelines 2002. Data regarding different types of average health care waste production in kg per day per patient revealed that total waste production in health care institutions was 3.0 kg/day/patient, whereas general waste was 1.6 kg/day/patient, 0.41, 0.47, 0.20, 0.18, 0.10 and 0.02 kg/day/patient recyclable, infectious, pharmaceutical, sharp, chemical and radioactive waste was produced respectively. Seventy one percent of the institutions had not conducted Environmental Impact Assessment (EIA) or Initial Environment Examination (IEE). Seventy six percent of the hospitals had no waste management committee. It was revealed that 61.29% of the institutions adopted reuse strategy, similarly 61.29% and 40.32% of the institutions followed recycle and avoidance respectively, whereas 22.58% of the hospital followed none of the strategies. It was seen that 40% of the hospitals spent 1-5% of the total budget, 18% of the institutions spent less than 1% of the total budget, whereas only 2% of the hospitals spent more than 20% of the total annual budget in health care waste management. The study revealed only 60% of the health care waste management workers had been given vaccination. Regarding importance of the waste segregation in waste handling, 51% of the hospital representative perceived it as highly significant.

Conclusions

Health care institutions must implement the standard waste management procedures guided by national legislation of health care waste. Health care waste management persons as well as general public must be aware about the health impact of weak health care waste management practice.

Keywords: environmental impact assessment; guidelines; health care institutions; health care waste; health care waste management; production.