



ISSN: 2277- 7695  
TPI 2016; 5(10): 128-133  
© 2016 TPI  
www.thepharmajournal.com  
Received: 19-08-2016  
Accepted: 20-09-2016

**Jyoti Joshi**  
Ph.D. Scholar  
Department of Home Science,  
University of Rajasthan, Jaipur,  
Rajasthan, India

**Dr. Sunita Agarwal**  
Associate Professor,  
Department of Home Science,  
University of Rajasthan, Jaipur,  
Rajasthan, India

## Susceptibility of school students to health related hazards due to lack of hygiene

**Jyoti Joshi and Dr. Sunita Agarwal**

### Abstract

Children are the most vulnerable segment of the population to hygiene and sanitation concerned health hazards and consequently are affected the most. The poor health and lack of sanitation facilities are important underlying factors for low school enrolment, absenteeism, poor classroom performance, and early school dropouts. In the nutshell, India is lacking sanitation and hygiene in its rural schools setup which affects the performance of children negatively and increases the chances of acquiring many diseases. Therefore, the present study is planned to assess the current situation of knowledge and practices regarding hygiene in school students of rural Bikaner. In the present study, 1280 students were selected from 32 schools, which comprised of 16 government and 16 private schools. These students were selected by the process of multistage sampling. A self-administered close ended questionnaire was prepared for the study. To find whether there exists a significant difference between knowledge and practice regarding hygiene, we conducted test of proportions where the same set of respondents were asked for two different aspects and the result was analyzed through z-test statistic. For knowledge of government school students regarding personal hygiene, water and food hygiene were (87.6%), (89.1%), (89.1%) and practices level were (63.3%), (53.8%), (52.2%) and the knowledge level of private student's were (92.6%), (91.4%), 94.6%) and practices level were (75.5%), (71.2%), (71.4%). The Z-value was found (-3.00) for personal hygiene and water hygiene Z-Calculated (1.41) is lower than the Z-critical (1.96). This implies that there is no significant level of difference found in the knowledge level of Water Hygiene amongst the two school groups. Z-calculated (3.57) is higher than the Z-critical (1.96). This leads to the conclusion of rejecting the null hypothesis regarding practice level amongst both the group of students with respect to these parameters.

**Keywords:** Knowledge, practices, personal hygiene, water hygiene, food hygiene, school students

### Introduction

Children have an increased risk and susceptibility to many pathogens and diseases, such as diarrheal diseases, as their immune systems are still maturing. Mortality rates, especially child, are measures of a country's health status, quality of life status, and socio-economic status, and are useful for informing health programs and policies. It has been estimated that more than 2.3 billion people still live without access to sanitation facilities and are unable to practice basic hygiene such as washing their hands with soap and water. Diseases related to poor sanitation, hygiene and water unavailability causes many people to fall ill or even die. Children are the most vulnerable segment of the population to sanitation concerned health hazards and consequently are affected the most. As per WHO fact sheet, 2013 nearly 1.7 billion diarrhoea cases occurred every year and it causes 7, 60,000 deaths every year. By another report 443 school days are lost annually by these preventable gastro intestinal upsets. In addition to this, poor sanitation has led to the infestation of nearly a billion people - largely children with a variety of worm infections, with its corresponding costs in health and energy. It is obvious that lack of sanitation and hygiene is a public disaster and deserves the highest priority from government as well as society.

It is widely recognised that schools could play an important role in bringing about behavioural changes and promoting better health with the weapon of knowledge. But, water and sanitation related diseases including diarrhoea, trachoma, scabies and Guinea worm, etc. All of these have compromise children's attendance and performance at school. Access to sanitation facilities is a fundamental right that safeguards health and human dignity. Such improvements may go hand in hand with hygiene behaviour change and the transmission of disease can be prevented which will result in to better performance, better enrolment stick and educated and healthy parents of next generation.

### Correspondence

**Jyoti Joshi**  
Ph.D. Scholar  
Department of Home Science,  
University of Rajasthan, Jaipur,  
Rajasthan, India

**Rationale of the Study**

1. Children are the most vulnerable to environmental health hazards and are subsequently also the worst affected. But then focus of the present study is made upon school children because they are eager to learn at the early stages of life, they have important roles in household chores, they can become agent of change and they are ready for initiatives guided in the schools by the school teachers and their peer groups.
2. Schools will partly determine children’s health and well-being by providing a healthy or unhealthy environment and by developing useful life skills on health and hygiene.
3. So whether the said enormously progress of the recent years made in India and consequently in Rajasthan percolates to end points which our villages are still uncertain, regarding the issues of hygiene and sanitation facilities erection, their maintenance and knowledge of children about them and actual adoption of knowledge in practice. Western Rajasthan has traditionally been considered as orthodox area poor in women education level and most importantly this area has been water deprived since time immortal due to its geo climatic condition.
4. Therefore, the present study is planned to find out the difference between Knowledge and Practices regarding Hygiene among Government and Private school students of rural Bikaner.

**Objective of the Study**

To find out the difference between Knowledge and Practices regarding Personal hygiene Water hygiene and Food Hygiene among Government and Private school students of rural Bikaner

**Methodology**

The Study was conducted in Bikaner district of Rajasthan.

1. **Locale of the study:** The study was conducted in Bikaner, Rajasthan.
2. **Selection of the sample:** In present study, multistage sampling was used for selection of Bikaner four directions, then village then schools, after that classes and finally students.
3. **Selection of the respondent:** In the present study upper primary students were selected because those students have knowledge from their primary class but important is that how many students are using their knowledge in actual practices in daily life. So a total of 40 students, from of 6th, 7th and 8<sup>th</sup> class of each school (government and private) were selected for study. A total of 1280 respondents were selected for the present study.

**Tools of data collection:** A self-administered, close ended questionnaire was prepared. Measurement of knowledge and practices regarding food hygiene and water hygiene among selected school students of rural Bikaner district was done by formulating 5 major research tools for data collection and these were:

- A. General information
- B. Knowledge about personal hygiene, water hygiene and food hygiene
- C. Practices about personal hygiene water hygiene and food hygiene

**Results and Discussion**

The study for this objective includes the understanding of the knowledge and practices regarding water and food hygiene. The results of the present study as well as relevant discussions have been presented under following sub headings.

**Table 1.1** General characteristics of Respondents

S. No	Characteristics	Government school	Private school	Overall
1	<b>Types Of Family</b>			
a.	Nuclear family	183	194	377
b.	Joint family	457	446	903
2	<b>Family Income</b>			
a	INR 1000-5000 P.M	51	16	67
b	INR 5001-10000 P.M	262	288	550
c	INR 10001-15000 P.M	202	253	455
d	Above INR 15000 P.M	125	83	208
3	<b>Father’s Education</b>			
a	Uneducated	46	39	85
b	Primary education	274	262	536
c	Secondary education	102	104	206
d	Higher secondary	110	119	229
e	Others	108	116	224
4	<b>Mother’s Education</b>			
a	Uneducated	179	159	338
b	Primary education	252	253	505
c	Secondary education	71	74	145
d	Higher secondary	128	122	250
e	Others	10	32	42

The family background of the students was also assessed in order to gain insights over the type of family environment that student are getting at home. This will be related to the habits developed and practiced at home and depict that whether students are exposed to the desired environment at home or not. Table 1.1 displays family type, income group, fathers and mother’s education background, respectively. The knowledge and practice level of the school students were collected and evaluated.

**Objective**

To find out the difference between Knowledge and Practices regarding Hygiene among Government and Private school students

The first category of Personal Hygiene or self-cleanliness has been segregated into various sub sections. Analyzing the knowledge level of both types of school students, we can see an overall difference in Government school and Private Schools. Considering knowledge regarding regular bathing habits, response of Private school students (94.3%) was slightly better as compared to Government school students (88.9%) because they were more vigilant about the need of bathing daily, wearing clean clothes, and washing hairs on regular basis. In terms of sense organs cleanliness, students of both the schools had different percentages (87.1% & 92.1%) reflecting that private school students better understood the importance of cleaning eyes, ears and tongue. Data of teeth and mouth cleanliness showed that government (86.0%) and private school (90.6%) students responded in a closely similar manner and possessed adequate knowledge about brushing teeth twice in a day with paste and gargling mouth after having meal. Government and private school students were well aware and informed about the need of washing hands before and after meal, cleaning nails, washing hands after using washroom because data corresponding to it differed very less

in percentage terms (88.4% & 93.3%). Considering the practice level of the two categories of schools, we can observe somewhat different scenario than the knowledge level. The practice level of bathing habit is slightly on the higher side for both Government school students (83.6%) and private school students (88.2%) but a significant drop could be seen in sensory organs cleaning. Only 44.8% of government school students and only 69.0% of the private schools students regularly cleaned their sense organs, which is an alarming situation. Moreover teeth and mouth cleaning

practice is also not followed regularly among the school students. Both government school (50.6%) and private school students (61.2%) regularly cleaned their teeth which can be attributed towards the potential rise in the dental cavities and gums related problems being more prominent in these regions. Hand and legs are cleaned regularly by the private school students (83.7%) but government school students (73.5%) too far behind in this parameter too. This shows that personal hygiene is taken care of well amongst the students and especially amongst the private school students.

**Table 1.2:** Percentage distribution of Knowledge & Practice level regarding various aspects of Personal Hygiene N=1280

Personal Hygiene	Government School (%)				Private School (%)			
	Knowledge	Practice	Z-value	Significance	Knowledge	Practice	Z-value	Significance
Bathing Habit	88.9	83.6	2.75	S	94.3	88.2	3.78	S
Sensory Cleaning	87.1	44.8	15.99	S	92.1	69.0	10.46	S
Teeth & Mouth Cleaning	86.0	50.6	13.64	S	90.6	61.2	12.29	S
Hand & Legs Cleaning	88.4	73.5	6.77	S	93.3	83.7	5.34	S

NS: Non-Significant                      S: Significant at 0.05 level

Table 1.3 shows that the knowledge level of Private school students (91.4%) took a forward leap when it came to the knowledge of using the water filter because the government school (76.0%) students were not much aware about this as reflected in corresponding data. Not knowing about the water filter system can be really dangerous as lot of diseases spread through the un-clean water. Students of government schools had responded at similar levels when asked about cleaning utensils (88.7%), water related diseases (88.7%) and cleaning of surroundings of drinking water (89.4%), as the data showed not much variability. The private school students had shown higher knowledge levels for these (94.3%, 94.8% and 94.4% respectively).

The practice level for the Water Hygiene maintenance was also found to be higher amongst the private school students on all the factors as compared to the government school students. With regard to water filter arrangements, 67.5% of the private

school students practiced it regularly while only 47.1% of the government school students used water filters. The clean water storage and clean utensils practice was found to be very low in Government school students (53.2% and 56.8% respectively) as compared to private school students (70.7% and 78.9% respectively). This may lead to lot of water borne diseases amongst the government school students. For private school students, this practice is quite higher which means better fight against diseases caused by water hygiene. The study by Jasper et al (2012) [2] provides evidence for an increase in water intake with increased provision of water and increased access to water facilities. Articles also report an increase in absenteeism from schools in developing countries during menses due to inadequate sanitation facilities. Lastly, there is a reported decrease in diarrheal and gastrointestinal diseases with increased access to adequate sanitation facilities in schools.

**Table 1.3:** Percentage distribution of Knowledge & Practice level regarding various aspects of Water Hygiene N=1280

Water Hygiene	Government School (%)				Private School (%)			
	Knowledge	Practice	Z-value	Significance	Knowledge	Practice	Z-value	Significance
Arrangement of Water Filter	76.0	47.1	10.63	S	91.4	67.5	10.58	S
Cleaning Water Utensils	88.7	56.8	12.81	S	94.3	78.9	8.13	S
Water Storage	88.7	53.2	13.98	S	94.8	70.7	11.40	S
Water Caused Diseases	89.4	58.4	12.60	S	94.4	67.9	12.08	S

NS: Non-Significant                      S: Significant at 0.05 level

Table:1.4 shows that the factors contributing to the Food Hygiene contributed highly towards the knowledge level of students. Private school students (90.0%) were found to be fully aware of the need of washing hands with soap before and after having food, cleaning them with neat cloth but the case is not same for the government school. Not only this, students studying in private schools had immense knowledge about washing utensils with soap, cleaning them for cooking and eating (87.0%) and cleanliness of food materials like washing fruits and vegetables before using, eating covered food (88.0%), etc. It is reflected in respective data that government school students were not far behind with scores of 81.6%, 73.6% and 78.2% respectively for the three factors. Since food is considered to be an important part of our daily lives, thus awareness about its hygiene is an important area of concern. And the performance of student indicates that they have

relatively higher knowledge of such practices. The practice level for Food related hygiene has been found on the higher side amongst the private school students on all the parameters. For private school students, Utensils cleaning and cleanliness of food preparation surroundings which is 71.1% for private schools were found to be much better than for government school students (58.6%). The cleanliness of hands in private schools (73.5%) was found to be very high as compared to government school students (47.9%). This may lead to various diseases and unhealthy practices which may cause malnutrition amongst the students. Food related cleanliness is practiced on the lower side for both the categories.

**Table 1.4:** Percentage distribution of Knowledge & Practice level regarding various aspects of Food Hygiene N=1280

Food Hygiene	Government School (%)				Private School (%)			
	Knowledge	Practice	Z-value	Significance	Knowledge	Practice	Z-value	Significance
Hands Cleanliness	81.6	47.9	12.57	S	90.0	73.5	7.66	S
Utensils & Surrounding	73.6	58.6	5.66	S	87.0	71.1	7.00	S
Food Material Cleanliness	78.2	54.2	8.01	S	88.0	72.5	6.94	S
Aspects related to Food caused Diseases	67.1	48.8	8.05	S	80.7	68.6	5.01	S

NS: Non-Significant      S: Significant at 0.05 level

This objective has been studied and analysed with the help of testing of hypothesis related to Knowledge and Practice separately on various parameters.

The Null Hypothesis for the Knowledge level is as follows:

**Ho:** There will not be a significant difference between the Knowledge of Government School students and Private School students regarding Personal Hygiene, Water Hygiene, Food Hygiene level in Schools.

To test the hypothesis, the z-test for proportion was calculated and results are shown in the following Tables. For the confidence interval of 95% confidence, significance level was 0.05. Based on this confidence level, the critical value for Z-statistic was 1.9600 to -1.9600 for the two tail test. As shown

in table 1.5, for personal hygiene, Z-calculated (-3.00) is lower than the Z-critical (-1.96). This implies that there was a significant level of difference found in the knowledge level of the government school and private school students for personal hygiene. From the proportions it can be inferred that Private School students (92.6%) had better knowledge than Government School Students (87.6%). Significant difference was also found in the knowledge level of the students of the two types of schools with respect to all the components of personal hygiene namely, Bathing Habits (-3.54), Sensory Cleaning (-2.94), Teeth & Mouth Cleaning (-2.53) and Hands & Legs Cleaning (-3.01). Private School Students were found to be better in all these respects.

**Table 1.5:** “Z” test showing Knowledge Level of Government & Private School students regarding personal hygiene and its components N=1280

Knowledge Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Personal Hygiene	87.60	92.60	-3.00	S
Bathing Habit	88.91	94.30	-3.54	S
Sensory Cleaning	87.11	92.11	-2.94	S
Teeth & Mouth Cleaning	86.02	90.59	-2.53	S
Hand& Legs Cleaning	88.40	93.32	-3.01	S

NS: Non-Significant      S: Significant at 0.05 level

As shown in table 1.6, for water hygiene, Z-Calculated (-1.41) is higher than the Z-critical (-1.96). This implies that there was no significant difference found in the knowledge level of Water Hygiene amongst the two school groups. The proportions indicated that Government School students (89.1%) were found to be having lower knowledge level as compared to Private School students (91.4%). However, all the

components of Water Hygiene showed a significant difference in the level of knowledge for the two types of schools. Private schools’ students were found to be better than Government schools’ students in their knowledge about Arrangement of Water Filter (-7.43), Cleaning Water Utensils (-3.62), Water Storage (-4.09) and Water Caused Diseases (-3.27).

**Table 1.6:** “Z” test showing Knowledge Level of Government & Private School students regarding Water hygiene and its components N=1280

Knowledge Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Water Hygiene	89.10	91.40	-1.41	NS
Arrangement of Water Filter	76.02	91.41	-7.43	S
Cleaning Water Utensils	88.71	94.30	-3.62	S
Water Storage	88.71	94.80	-4.09	S
Water Caused Diseases	89.41	94.41	-3.27	S

NS: Non-Significant      S: Significant at 0.05 level

As shown in table 1.7, with respect to Knowledge of Food Hygiene, Z-calculated (-3.57) was found to be lower than the z-critical (-1.96). This implies that there is a significant level of difference found in the knowledge level of Food related hygiene amongst the school students’ groups. The proportions indicate that Private school students (94.6%) were having better knowledge about it as compared to Government school

students (89.1%). Significant difference was also found for all the respective components that constitute the factor Food Hygiene, namely, Hands Cleanliness (-4.32), Utensils & Surroundings Cleanliness (-6.05), Food Material Cleanliness (-4.63) and Aspects related to Food caused Diseases (-5.54).

**Table 1.7** “Z” test showing Knowledge Level of Government & Private School students regarding Food hygiene and its components N=1280

Knowledge Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Food Hygiene	89.10	94.60	-3.57	S
Hands Cleanliness	81.60	90.00	-4.32	S
Utensils & Surrounding	73.63	86.99	-6.05	S
Food Material Cleanliness	78.20	88.01	-4.63	S
Aspects related to Food caused Diseases	67.11	80.70	-5.54	S

NS: Non-Significant S: Significant at 0.05 level

Therefore, we reject the Null hypothesis on the basis of three parameters i.e. Personal Hygiene, Food Hygiene, while it was accepted for Water Hygiene. Nansereko (2010) [3] found that the available sanitation facilities are poorly utilized in Mpigi district which is a result of many factors including student’s background and upbringing, discipline regarding personal hygiene and school and weakness in implementation of sanitation and hygiene policies.

**Ho:** There will not be a significant difference between the Practices of Government School students and Private School students regarding Personal Hygiene, Water Hygiene, Food

Hygiene level in Schools.

As shown in table 1.8, for the practice level of personal hygiene, there was found a significant difference in the students of government and private schools, as the Z-calculated (-4.79) is found to be lower than the Z-critical (-1.96). The private school students (75.53%) reported a better practice level compared to the government school students (63.13%). The respective components of the personal hygiene, namely, Bathing Habits (-2.41), Sensory Cleaning (-8.75), Teeth & Mouth Cleaning (-3.83) and Hands & Legs Cleaning (-4.50) also reported a significant difference with private school students being better in all the cases.

**Table 1.8:** “Z” test showing Practice Level of Government & Private School students regarding Personal hygiene and its components N=1280

Practice Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Personal Hygiene	63.13	75.53	-4.79	S
Bathing Habit	83.59	88.20	-2.41	S
Sensory Cleaning	44.80	69.02	-8.75	S
Teeth & Mouth Cleaning	50.63	61.21	-3.83	S
Hand& Legs Cleaning	73.48	83.71	-4.50	S

NS: Non-Significant S: Significant at 0.05 level

As shown in table 1.9, for water hygiene too, the practice level of private school students (71.25%) was found to be significantly better than government school students (53.88), as can be seen by a lower Z-calculated value (-6.41) compared to Z-critical (-1.96). Similar results were also found for the

various components that constitute water hygiene, namely, arrangement of water filter (-7.35), Cleaning Water Utensils (-8.44), Water Storage (-6.45) and Water Caused Diseases (-3.54).

**Table 1.9:** “Z” test showing Practice Level of Government & Private School students regarding Water hygiene and its components N=1280

Practice Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Water Hygiene	53.88	71.25	-6.41	S
Arrangement of Water Filter	47.11	67.50	-7.35	S
Cleaning Water Utensils	56.84	78.91	-8.44	S
Water Storage	53.20	70.70	-6.45	S
Water Caused Diseases	58.44	67.93	-3.54	S

NS: Non-Significant S: Significant at 0.05 level

As shown in table 1.10, the Z-calculated value (-7.08) was also found to be lower than the Z-critical (-1.96) value for the practice levels of food hygiene of the students of two school groups. The private school students were found to be better even in this case with 71.43% students practicing Food Hygiene compared to 52.26% of government schools. They

were also found to be significantly better in practicing all the components of maintaining food hygiene, namely, Hands Cleanliness (-8.55), Utensils & Surroundings Cleanliness (-4.68), Food Material Cleanliness (-6.79) and Aspects related to food caused diseases (-7.21).

**Table 1.10:** “Z” test showing Practice Level of Government & Private School students regarding Food hygiene and its components N=1280

Practice Parameters	Government School Count (%)	Private School Count (%)	Z-test (for proportions) Statistic	Significance Level
Food Hygiene	52.26	71.43	-7.08	S
Hands Cleanliness	47.89	73.52	-8.55	S
Utensils & Surrounding	58.63	71.09	-4.68	S
Food Material Cleanliness	54.18	72.50	-6.79	S
Aspects related to Food caused Diseases	48.79	68.63	-7.21	S

NS: Non-Significant S: Significant at 0.05 level

The null hypothesis is therefore rejected based on all the five components, personal hygiene, water hygiene, food hygiene. Comparing the Knowledge and Practice level in various school students with respect to Hygiene and Sanitation, there were many studies conducted in various parts of the world. Study by Reena Chudgar (2010) <sup>[1]</sup> regarding Knowledge and Practices in Ghana. Instead of two school groups, the hygiene was compared in two regions irrespective of age and education. Hygiene was the focus of the study which concentrated on Human Sanitation and its disposal in both the areas. There were significant differences found. Particularly school hygiene and sanitation was studied by Fatuma Nansereko (2010) <sup>[3]</sup> in the Mpigi district for secondary schools. The study also focused on the hygiene level in the schools. But the study was not positively inclined towards the better arrangements of the sanitation and hygiene in the schools. Not more than 50% of the students responded positively in this regard. The facilities were also not good. But as per the present study, we can see a very high rate of knowledge and practice level amongst the school students.

### Conclusions

This study has shown a need to improve practices regarding hygiene condition of school students because the government and private school students have good knowledge about personal hygiene, water and food hygiene but they have not good practices due to lack of resources. Such as the water problem in rural area and water source or sanitation service, use of these services, water storage and treatment practices, availability of soap and toothpastes. A change in awareness or knowledge can lead, through the complex system, to the changes in behavior ultimately.

### Recommendations

- The strength of the government schools is way too much then the private schools but the awareness campaigns run by them are not up to the mark accordingly. They need to be more rigorous and widespread.
- The huge strength of students also calls for a greater number of facilities. Facilities related to water and sanitation needs to be more appropriate considering the greater number. Toilets and sanitation need to be more frequently cleaned. Also, more number of facilities should be made available so as to fulfill the needs of everyone.
- Taboos exist in the uneducated classes regarding the usage of public toilets and the usage of same toilet by girls and boys. To deal with the former authorities can ensure better public toilet conditions and can run awareness campaigns to help break the taboos.
- All the students despite their backgrounds of family income and type should be addressed with care and caution. The students from lower background might need more attention and convincing.
- Hygiene and sanitation would no doubt lead to positive health impacts. Therefore improvement in them would help in achieving better health standards for the country.

Although just knowledge about the practices or even following them is not enough until the proper facilities are also provided. Health impacts can be achieved only if the practices are properly taught about and adopted.

### References

1. Chudgar R. Water, Sanitation and Hygiene Practices in Dawa and Tugakope: A Multiple Methods Baseline Assessment of Two Rural Communities in Ghana (Doctoral dissertation, Emory University), 2010.
2. Jasper C, Le TT, Bartram J. Water and sanitation in schools: a systematic review of the health and educational outcomes, *International journal of environmental research and public health*, 2012; 9(8):2772-2787
3. Nansereko F. Adequacy and Utilization of Sanitation Facilities in Secondary Schools in MPIGI District, Mekerere University, 2005/HD04/3280U, 2010.
4. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. (2010) Progress on Sanitation and Drinking Water.
5. World Health Organization. Global Burden of Disease Retrieved 12/1, 2010, from [http://www.who.int/healthinfo/global\\_burden\\_disease/en/index.html](http://www.who.int/healthinfo/global_burden_disease/en/index.html)
6. World Health Organization. GIS and public health mapping Retrieved 11-10, 2010, from [http://www.who.int/health\\_mapping/gisandphm/en/index.html](http://www.who.int/health_mapping/gisandphm/en/index.html)