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**2 Editorial**  
*Ahmad Husari*

**Original Contribution / Clinical Investigation**

**3 Surgical Site Infections: Incidence and Risk Factors At Southern Iran Teaching Hospitals**  
*Seyed Habibollah Kavari, Ahmad Reza Rasekhi*

**8 Study on Arsenic Disaster and Sanitation Condition of Nawabganj Paurashava**  
*Mosieur Rahman, Tapan Kumar Roy, Golam Mostafa & Rafiqul Islam*

**18 Tinea Capitis in Iraq: Comparison between Community Based and Hospital Based Studies**  
*Abdul Ghani Mohamed Al Samarai*

**25 Smoking Among Boys: The Role of Family and Environment On Smoking In A Rapidly Developed Country**  
*Ahmad M. A.K Al-Mulla, Abdulbari Bener*

**28 Association Between Stages of Liver Fibrosis and Some Chronic Diseases [Thalassemia, Chronic Renal Failure and Diabetes] In Patients with Chronic Viral Hepatitis**  
*Abdul Ghani Mohamed Al Samarai, Isra Hashim Sadoon*

**Review Articles**

**38 Anti-Infectives from The Sea**

**Education and Training**

**42 Validity and Reliability In Measuring Health Professions Competencies for Undergraduate Medical Students**  
*Thamer.K.Yousif*

# From the Editor



**Ahmad Husari** (*Chief Editor*)

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Welcome to the Middle-East Journal of Internal Medicine

On Behalf of the editorial team, I welcome you to the first issue of the Middle East Journal of Internal Medicine (MEJIM). MEJIM is a peer-reviewed journal designed to meet the needs of physicians, scientists, policymakers, patients and communities that serve the Middle-East. We are excited about the prospects of this journal and its impact on health care in the Middle East. MEJIM will aim to create a platform where Middle East internists from different backgrounds and specialties present their medical knowledge to their peers in areas of interest to this region.

During the past two decades, Middle East countries have witnessed a remarkable expansion in the health care industry and we believe that MEJIM will be an additional important tool in taking our medical knowledge towards the second level of expansion and better communication between the different divisions of Internal Medicine in the Middle East.

In this issue, Kayyari et al examine the incidence of

surgical site infections in southern Iran, and present interesting associations and possible remedies to limit the increased incidence of surgical wound infections. A paper from Qatar, examines the prevalence of smoking habits among high school boys aged 15-24 years. The study also inspects the attitudes toward cigarette smoking and raises important issues about the youth in the Middle East and the alarming high incidence of smoking. It is clear from this study that we face real challenges as one third of Qatar high school students are already regular smokers. More than two thousand subjects participated in the study.

A paper from Iraq examined the characteristics of 133 patients with chronic liver disease and evaluated the incidence of hepatitis (HBV, HCV) in patients with thalassemia, hemodialysis and diabetes. We are also including a nice review article describing the resourceful natural products noted in the sea and their potential anti-infective role.

Once again, welcome to MEJIM. We are counting on your support and participation. MEJIM is your internal medicine journal for years to come.

# Surgical Site Infections: Incidence and Risk Factors At Southern Iran Teaching Hospitals

## ABSTRACT

**Background:** Surgical site infections (SSI) are among the most common complications of inpatient admissions and have serious consequences for outcomes and costs. Different risk factors may be involved, including age, sex, nutrition and immunity, prophylactic antibiotics, operation type and duration, type of shaving, and secondary infections. The purpose of the study was to determine the risk factors affecting surgical site infections and their incidence at Shahid Beheshti teaching hospital in Shiraz, Iran.

**Study Design:** A prospective follow up study of 400 patients post surgery date who were administered a questionnaire containing 20 items. Patients were followed up for thirty days to determine the incidence rate of SSI.

**Methods:** Four-hundred patients who had undergone abdominal surgery were studied and the relationships among variables were analyzed by Student's t and Chi-square tests. The subjects were followed for 30 days and by a 20-item questionnaire. Data were collected through pre- and post-operative examinations and telephone follow-ups.

**Results:** Of the 400 patients, 70 patients (17.5%) suffered from SSI. In 163 patients (40.7%) of the cases, the wound was dirty infected. The mean age for the patients was 46.7 years (45.2 years for females and 48.2 years for males). The operations were elective in 75.7% of the cases and 24.3% were urgent. The average duration of the operation was 2.24 hours, the average duration of pre- and post-operative hospital stay were 4.31 and 6.9 days, respectively. Three-hundred (75%) of the patients were shaved 12 hours before the operation. Increased operation time, increased bed stay, electivity of the operation, septic conditions of the wound, type of incision, the administration of prophylactic antibiotic, type of operation, background disease, and the increased time lapse between shaving and operation were statistically significantly associated with SSI with a p-value less than 0.001.

**Conclusion:** We report a higher incidence rate of SSI at our institution as opposed to what has been reported in the literature, 17.4% as opposed to 14%, respectively. In view of our finding, we suggest that by reducing the average operation time to less than 2 hours, when applicable, the average preoperative stay to 4 days and the overall stay to less than 11 days, and approximating the timing of shaving to the operation as well as substituting cefazolin for cephalothin when prophylactic antibiotic is to be administered, the SSI may be reduced to a more acceptable level.

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**Keywords:** Surgical site, Infections, Incidence, Risk factors

## Introduction

Surgical site infections (SSIs) are among the most common hospital acquired infections comprising 14-16 percent of inpatient infections also known as nosocomial infections. Nosocomial infections are those acquired during hospitalization. An estimated 3-5% of patients admitted to hospitals acquire a nosocomial infection; rates are much higher in intensive care units (Gurevich, 1995) SSI is a condition characterized by severity and a heavy financial burden on the patient and social health system (Culver, 1991). Such infections prolong hospital bed stay for an average of seven days. Potential sources of infection are the patient (especially contamination by alimentary tract bacteria), hospital environment, food, other patients, staff, infected surgical instruments, dressings, and even drugs and injections (Cruse, 1980, Heipel, 2007). The incidence of SSIs with regard to abdominal surgical sites and operating conditions is as follows:

Clean wounds (1.5-3.7%); clean-contaminated wounds (3-4%); contaminated wounds (8.5%); dirty-infected wounds (28-40%); in laparoscopy (10%), umbilical hernia (2-5%); in the cancer of the colon without taking antimicrobial drugs (30-60%); or with antibiotic and proper intestine wash (10%); in colostomy (above 50%); in colon perforation (20%); in gastric cancer surgery (20%); in herniorrhaphy (50%); in adult appendectomy (10-20%); in children's appendicitis (2-5%); in chronic appendicitis and in pregnant women (10-50%); and in AIDS victims (above 50%); in liver abscess (20%); in hydatid cyst (2-5%); in acute and chronic cholecystectomy without stones (10%); in acute septic cholangitis (10-20%); in laparoscopic cholecystectomy (2-5%); and in splenectomy (2-5%). The percents are the number of surgical wounds per 100 operations. (Skarzynska, 2000, Troillet, 2001, Burkitt, 1963)

SSI is identified by the presence of redness, inflammation,

heat, pain, a temperature of 38°C, and septic drainage from the surgical site during the 30 days following operation (Skarzynska, 2000) SSI has identifiable risk factors, several of which should be taken into account. The most significant risk factors are as follows:

Age has been proven to be an important as well as a significant risk factor. The rate of wound infection for 15 to 24-year-old patients was about 10% but increased significantly for those over 65 years of age (Troillet, 2001, Nichols, 2001).

The extent of SSI was doubled for obese patients because of more fatty content of subepidermal tissues.

The duration of surgical operation also proved to be a significant factor. SSI rate increased with longer durations of preoperative bed stay, but preoperative showers with a disinfecting soap such as chlorhexidine or Betadine decreased the cutaneous bacterial load (Burkitt, 1963, Nystrom, 1987). The rate of infection was reduced to 1.3% among patients who showered with disinfecting soap containing hexachlorophene. In those who showered with ordinary soap the corresponding figure was 2.1%, and for patients who did not shower at all it increased to 2.3% (Skarzynska, 2000). However, another study conducted on 5536 subjects showed no decrease in SSI in patients who showered with chlorhexidine preoperatively; the rate was 4%. (Skarzynska, 2000).

Among other factors that delay wound healing or increase the infection rate are cigarette smoking. Smoking increases the postoperative infection rate 5-fold (Skarzynska, 2000, Schwartz, 1999).

Use of steroids delays wound healing and increases the infection rate from 7% to 16% (Skarzynska, 2000).

Aseptic surgical techniques are claimed to decrease the infection rate, though not to zero (Cruse, 1980).

However, the administration of prophylactic antibiotics 30 to 60 minutes before surgery decreases the incidence of SSI (Schwartz, 1999, Habte-Gabr, 1988, Lecuona, 1988, Nystrom, 1987).

Of note, remote infections (concomitant infections far from the surgical site such as rhinopharyngeal, skin, urinary tract and respiratory infections) increase SSI (Schwartz, 1999, Habte-Gabr, 1988, Lecuona, 1988, Nystrom, 1987).

Other contributing risk factors include the type of surgery and secondary infections. The aim of this study was to identify the incidence rates of SSI, and the factors contributing to such infections at Shahid Beheshti Hospital in Shiraz, Southern Iran.

## Methods

In this study, 400 patients underwent abdominal surgery in a teaching hospital during the 12 months from April 2003

to April 2004 and were studied for SSI and the risk factors affecting it. Initially, 482 patients were recruited for the study but 82 were excluded on the basis of the following criteria: deficient medical records; patients operated at a different hospital and subsequently transferred to Shahid Beheshti teaching hospital or patients deceased during the operation or within the following 30 days.

The dependent variable in this study was abdominal surgical site infection, defined as redness, swelling, pain, temperature above 38°C, during the 30 days after operation. The independent variables were: age, sex, site operated, body mass index, time of shaving the site of incision, administration of prophylactic antibiotics, type of surgical operation, duration of operation, duration of preoperative bed stay; preoperative shower, type of shaving, and accompanying conditions. The data were collected through a 20-item questionnaire. The stages for data collection and information completion were as follows: identification of patients; preoperative interview; postoperative interview; record completion; pre-discharge examinations; weekly examinations and telephone follow-ups for 30 days following operation. The collected data were analyzed by using SPSS 10 package, Student's t-test for continuous variables and chi-square test for categorical variables.

To the best of our ability, this study was conducted with due attention to research ethics. However, problems met in the follow-ups including lack of access to telephone number of the patients imposed limitations on the study. To overcome this problem, the patients with limited data were excluded (82 patients) and 82 age-matched patients were replaced.

## Results

Of the 400 patients studied who had undergone abdominal surgery 70 (17.5%) suffered from SSI as defined in Table 1. No infections were observed in the other 330 cases (82.5%). As far as wound type is concerned, we found clean wounds in 55 cases (13.7%); clean-contaminated wounds in 107 cases (26.7%); contaminated wounds in 153 cases (38.2%); and dirty infected wounds in 56 cases (14%). While 127 cases (31.7%) did not shower before the operation, the other 273 patients (68.2%) did.

The body mass index for 36 patients (9%) was above 30, indicating obesity. Over half the patients (202 cases) suffered from accompanying conditions such as diabetes, high arterial blood pressure, kidney or liver failure, malignancy, febrile conditions, cardiac disorders, thyroid disorders, blood disease, chronic obstructive pulmonary disease, convulsion, hyperlipidemia, or immunological disorders; or had previously undergone surgical operations. The rest were free of accompanying conditions (Table 2).

We found no significant correlations between SSI incidence and sex or preoperative shower. However,

correlations with duration of operation, duration of preoperative bed stay, electivity of surgery, lengthening of preoperative shaving time, increasing age, wound infection, site of surgery, type of incision, accompanying disorders, and type of prophylactic antibiotic administered before operation were all significant at  $p < 0.001$ . Although differences in SSI rates were not significantly related to BMI, a trend was apparent: SSI rate was higher with low and high BMI.

The following prophylactic antibiotics were used: ampicillin, gentamicine, cephalothin, metronidazole, ceftriaxone and cefazoline (Table 3).

## Discussion

For the 400 participants in this study, the SSI reported was 17.4%, which is well above the 14-16% reported in other studies (Gurevich, 1995). There were particularly high values in cases of umbilical hernia (14.3% compared with previously reported 5%) and stomach cancer (39.7%; in previous studies 20%) (Schwartz, 1999). Increasing age is correlated with greater likelihood of certain chronic conditions, malnutrition and a fall in the body immunological efficiency, causing more extensive SSI (Schwartz, 1999). The present findings supported this argument ( $p = 0.001$ ).

SSI is not correlated with sex (Habte-Gabr, 1988) in agreement with previous findings ( $p = 0.093$ ). The literature shows that SSI increases with obesity, one reason being a decrease in blood circulation in fat tissues (Majidpoor, 2004).

Malnutrition is another factor predisposing to SSI (Habte-Gabr, 1988). In this study we considered a BMI of above 30 obese, and that of below 20 as malnutrition. We found no significant correlations between the two ranges and SSI extensity ( $p = 0.692$ ). However, the previously reported correlation between SSI and pre-operation bed stay ( $p = 0.018$ ) (Majidpoor, 2004, Troillet, 2001) was supported by this study. This is one of the factors to be taken into account. Thus, by reducing pre-operation bed stay we may decrease SSI. The findings of this study also proved the risk of SSI to be less in elective surgeries than those referred to emergency departments, for example, cases of acute abdomen due to acuteness of the condition. In non-urgent conditions, however, the physician can reduce SSI by operating on the patients in an elective situation.

Our findings were supported by the literature and showed that administration of prophylactic antibiotic half an hour before the operation would bring about the best results and the lowest SSI (Gante, 2002, Mangram, 1992))

This was proved for all antibiotics ( $p = 0.001$ ) with the exception of cephalothin with ( $p = 1$ ), which requires a lot

more research.

The literature shows that with the duration of above 2 hours of surgery, the risk of SSI increases (Nichols, 2001, Gilbert, 1998). The average time of surgery in this study was 2.24 hours, which must be reduced to below 2 hours although the nature of surgical operations is not always the same.

When shaving time approaches the operation and if done by clippers, will reduce the SSI risk. In this study the two times: one hour before and 12 hours before surgical operations were contrasted in accordance to previous findings with  $p = 0.001$ . This is one area where we can lower the risk by approximating the time of shaving as much as possible to that of operation.

Other factors quoted in the literature are the conditions of the operating theatre, personal hygiene, accompanying diseases, immunological disorders, smoking, techniques of surgery, the surgeon's expertise, duration of surgical scrub, preoperative skin preparation, poor homeostasis, failure to obliterate dead space, tissue trauma, and inadequate sterilization of instruments, which were not included in this study and might be considered as confounding factors.

## Conclusion

Considering the relatively higher rate of SSI in this study (17.4% compared with the 14% quoted in the literature), especially in such cases as stomach cancers and umbilical hernia, where the rate is considerably higher, we should carefully reconsider the whole operation procedure. In general, we should do our best to reduce the average operation duration to less than 2 hours and the average preoperative bed stay to less than 4 days. Thus, the present average of 11.2 days for the total bed stay would be reduced to less than 11 days. The time of shaving should approximate to the operation time as much as possible. Finally, when the administration of prophylactic antibiotics is required, cefazoline is recommended in place of cephalothin.

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**Table 1.** Population Distribution based on the type of operation and SSI Incidence.

Type of operation	Frequency	Percent	Reported SSI Cases	SSI Incidence Rate	Percent
splenectomy	12	3	--		--
cholecystectomy	136	33.9	12		9.2
umbilical hernia	17	4.4	3		14.3
appendicitis	66	16.5	9		14.4
stomach cancer	29	7.2	12		39.7
Excision biopsy	8	1.9	--		--
laparotomy	71	17.7	12		17.6
cystectomy	4	1.1	2		44.4
colon cancer	12	3	7		58.3
colostomy	8	1.9	5		66.7
laparoscopy	9	2.2	--		--
abdominal mass	5	1.2	1		20
ileostomy	5	1.2	3		50
Intestinal adhesion	3	0.6	2		80
others	17	4.2	2		12.1
total	400	100	70		17.4

**Table 3:** Antibiotics used in the patients before and/or following operation. More than one antibiotic might be used.

Type of operation	cefazoline	ampicillin	gentamicine,	cephalothin,	metronidazole,	ceftriaxone
splenectomy	Y	Y		Y	Y	Y
cholecystectomy	Y			Y	Y	
umbilical hernia	Y	Y		Y	Y	
appendicitis	Y			Y	Y	
stomach cancer		Y		Y	Y	Y
Excision biopsy				Y		Y
laparotomy				Y		
cystectomy	Y	Y		Y	Y	Y
colon cancer	Y	Y		Y	Y	Y
colostomy	Y	Y			Y	
laparoscopy	Y				Y	Y
abdominal mass	Y	Y		Y	Y	
ileostomy	Y	Y	Y	Y	Y	Y
Intestinal adhesion			Y	Y	Y	Y

Y : antibiotic was used

**Table 2.** SSI Distribution according to age, sex, type of wounds, type of operation, operation duration, preoperative bed stay, shaving time, showering before operation, body mass index

Variable	Classification	SSI (+)		SSI (-)		total		P. Val.
		N	%	N	%	N	%	
Age	Age groups under 25	2	3.7	51	96.3	54	100	<0.001
	Age groups 25–65	51	18.1	231	81.9	282	100	
	Age groups above 65	17	25.2	49	74.8	65	100	
Sex	Female	31	15.1	172	84.9	203	100	<0.093
	male	39	19.6	160	80.4	199	100	
Type Of Wounds	Clean wounds	3	4.6	52	95.4	55	100	<0.001
	Clean contaminated wounds	5	4.2	103	95.8	107	100	
	Contaminated wounds	57	31.3	126	68.7	184	100	
	Dirty – infected wounds	5	8.9	51	91.1	56	100	
Type Of Operation	Urgent	15	14.9	83	85.1	97	100	<0.001
	elective	55	18.1	249	81.9	304	100	
Operation Duration	Below 1.5 hours	5	5.4	78	94.6	83	100	<0.001
	1.5 – 4 hours	61	19.5	250	80.5	311	100	
	Above 4 hours	5	64.3	3	35.7	7	100	
preoperative bed stay	Emergency	12	11.7	90	88.3	102	100	<0.018
	1 – 15 days	50	18.6	220	81.4	270	100	
	More than 15 days	8	25.9	22	74.1	29	100	
Shaving Time	One hour before operation	15	14.5	85	85.5	100	100	<0.001
	12 hours before operation	55	18.3	246	81.7	301	100	
showering Before op.	Taken	40	13.9	249	86.1	289	100	1.00
	none	30	26.2	83	76.8	127	100	
Body mass index	Under 20	5	17.2	24	82.8	29	100	0.692
	Ranging 20.1 – 25	36	16	191	84	228	100	
	Ranging 25.1 – 30	21	19.5	87	80.5	107	100	
	Above 30.1	7	19.2	30	80.8	36	100	

# Study on Arsenic Disaster and Sanitation Condition of Nawabganj Paurashava

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**Keywords:** Sanitation condition, safe drinking water, toilet facilities, stepwise regression analysis.

## ABSTRACT

This study has been designed primarily to make an assessment on the sanitation system and identify the poor sanitary condition with particular emphasis on the present arsenic situation. Using the information from 500 household heads of Nawabganj Paurashava in Chapai Nawabganj District, we found that the majority of the respondents use tube-well water. The study also indicates that NGO's contribution for safe water supply is not so good. Although the majority of the respondents of Paurashava use sanitary latrines many of them use open land as lavatories. We found that the maximum number of inhabitants practice personal hygiene. This study also envisage that a large portion of the respondents dispose if their household refuse anywhere which not only causes anxiety but is also unhygienic. It is remarkable that still 22 percent of arsenic contaminated tube wells were found to operate despite Nawabganj Paurashava being a vulnerable arsenic area. To identify the significant factors on the sanitation system multiple regression analysis is used. The regression model of toilet facilities explains nearly 60 percent of total variations. The multiple regression models of respondent's habits of washing hands explain 44 percent of total variation. The regression equation is set for sources of drinking water during floods, which explains nearly 99 percent of total variation. The multiple regression model of knowledge of arsenic represents 75 percent of total variation. This study intends to help the policy makers to understand the present sanitation condition of Nawabganj Paurashava and allow them to take initiatives for appropriate policies.

## Introduction

Bangladesh is one of the developing countries in the world. Unemployment, housing, communication problems, environmental hazards, poverty etc., are the major problems of this country due to over-population. Besides these, one of the most complicated problems of Bangladesh is the public health problem. The public health problem has become a major concern of our country. Lack of awareness about personal health, lack of education,

poor sanitary conditions, poverty and superstitions are the main reasons for this problem.

The most important factor of public health is to supply safe drinking water and to develop a sanitation system. In Bangladesh 80 percent of diseases occur due to water born infectious diseases and water born diseases kill about 250,000 children every year (DPHE Profile, 1999). The circumference of the sanitation system or hygiene livelihood is widespread. If we include sewerage facilities, safe drinking water and use of healthy sanitary latrines under the sanitation system, then the present situation of the sanitation system of Bangladesh will not only cause anxiety but also amazement. About 7 crores and 41 lakhs people out of total 13 crores are deprived of sanitation facilities (Daily Ittefaq, June 2, 2003). Due to poor sanitary conditions one third of the total children under age 5 are affected by diarrhoea on average 5 to 6 times every year and about 90 percent of babies are affected ( DPHE, profile, 2002). Though it is claimed that sanitary coverage has been a significant breakthrough in the country, about 40 percent of people have access to sanitary latrines in the twenty-first century in Bangladesh. Although it is possible for the government to provide tube-wells for all people, it is not possible for the government to provide sanitary latrines for all, since latrines are used in a family basis. If the government set up a latrine per 6 people then approximately 130,000, 00 latrines will be needed (DPHE profile, 2001).

A sanitation system is not only confined to the use of healthy sanitary latrines but also related with personal hygiene practices such as, regular cleaning of the latrine, washing hands with soap or ash after contact with faeces, knowledge of how to go to the latrine with sandals, process of disposal of household refuse etc.,. According to a survey carried out by International Water and Sanitation Center in 2000 A.D it was found that knowledge of the above kinds of hygiene practices are not so good.

At present arsenic pollution is a serious anxiety of

Bangladesh. Arsenic pollution has become a major concern for the people of our country. High arsenic concentrations are suspected to exist so far in 41 districts out of a total of 64 and the people of 20 districts have been found to be suffering from various affections caused by arsenic pollution ( Daily Observer, May 11, 2002). There is a proverb, “the other name of water is life”. But this proverb is going to be worthless because water is taking our lives due to arsenic.

## Data Collection and Methodology

### Data Collection

The data was collected according to a field survey from May 20 to July 15 in 2005 from 500 respondents of Nawabganj Paurashava. For the method of data collection the household heads were directly interviewed and the desired information was collected by the predesigned questionnaire. The data was collected using stratified random sampling technique. Nawabganj Paurashava is constituted of 15 wards. Each ward is considered as a stratum. There are 15 strata. Next, data was collected from each ward by using stratified random sampling without replacement method with proportional allocation. The total household size of Nawabganj paurashava is 25,083 and our desired sample size is 500.

### Methodology

Data analytic method envisaged in this paper is a percentage distribution and Stepwise regression analysis. Multiple regression analysis is performed in order to see how much variation is explained by all explanatory variables of the phenomenon under study and step wise regression analysis is used to assess the contribution of the influential variables and adequacy of the models with the limited number of variables.

### Conceptual Framework

The conceptual framework of the present study is presented in Figure 1 and 2. When the people are not using healthy sanitary latrines or use open land as a lavatory how does the stool pose environmental problems? We can see by Figure-1. The human excreta of a sick person or a carrier of disease is the main focus of infection. It contains the disease agent which is transmitted to a new host through various channels: (1) water, (2) fingers, (3) flies, (4) soil and (5) food. These events are shown in Figure 1.

Community medicine aims at breaking the disease cycle at vulnerable points. The disease cycle (Figure 1) may be broken at various levels: segregation of faeces, protection of water supplies, protection of foods, personal hygiene and control of flies. Of these, the most effective step would be to segregate the faeces and arrange for its proper disposal so that the disease agent

cannot be reached by the new host. Figure 2 shows the segregation of the excreta by imposing a barrier called the “sanitation barrier”.

## Characteristics of The Respondents

Education is the single most important indicator of the socio-economic status of an individual, which affects almost all aspects of human life. Table 1 shows that about 24.4 percent of respondents had no education, 18.6 percent of the respondent had primary education and 57.0 percent had secondary and higher levels of education. The occupation and knowledge about proper sanitation systems is closely related. Where the people enjoy a high social status the sanitation system will also be better in the family. From Table 1 it can be seen that about 22.0 percent were service holders, 41.4 percent were businessmen, 26.0 percent were day labourers and 10.6 percent were other workers (housewives, retired, farmer, driver). Among the respondents 39.6 percent had never read a newspaper at all, 33.4 percent read irregularly and the remaining 27.0 percent read newspapers regularly. Table 1 indicates that 49.8 percent listen to the radio irregularly, 23.8 percent never listen at all and the remaining 26.4 percent listen regularly. Table 1 also elucidates that only small portions of the respondents never watch television, which is 16.2 percent and 40.2 percent watch irregularly. It is also seen that the maximum of respondents live in a pucca house (53.6 percent)

Water is life. Clean water is helpful for better life but polluted water is harmful for health. In order to get information regarding sources of drinking water, the respondents were asked what were the sources from which they took water for drinking purposes. Table 1 shows that 78.6 percent respondents use tube-well water, 14.8 percent use supply water for drinking purposes and the remaining 6.6 percent if respondents drink water from various sources such as ponds, river, ring-well, marsh etc. Nawabganj Paurashava is marked as a flood affected region. Every year floods visit Paurashava. This may be due to that fact that Paurashava is near to the river Mahananda. Table 1 shows that the maximum number of respondents drink tube-well water (54.6 percent) and only a few respondents (0.6 percent) drink supply water during floods and 44.8 percent from other sources (Ring-well, ponds, Marsh etc.) It is also observed from the Table that 10.2 percent of respondent’s responses are positive for NGO contribution of supplying safe sources of water. From Table 1 it is obvious that the distance between houses to the river was less than 1 to 2 kilometers of maximum respondents (44 %). Many deaths, especially those caused by diarrhoea come from the germs found in human faeces. To prevent this happening always use sanitary latrines. Result shows that 71.4 percent of respondents use a modern toilet, 22.0 percent use a traditional toilet and 6.6 percent of respondents use open lands as lavatories. Thus,

we see that the majority of the respondents of the study area use sanitary latrines.

We also see that about 72.6 percent respondents use a latrine, and 27.4 percent use open places to answer the call the nature during floods (Table 1). Before installing any new tube-well, it is essential to keep in mind that, it should be far away from latrines otherwise, the water can be polluted. It is obvious that the distance between latrines to tube-well was less than 50 feet for the majority of the respondents (Table 1). It is obvious from Table 1 that the majority of the respondents wash hands (92 %) and only few persons (8 %) do not wash hands after contact with faeces. Latrines should be cleaned regularly. From Table 1 we also observe that 68.6 percent if respondents cleaned the latrine regularly and 24.8 percent did not clean it regularly and it is also seen that the majority of the respondents of the study area go to the latrine in sandals. Table 1 shows that most of the respondents buried their household refuse (41.6%), but we also see that a large portion of the respondent’s throw their household refuses in any place (39.2%) and the remaining 4.0 percent burned and 15.2 percent throw their household refuse to the Paurashava’s dustbins. Among the respondents 94.4 percent know that arsenic is a poisonous element and the remaining 5.6 percent have never known about arsenic. It is observed from Table 1 that out of a total 500, 110 tube-wells were arsenic contaminated (22 percent). Hence, we can say that Nawabganj Paurashava is an arsenic hot spot.

Abbreviations of the Selected Socio-economic, Sanitation and Arsenic related variables, used for Regression analysis

The selected variables, which are used for regression analysis, are presented in the Table 2.

**Equations for Regression Analysis:**

To evaluate the multiple effects of explanatory variables following five regression models is assumed:

**Model A:**

$$SDW = \beta_0 + \beta_1 EDQ + \beta_2 RAL + \beta_3 WTV + \beta_4 NER + \beta_5 KOA + \beta_6 HOC + U \dots \dots \dots (1)$$

**Model B:**

$$TOF = \beta_0 + \beta_1 EDQ + \beta_2 HOC + \beta_3 DLT + \beta_4 WHL + \beta_5 RAL + \beta_6 ICL + \beta_7 IGS + U \dots \dots \dots (2)$$

**Model C:**

$$RHW = \beta_0 + \beta_1 EDQ + \beta_2 OCU + \beta_3 WTV + \beta_4 ICW + \beta_5 ICF + \beta_6 PDH + U \dots \dots \dots (3)$$

**Model D:**

$$SDF = \beta_0 + \beta_1 EDQ + \beta_2 HOC + \beta_3 DRH + \beta_4 INP +$$

$$\beta_5 DLC + \beta_6 DLW + U \dots \dots \dots (4)$$

**Model E:**

$$KOA = \beta_0 + \beta_1 EDQ + \beta_2 OCU + \beta_3 WTV + \beta_4 NER + \beta_5 RAL + \beta_6 AWC + \beta_7 HEA + U \dots \dots \dots (5)$$

First of all I have tried to give full models for SDW, TOF, RHW, SDF and KOA in order to see how much variation is explained by all explanatory variables included in the models (given in Model A, B, C, D, and E).

**Evaluation of Simultaneous Effects:**

Table 3 presents the results of multiple regression analysis on the respective five models. The table contains the explanatory variables included in the regression analysis, multiple correlation coefficient R2, coefficient of determination R2, partial regression coefficient and standard error of [S.E ()].

From Model-A (Table 3) the multiple correlation coefficients have been found to be statistically significant (at 5% level) with the sources of drinking water (SDW) of which only educational qualification (EDQ) is not statistically significant. The partial effects (measure in terms of partial regression coefficients) of RAL, NER and KOA and have been found to be statistically significant. The amount of variation explained by all 6 variables considered for SDW is about 41 percent. This means all 6 explanatory variables explain nearly 41 percent of total variation for SDW (Model-A) is then

$$SDW = -26.451 - 0.0149 EDQ - 1.546 RAL - 1.166 WTV + 3.120 NER + 0.499 KOA - 0.04365 HOC$$

The multiple correlation coefficient of SDW with all explanatory variables is 0.64 and is statistically significant at 5% level.

Model-B (Table 3) presents the results of multiple regression analysis on toilet facilities of the respondents (TOF). From Model-B, it can be seen that all explanatory variables taken together have explained about 60 percent of the total variations of toilet facilities (TOF). The multiple correlation coefficients have been found to be statistically significant at 5% level. The partial effects of EDQ and DLT on TOF are not statistically significant but others have been found to be statistically significant. The multiple correlation coefficient of TOF with all 7 explanatory variables is 0.78 and is statistically significant at 5% level. The fitted regression model is given by

$$TOF = - 0.03583 - 0.0106 EDQ + 0.257 HOC - .000068 DLT - 1.158 WHL + 0.05218 RAL + 1.358 ICL + 0.570 IGS$$

Model-C (Table 3) presents regression analysis considering respondents’ habits of washing hands (RHW) as the dependent variables and the variables in the right

hand side of equation (3) as explanatory variables. From Model-C (Table 3), it can be seen that all explanatory variables taken together have explained about 44 percent of the total variations of respondents' habits of washing hands (RHW). The multiple correlation coefficients have been found to be statistically significant at a 5% level. The partial effects of the regression coefficient have been found to be statistically significant (looking at the respective  $t$  values). The multiple correlation coefficient of RHW with all 6 explanatory variables is 0.67 and is statistically significant at a 5% level. The fitted regression model is given by

$$\text{RHW} = 1.697 - 0.0395 \text{ EDQ} + 0.02258 \text{ OCU} - 0.157 \text{ WTV} + 0.09713 \text{ ICW} - 0.160 \text{ ICF} + 0.123 \text{ PDH}$$

Model-D (Table:-3) presents regression analysis considering sources of drinking water during floods (SDF). With regard to sources of drinking water (SDF), we see from Model-D that the total variations in SDF explained by the predictors under consideration are about 99 percent. The partial effects of EDQ, HOC, DLC, and DLW have been found to be statistically significant. The variables like DRH and INP have been found to be negative but with insignificant effects on SDF. The fitted regression model with all 6 explanatory variables for SDF following equation (4) is

$$\text{SDF} = 5.147 + .004881 \text{ EDQ} + .02739 \text{ HOC} - .0159 \text{ DRH} - .0457 \text{ INP} - .0688 \text{ DLC} - 4.063 \text{ DLW}$$

The multiple correlation coefficient of SDF with all 6 explanatory variables is 0.99 and is statistically significant at a 5% level.

Model-E (Table 3) presents regression analysis considering respondent's knowledge of arsenic (KOA). From Model-E it can be seen that all explanatory variables taken together have explained 75 percent of the total variations of respondent's knowledge of arsenic (KOA). The multiple correlation coefficients have been found to be statistically significant at a 5% level. The partial effects of RAL, AWC and HEA on KOA have been found to be statistically significant (looking at the respective  $b$  values). The multiple correlation coefficient of KOA with all 7 explanatory variables is 0.86 and is statistically significant at a 5% level. The fitted regression model is given by

$$\text{KOA} = 1.158 - 0.0233 \text{ EDQ} + 0.0564 \text{ OCU} - 0.0333 \text{ NER} - 0.0228 \text{ WTV} - 0.0668 \text{ RAL} + 0.580 \text{ AWC} + 0.09366 \text{ HEA}$$

#### **Selection of "BEST" Regression Model:**

The multiple regression equation of SDW, which is represented by all 6 explanatory variables, explains nearly 41 percent of total variation in SDW by these variables. Now, the problem remains to fit the best regression equation for SDW with the variables EDQ, RAL, WTV, NER, KOA and HOC.

In stepwise regression analysis KOA has been taken to be the first most influential variable, which explains 29 percent of total variation in SDW. The regression equation is given as

$$\text{SDW} = 7.430 + 0.612 \text{ KOA}$$

(0.473)    (0.044)

$$\text{R-square} = 0.285$$

NER has been taken to be the second influential variable after KOA. The joint effect of KOA and NER on SDW is statistically significant giving rise to a multiple correlation coefficient of 0.631. The value of  $R^2 = 0.40$  indicates that 40 percent of variations of sources of drinking water (SDW) is explained by KOA and NER. The best-fitted regression model with the most 2 influential variables is given by

$$\text{SDW} = -27.114 + 0.522 \text{ KOA} + 3.025 \text{ NER}$$

(3.572)    (0.041)    (0.310)

$$\text{R-square} = 0.399$$

Finally, RAL is taken as the last, most influential variable only. The joint effect of KOA, NER and RAL on SDW is statistically significant giving rise to a multiple correlation coefficient of 0.636. The value of  $R^2 = 0.405$  indicates that 41 percent of variations of sources of drinking water (SDW) is explained by KOA, NER and RAL. The best-fitted regression model with the most 3 influential variables is given by

$$\text{SDW} = -27.400 + 0.527 \text{ KOA} + 3.116 \text{ NER} - 1.289 \text{ RAL}$$

(3.561)    (3.561)    (0.312)    (0.603)

$$\text{R-square} = 0.405$$

The multiple regression equation of toilet facilities of the respondents (TOF), which is represented by all 7 explanatory variables, explains nearly 60 percent of total variation in TOF by these variables.

Now, the problem remains to fit the best regression equation for TOF with the variables EDQ, HOT, DLT, WHL, RAL, ICL and IGS.

In stepwise regression analysis ICL has taken to be the first most influential variable, which explains more than 52 percent of total variation in TOF. The regression equation is given as

N.B. Figures in the brackets in the above equations and in all subsequent equation in this chapter gives the values of standard errors of the estimated parameter.

$$\text{TOF} = -0.661 + 1.901 \text{ ICL}$$

(0.122)    (0.081)

$$\text{R-square} = 0.524$$

Having ICL as the first most influential variable, HOC is observed to be the second most influential variable

as generated by stepwise method. These two variables explain together more than 57 percent of total variation in TOF. In this case, the regression equation is given by

$$\text{TOF} = -0.767 + 1.521 \text{ ICL} + 0.307 \text{ HOT}$$

(0.117)    (0.095)    (0.044)

R-square = 0.567

Also, using a stepwise regression method after first and second influential variables of ICL and HOC, then the third influential variable of IGS and all three variables explain together approximately 58 percent of total variation in TOF. In this case, the regression equation is given by

$$\text{TOF} = -1.173 + 1.363 \text{ ICL} + 0.284 \text{ HOC} + 0.598 \text{ IGS}$$

(0.166)    (0.105)    (0.044)    (0.174)

R-square = 0.577

At, the 4th step, using stepwise regression method, WHL has taken to be the fourth influential variable. Thus, the four variables (ICL, HOC, IGS and WHL) together explain 59 percent of total variation in TOF. The estimated regression equation is given by

$$\text{TOF} = -0.1179 + 1.440 \text{ ICL} + 0.284 \text{ HOT} + 0.641 \text{ IGS} - 1.125 \text{ WHL}$$

(0.348)    (0.106)    (0.044)    (0.173)    (0.347)

R-square = 0.586

Finally, we have found that RAL, ICL, HOT, IGS and WHL have jointly affected the response variable TOF and the multiple regression coefficient is 0.770 is statistically significant at 5% level of significance. RAL the fourth and last influential variable and all explanatory variables together explain more than 59 percent of total variation in TOF. Then the best-fitted regression model with all influential variables is given by

$$\text{TOF} = -0.141 + 1.387 \text{ ICL} + 0.274 \text{ HOT} + 0.573 \text{ IGS} - 1.162 \text{ WHL} + 0.056 \text{ RAL}$$

(0.345)    (0.107)    (0.044)    (0.174)    (0.344)

(0.020)

R-square = 0.592

The multiple regression model of RHW, which is represented by 6 explanatory variables nearly 44 percent of total variation in RHW, is explained by these variables (From Model-c). Now, the problem is to fit the best regression equation for RHW with these explanatory variables

In stepwise regression analysis EDQ has been taken to be the first most influential variable, which explains more than 37 percent of total variation in RHW. The regression equation is given as

$$\text{RHW} = 1.617 - 0.0431 \text{ EDQ}$$

(0.026)    (0.003)

R-square=0.369

After EDQ, the next variable considered is PDH, which is the second most influential variable using a stepwise method. These two variables Viz. EDQ, PDH explain together about 41 percent of total variation in RHW. The regression equation is then

$$\text{RHW} = 1.284 - 0.0443 \text{ EDQ} + 0.129 \text{ PDH}$$

(0.056)    (0.002)    (0.020)

R-square=0.410

Out of the remaining 4 explanatory variables, OCU is considered as the third most influential variable, and these three variables (EDQ, PDH and OCU) explain together nearly 42 percent of total variation in RHW. The regression equation is then

$$\text{RHW} = 1.176 - 0.0401 \text{ EDQ} + 0.126 \text{ PDH} + 0.0283 \text{ OCU}$$

(0.067)    (0.003)    (0.019)    (0.010)

R-square=0.424

Finally, ICF has been taken to be the last influential variable. Thus, EDQ, PDH, OCU and ICF explain more than 43 percent of total variation in RHW against 44 percent of total variation in RHW by 6 explanatory variables included in the Model-C. The effects of partial regression coefficient are statistically significant. The regression equation is then

$$\text{RHW} = 1.534 - 0.0395 \text{ EDQ} + 0.123 \text{ PDH} + 0.0251 \text{ OCU} - 0.175 \text{ ICF}$$

(0.067)    (0.003)    (0.019)    (0.010)    (0.084)

R-square=0.435

The multiple regression equation of sources of drinking water during floods (SDF), which is represented by all 6 explanatory variables explain nearly 99 percent of total variation in SDF by these variables. Now, the problem remains to fit the best regression equation for SDF with the variables EDQ, HOC, DRH, INP, DLC and DLW.

In a stepwise regression analysis DLW has been taken to be the first most influential variable, which explains more than 98 percent of total variation in SDF. The regression equation is given as

$$\text{SDF} = 5.000 - 3.967 \text{ DLW}$$

(0.015)    (0.021)

R-square=0.984

Having DLW as the first most influential variable, DLC is observed to be the second most influential variable as generated by stepwise method. These two variables explain together more than 99 percent of total variation in SDF. In this case, the regression model is given by

$$\text{RHW} = 5.194 - 4.065 \text{ DLW} + 0.0647 \text{ DLC}$$

(0.085)    (0.047)    (0.028)

R-square = 0.987

At the 3rd and last step, using stepwise regression analysis, DRH has been taken to be the 3rd influential variable. Thus, the three variables (DLW, DLC and DRH) taken together explain 99 percent of total variations in SDF. The estimated regression equation is given by

$$\text{SDF} = 5.227 - 4.065 \text{ DLW} + 0.0652 \text{ DLC} - 0.0147 \text{ DRH}$$

(0.086)    (0.046)            (0.028)            (0.007)

$$\text{R-square} = 0.987$$

The multiple regression model of KOA, which is represented by 7 explanatory variables nearly 75 percent of total variation in KOA, is explained by these variables (From model-D). Now, the problem is to fit the best regression equation for KOA with these explanatory variables. In a stepwise regression analysis AWC has been taken to be the first most influential variable, which explains more than 72 percent of total variation in KOA. The regression equation is given as

$$\text{KOA} = 0.998 + 0.635 \text{ AWC}$$

(0.021)    (0.018)

$$\text{R-square} = 0.721$$

After AWC, the next variable considered is HEA, which is the second most influential variable by using stepwise method. These two variables Viz. HEA and AWC explain together about 73 percent of total variation in KOA. The regression equation is then

$$\text{KOA} = 0.880 - 0.887 \text{ AWC} + 0.09264 \text{ HEA}$$

(0.027)    (0.018)            (0.014)

$$\text{R-square} = 0.730$$

Finally, RAL has been taken to be the last influential variable. Thus, AWC, HEA and RAL explain more than 74 percent of total variation in KOA against 75 percent total variation in KOA by 7 explanatory variables included in the model 5.5. The partial effects of AWC, HEA and RAL have been found to be statistically significant. The regression equation is then

$$\text{RHW} = 0.992 + 0.585 \text{ AWC} + 0.09180 \text{ HEA} + 0.0559 \text{ RAL}$$

(0.062)    (0.018)            (0.014)            (0.028)

$$\text{R-square} = 0.74$$

## Discussion

The study has been designed primarily to make an assessment on sanitation systems and identify the poor sanitary conditions with particular emphasis on the present arsenic condition. The study reveals that the majority of the respondents use tube-well water. Although, the government had said that they have achieved 97% fulfillment for supplying safe drinking water (Journal paper of Environmental Science, Vol., 25) the study

showed that only 85 percent of the population has safe water availability for all of the year.

The study also indicates that NGO's contribution to a safe water supply is not so good. Although the majority of the respondent of Paurashava use sanitary latrines, many of them use open lands as lavatories, which may be the main reason for the transmission of diarrhoea, dysentery, typhoid and many other water borne and communicable diseases. The study found that a large portion of the respondents threw their household refuse anywhere, which is causing not only anxiety but also amazement since germs can grow in dirty spots. From this study, it is found that over 94% of the household heads were knowledgeable about arsenic poisoning. It is remarkable that still 22 percent arsenic contaminated tube-wells were found despite the fact that Nawabganj Paurashava is a vulnerable arsenic area. Arsenic poisoning has become a serious anxiety for the people of Paurashava. Finally; multiple regression analysis is used to identify the significant factors on sanitation systems. The regression equation of sources of safe drinking water which includes 6 explanatory variables of education, habits of radio listening, habits of watching television, knowledge of arsenic and house conditions. It explains nearly 41 percent of total variations. For this equation, we fitted the best model by stepwise regression method. It shows that knowledge of arsenic has taken to be the first most influential variable, which explains 29 percent of total variation in sources of safe drinking water. The regression model of toilet facilities explains nearly 60 percent of total variations. In stepwise regression technique this model exhibits that regularity of cleaning the latrine has taken to be the first most influential variable, which explains more than 52 percent of total variation in toilet facilities. The multiple regression models of respondent's habits of washing hands explain 44 percent of total variation. In a stepwise method the above model indicates that education has taken to be the first most influential variable, which explains more than 37 percent of total variation. The regression equation is set for sources of drinking water during flood, which explains nearly 99 percent of total variation. The multiple regression model of knowledge of arsenic represents that 75 percent of total variation. In stepwise regression analysis respondent's knowledge that arsenic contaminated water cannot be drunk has been taken to be the first most influential variable, which explains more than 72 percent of total variation. Finally, the respondent's habit of radio listening has taken to be the last influential variable.

From the forgoing analysis, it appears that poor sanitary conditions and arsenic contamination in groundwater in Bangladesh has become a serious concern for the development program. The available resource for improving the sanitation system of our country is still inadequate as compared to the requirement. In order to

obtain coverage all people under the sanitation system have to achieve the national objectives “Healthy sanitary latrines for all by the year 2010”; it will be necessary to establish a latrine in each family. But due to limited national resources and the money given by donor countries, it is not possible for the government to provide sanitary latrines for all. For this reason, it is necessary to give advice and create awareness among people, so that they can make hygienic sanitary latrines by using local materials. Efforts should be made to involve NGOs, the private sector and local communities in sanitation programs to bridge the resource gap as much as possible.

In the light of the above discussions and policy implications, the following recommendations are made:

- Attempts should be made to increase access to safe drinking water supply and healthy toilet facilities for all inhabitants of Nawabganj Paurashava such that waterborne diseases cannot be transmitted as an epidemic.
- Purification of piped water supply and alternate sources of safe water supply should also be accelerated in Paurashava such that people will not fully be dependent on contaminated shallow tube-wells. Provide availability of water supply and sanitation facilities to the vulnerable poor and slum dwellers, free of cost or at minimum cost.
- Private sector initiatives would be promoted especially for sanitation and solid waste disposal. Dispose of the household refuse by burning or burying such that germs cannot grow in dirt.
- Set up more community and public toilets and safe water sources after a certain distance as people can consume these facilities easily.
- Strengthen the capacity of sectoral institutions for sustainable development of water supply and sanitation management.
- Attempts should be made to declare Nawabganj Paurashava as an arsenic hot spot and take proper initiatives immediately to remove people from arsenic disaster.
- Every tube-well of Paurashava should be tested and marked with red or green color. Survey of arsenic poisoning tube-wells will be undertaken and remedial measures should be implemented.
- Improve awareness of hygienic practices so that people can clean latrines regularly, wash both hands with soap or ash after defecating, wash hands before eating and handling foods and clean hands after defecation of a baby. In addition, dwellers of Nawabganj Paurashava can also use safe sources of water such as tube-well, ring-well etc. for all household purposes and keep the foods clean and covered.

- Mass media, campaign, billboard, bioscope, posturing, local folk etc. programs should be promoted in favor of sanitation, arsenic and hygienic education. This program will help to create awareness and provide education of people about sanitation and disposal management systems.

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12. Victoria, C.G. (1988). “Water Supply, Sanitation and Housing in Relation to the Risk of Infant Mortality from Diarrhea”. International journal of Epidemiology, Vol/ 17, No. 3, pp. 651-654. **Table 3.** Results of Multiple Regression Analysis

**Table 1.** Percentage Distribution of the Respondents according to Selected Characteristics

Characteristics	No. of Cases	Percentage
Respondent's education		
No education	122	24.4
Primary education	93	18.6
Secondary and higher	285	57.0
Respondent's occupation		
Service	110	22.0
Business	207	41.4
Day labor	130	26.0
Others	53	10.6
Habits of reading newspaper—		
Never	198	39.6
Irregular	167	33.4
Regular	135	27.0

Habits of listening radio		
Never	119	23.8
Irregular	249	49.8
Regular	132	6.4
Habits of watching television		
Never	81	16.2
Irregular	201	40.2
Regular	218	43.6
Housing quality		
Pucca	268	53.6
Rudimentary	187	37.4
Straw	45	9.0
Sources of drinking water		
Tube well	393	78.6
Supply water	74	14.8
Others	33	6.6
Sources of drinking water during flood		
Tube-well	273	54.6
Supply water	3	0.6
Others	224	44.8
Distance from house to river		
<1 kilometer	135	27.0
1-2 kilometer	220	44.0
2 kilometers and over	145	29.0
NGOs contribution for safe water		
Yes	51	10.2
No	449	89.8

**Table 2.** Abbreviations of the Selected Variables, Used for Regression Analysis.

Variable	Abbreviation	Variable	Abbreviation
SDW	Sources of safe drinking water	SDF	Sources of drinking water during flood
EDQ	Educational qualification	DRH	Distance from house to river
RAL	Habits of radio listening	INP	If any NGO plays a role in salvation of water
WTV	Habits of watching television	DLC	During flood where the respondents call the nature
NER	Habits of newspaper reading	DLW	During flood if the respondents house goes under water
HOC	House condition	RHW	Respondents habits of washing hands
TOF	Respondent's toilet facilities	OCU	Occupation
DLT	Distance from toilet to tube-well	ICW	If the respondents child wash hands before or after eating food.
WHL	Washing hands after contact the faces	ICF	If the respondents cover the food before serving
ICL	If the respondents clean the latrine regularly	PDH	Process of disposal of household refuse

IGS	If the respondents go to latrine in sandals	KOA	Knowledge of arsenic
AWC	Knowledge of respondents that arsenic contaminated water cannot be drink	HEA	Knowledge of respondents about the health which is caused due to arsenic

**Table 3.** Results of Multiple Regression Analysis

Variables included	Status	R	R <sub>2</sub>		[S.E (β)]
<b>Model A:</b>					
SDW	Dependent variable	--	--	--	--
EDQ	Independent variable	0.056	0.003	-0.0149	0.043
RAL	Independent variable	0.079*	0.006	-1.546*	0.775
WTV	Independent variable	0.091*	0.008	-1.166	0.643
NER	Independent variable	0.460*	0.212	3.120*	0.312
KOA	Independent variable	0.639*	0.408	0.499*	0.051
HOC	Independent variable	0.639*	0.409	-0.04365	0.050
Constant in reg. Equation		--	--	-26.451	3.593
<b>Model B:</b>					
TOF	Dependent variable	--	--	--	--
EDQ	Independent variable	0.489*	0.239	-0.0106	0.009
HOC	Independent variable	0.622*	0.387	0.257*	0.046
DLT	Independent variable	0.622*	0.387	-0.000068	0.001
WHL	Independent variable	0.623*	0.388	1.158*	0.345
RAL	Independent variable	0.645*	0.416	0.05281*	0.020
ICL	Independent variable	0.765*	0.585	1.358*	0.111
IGS	Independent variable	0.776*	0.602	0.570*	0.176
Constant in reg. Equation		--	--	-0.03583	0.379

(Continued)

Variables included	Status	R	R <sub>2</sub>	β	[S.E (β)]
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Model C:					
RHW	Dependent variable	--	--	--	--
EDQ	Independent variable	0.607*	0.369	-0.0395*	0.003
OCU	Independent variable	0.618*	0.382	0.02258*	0.010
WTV	Independent variable	0.618*	0.382	-0.157*	0.079
ICW	Independent variable	0.623*	0.388	0.09713*	0.045
ICF	Independent variable	0.628*	0.395	-0.160*	0.084
PDH	Independent variable	0.665*	0.440	0.123*	0.019
Constant in reg. Equation	Independent variable	--	--	1.697	0.212
	Independent variable				
Model D:					
SDF	Dependent variable	--	--	--	--
EDQ	Independent variable	0.160*	0.026	0.004881*	0.002
HOC	Independent variable	0.160*	0.026	0.02739*	0.010
DRH	Independent variable	0.160*	0.026	-0.0159	0.007
INP	Independent variable	0.253*	0.064	-0.0457	0.031
DLC	Independent variable	0.901*	0.811	-0.0688*	0.029
DLW	Independent variable	0.993*	0.987	-4.063*	0.050
Constant in reg. Equation	Independent variable	--	--	5.147	0.094
	Independent variable				

(Continued)

Variables included	Status	R	R2	$\beta$	[S.E ( $\beta$ )]
Model E:					
KOA	Dependent variable	--	--	--	--
EDQ	Independent variable	0.201*	0.040	-0.0233	0.037
OCU	Independent variable	0.202*	0.041	0.0564	0.018
NER	Independent variable	0.204*	0.042	-0.0333*	0.040
WTV	Independent variable	0.233*	0.054	-0.0228	0.036
RAL	Independent variable	0.238*	0.057	-0.0668*	0.030
AWC	Independent variable	0.851*	0.724	0.580*	0.019
HEA	Independent variable	0.864*	0.746	0.09366*	0.014
Constant in reg. Equation	Independent variable	--	--	1.158	0.192
	Independent variable				
	Independent variable				
	Independent variable				

\* Significance at 5% level

Figure 1: Transmission of faecal borne diseases

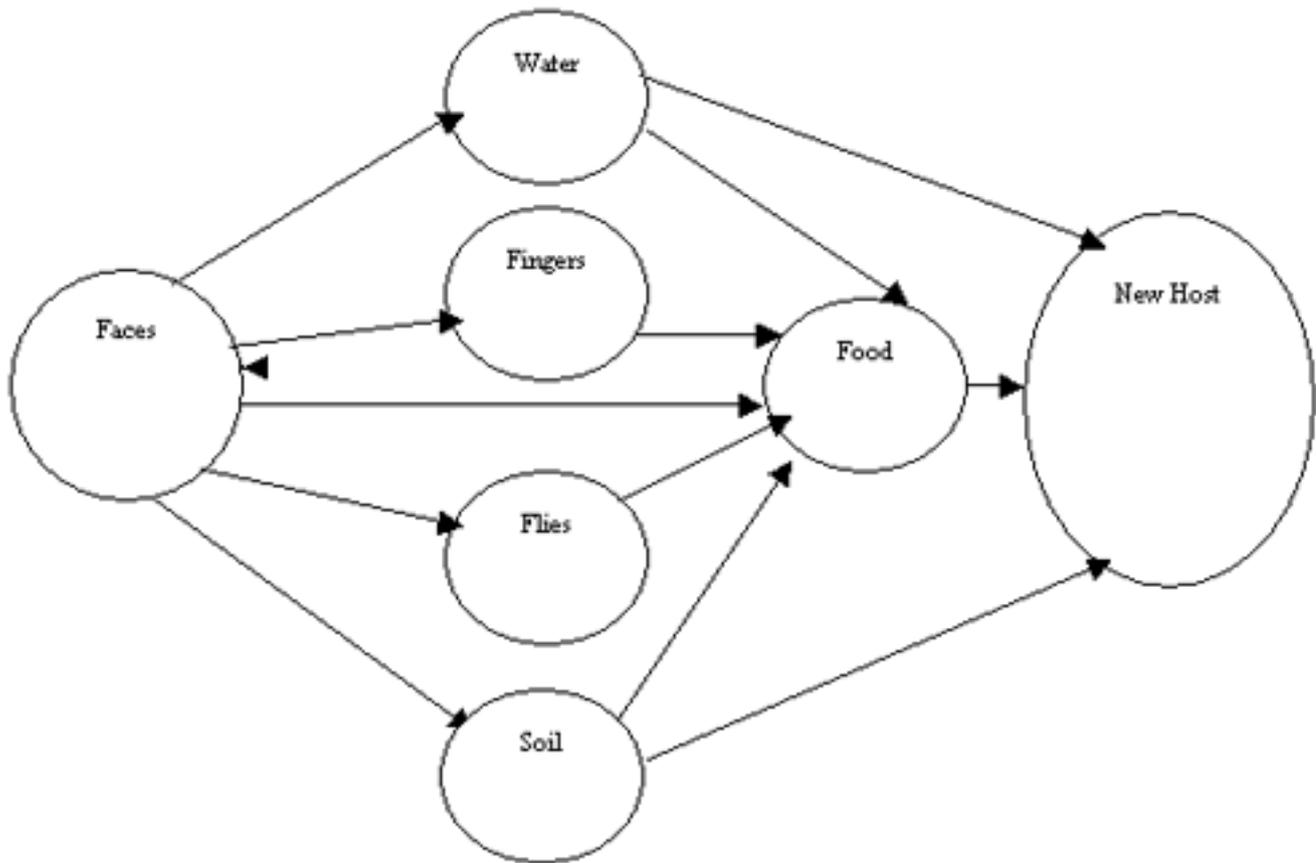
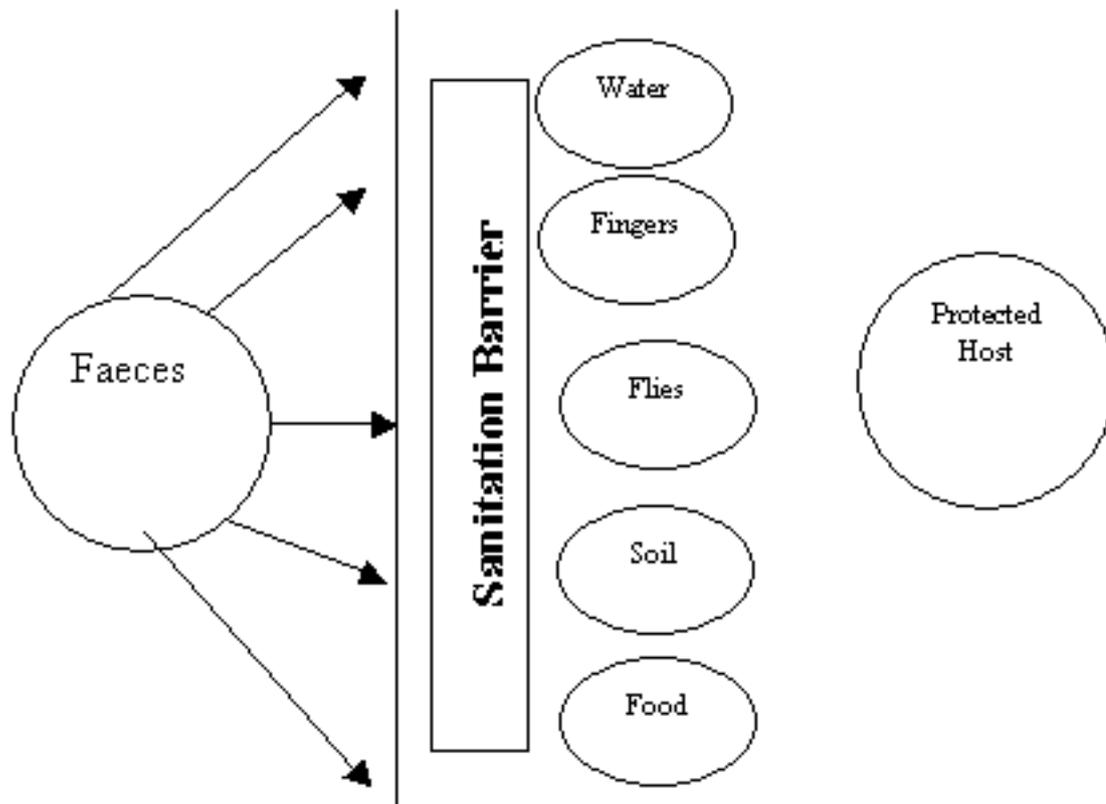


Figure 2: Sanitation barrier to transmission of faecal borne diseases



# Tinea Capitis in Iraq: Comparison between Community Based and Hospital Based Studies

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## ABSTRACT

**Background:** Recent observation on tinea capitis in Iraq suggests that there has been a change in the pattern of infection in both community based (CBS) and hospital based (HBS) studies with a recent and significant rise in the incidence of infections due to anthropophilic dermatophytes.

**Objectives:** Determine the differences between CBS and HBS in regards to epidemiological and clinical characteristics and the shift in pattern of tinea capitis in Iraq.

**Patients and methods:** Two hospital based and two community based studies were selected for analysis.

**Results:** Sex seems to influence the frequency of tinea capitis in CBS and HBS and cases are more frequent in males. Tinea capitis was more frequent at age group 6-11 years in both CBS and HBS. Non-inflammatory tinea capitis was predominant in both CBS and HBS. *T. tonsurans* was found to have become the predominant cause of tinea capitis in CBS, while in HBS *M. canis* was the predominant cause.

**Conclusion:** It is thus important to be aware of the emergence of *T. tonsurans* in Iraq, so an early diagnosis can be made to facilitate appropriate treatment and prevent spread of infection to close contacts.

## Introduction

The epidemiology of tinea capitis has changed over the past 50 years in different parts of the worlds<sup>[1,2]</sup>. The shift in the cause of tinea capitis in different geographical areas has been documented<sup>[3-6]</sup>. Most of the published reports deal with hospital based studies and only a few reports deal with community based studies<sup>[5-8]</sup>. Since HBS are dealing with selected populations and hence don't give the exact situation of the disease, thus a comparative study between CBS and HBS was performed to determine the similarity and dissimilarity in their epidemiological and clinical patterns.

### Objectives: To.

1. Determine the differences between CBS and HBS in regards to epidemiological and clinical characteristics of tinea capitis in Iraq.
2. Identify whether there has been a shift in the above

patterns.

## Patient and Methods

Two hospital based and two community based studies were selected for analysis<sup>[9-12]</sup>. For CBS the patients' selection criteria were as described previously<sup>[11,12]</sup>. The two HBS were performed on all cases of tinea capitis attending the dermatology clinic in Saddam Medical Centre in Baghdad<sup>[9,10]</sup>. The comparison was performed after pooling of CBS in one group and HBS in another group. Statistical analysis was performed using Chi square test.

## Results

In the CBS, tinea capitis was more predominant in males [70%] as compared to females [30%]. While the corresponding value in HBS were 61% and 39% respectively (Table.1;  $P < 0.025$ ). Tinea capitis cases were more frequent at age group of 6-10 years for both CBS (86%) and HBS (88%;  $P > 0.05$ ).

In CBS the most common clinical form was seborrheoid (81%), while in HBS seborrheoid form only 51.6%, followed by kerion (28.7%) and backdot (18.7). This difference in clinical forms' frequency was statistically significant ( $P < 0.005$ ) - Table.3.

In regards to etiology, for CBS *T. tonsurans* was the predominant (27.6%) cause of tinea capitis followed by *T. verrucosum* (26.7%) and *T. interdigitale* (23.4%). For HBS, the predominant cause was *M. canis* (42.1%), followed by *T. mentagrophytes* var *mentagrophytes* (17.5%) and *T. verrucosum* (15.8%), Table.4. The anthropophilic species were the most predominant (77.6%) cause of tinea capitis in CBS, while in HBS tinea capitis most commonly (73.3%) was caused by zoophilic species (Table .5.  $P < 0.005$ ).

The clinico-etiological correlation indicates that in CBS, seborrheoid form was caused mostly by *T. tonsurans* (30.2%), followed by *T. verrucosum* (27.6%) and *T. mentagrophytes* var *mentagrophytes* (25.7%). In HBS, the Seborrheoid form was mostly caused by *M. canis* (55.9%),

followed by *T. mentagrophytes* var *mentagrophytes* (17.3%). Kerion in CBS was caused by *t. mentagrophytes* (69%) and *T. verrucosum* (31%), while in HBS it was caused mainly by *T. verrucosum* (49%), followed by *T. mentagrophytes* var *mentagrophytes* (26.4%) and *M. canis* (18.8%). Blackdot form was caused in all cases by *T. tonsurans* in CBS, while in HBS it was mainly caused by *M. canis* (31.3%), followed by *T. violaceum* (30%). Favus was caused in all cases by *T. violaceum* in CBS. 'Gray patch' was caused by *T. verrucosum* and *M. audouinii* (Table.6).

## Discussion

Scalp ringworm is a common condition in Iraq and most frequently found in prepubertal children<sup>[12,13]</sup>. The disease was endemic in the country and recent observations on tinea capitis in Iraq suggest that there has been a change in the pattern of infection<sup>[14]</sup>. Sex seems to influence the frequency of tinea capitis in CBS and HBS as this study indicated. The cases were more frequent in males as compared to females. This finding could be accepted since many studies have demonstrated male to female predominance<sup>[15-18]</sup>.

Tinea capitis cases were predominant at age of 6 - 10 in both CBS and HBS. This finding is inconsistent with that reported by others, whether the study was CBS<sup>[7,8]</sup> or HBS<sup>[4,19-23]</sup>. This study suggests that the clinical appearance of tinea capitis is highly variable. Non-inflammatory tinea was more common than inflammatory types in both CBS and HBS in accordance with others' data<sup>[4,7,8,22,24-28]</sup>. No case of favus was found in HBS, while 1.7% cases were detected in CBS. This was in accordance to that reported for Pakistan<sup>[22]</sup> and in contrast to other reports<sup>[29,30]</sup>. Seborrheoid form was the predominant clinical form in both CBS and HBS, but it was more common in CBS as compared to HBS. This could be explained by the shift in the etiology of tinea capitis in CBS<sup>[3,14]</sup>. Unfortunately, kerion was more common in HBS as compared to CBS. In addition, this rate was in accordance with other findings<sup>[22,31]</sup>, but it was higher than that reported by others<sup>[32]</sup>.

The isolated species and their relative percentages in CBS and HBS show a shift in the role played by various organisms responsible for tinea capitis in Iraq. Zoophilic dermatophytes, previously (1948 - 1990) were not the common etiology of the disease in the HBS, and became more frequent<sup>[33-38]</sup>. This change appears to result from improved socioeconomic and hygienic conditions, with a resulting decrease of infection through inter-human contacts and increased number of pets/animals that resulted in an increase of infection by animals.

*T. schoelinii* played a significant role during 1948 to 1990. From then on, the frequency of this dermatophyte decreased enormously. So as indicated in this study *T. schoelinii* was never important in Iraq and only rarely

isolated from tinea capitis. In contrast, the zoophilic dermatophytes *M. canis* has become increasingly important. This has been observed in United Arab Emirates<sup>[26]</sup>, in Saudi Arabia<sup>[4,24,39,40]</sup>, and Kuwait<sup>[41-44]</sup>. The increasing frequency of *M. canis* was first observed in the post war period in different geographical areas<sup>[1,19,20,24,45-59]</sup>.

Until 1979, *M. canis* represented a less frequent cause of tinea capitis in Iraq, but now it is already the most important dermatophyte in HBS and represents 40% of causes of tinea capitis. *T. mentagrophytes* var *mentagrophytes* was the second most common cause of tinea capitis in HBS, is zoophilic and can be acquired through contact with animals<sup>[3]</sup>.

In contrast to HBS, the CBS performed in Iraq, indicates that anthropophilic dermatophytes still represent the predominant causes of tinea capitis. But there was a shift in the causative species<sup>[14]</sup>. This change appears to result from that anthropophilic infections are often epidemic in nature<sup>[3,60-64]</sup>. They are transmitted from person to person either by direct contact or indirectly through fomites<sup>[64-66]</sup>.

Host differences and strains virulence play a role in the epidemiology of anthropophilic infection<sup>[67]</sup>. In addition, other factors including age, sex, race<sup>[68]</sup>, habits, geographical location<sup>[69-71]</sup> and genetic background may play a role in epidemicity of anthropophilic dermatophytes. Lastly, the presence of asymptomatic carrier states in tinea capitis has been repeatedly documented<sup>[8,28,73,74]</sup>. This finding has important epidemiologic implications, as silent sources of infection are more difficult to detect and eradicate<sup>[67]</sup>. The anthropophilic organisms maintain their virulence in person to person transmission, thereby allowing epidemicity to be a prominent feature of the infection<sup>[75]</sup>.

*T. tonsurans* was never important in Iraq prior to recent CBS<sup>[11,12]</sup>. In CBS *T. tonsurans* was the predominant cause of tinea capitis in Iraq. Patients with *T. tonsurans* infection of the scalp present with a multiplicity of clinical appearances and the infected hairs do not fluoresce under ultraviolet light<sup>[2]</sup>. Tinea capitis caused by *T. tonsurans* is more difficult to diagnose than that related to the microsporum species. Case of *T. tonsurans* scalp infections therefore may be missed and has led to more difficult diagnoses and management. These missed cases act as a source of infections. In vitro lymphocytes transformation studies reveal that in some patients a selective failure to respond to Trichophyton antigen, whereas mitogen responses remain intact<sup>[76-79]</sup>, this may lead to disease chronicity and spread. There have also been some reports that *T. tonsurans* does not respond as well to griseofulvin as to other antifungal drugs<sup>[80,81]</sup>. This resistant strains may be transmitted and lead to an increase in *T. tonsurans* as a cause of tinea capitis. The CBS performed in Iraq indicates similar finding to that

reported for London, UK[7].

Another anthropophilic agent that has undergone a change in distribution is *T. mentagrophytes* var *interdigitale*. Before 1995, it had never been isolated from tinea capitis cases in Iraq<sup>[6]</sup>, and it is exceptional in apparently never causing tinea capitis<sup>[82]</sup>. However, this study indicated that *T. mentagrophytes* var *interdigitale* was responsible for 23.4% of tinea capitis in CBS. This dermatophyte rarely causes tinea capitis in Italy<sup>[83]</sup>. The rise in frequency of *T. mentagrophytes* var *interdigitale* as a cause of tinea capitis could be due to fact that once the organism become endemic within the community, several factors may favor its spread. Children are the population at risk for anthropophilic tinea capiti<sup>[60,61,63,75]</sup> and this may be the case for *T. mentagrophytes* var *interdigitale*.

*T. verrucosum* was the most important dermatoozoonose in CBS and represents 26.7% of the cases of tinea capitis. While in HBS it involves only 15.8% as the cause of tinea capitis. The prevalence of *T. verrucosum* increased due to the fact that a large number of families lived in mixed houses with their animals. Thus the infection, often through contact with animals is becoming an increasing source of infection. *T. verrucosum* has been the predominant fungus causing tinea capitis in Esfahan, Iran<sup>[84]</sup>, Germany<sup>[62]</sup> and the third most common organism in Lahore, Pakistan<sup>[22]</sup>.

In CBS, non-inflammatory tinea capitis was mainly caused by *T. tonsurans* (31.6%), followed by *T. verrucosum* (26.7%) and *T. mentagrophytes* var *mentagrophytes* (23.9%). While in HBS the non-inflammatory tinea capitis was mainly caused by *M. canis* (49%), followed by *T. mentagrophytes* var *mentagrophytes* (14.8%). Inflammatory type of tinea capitis was mainly caused by *T. mentagrophytes* var *mentagrophytes* (61%), followed by *T. verrucosum* (26.8%) for CBS, while in HBS it was mainly caused by *T. verrucosum* (49%), followed by *T. mentagrophytes* var *mentagrophytes* (26.4%). *T. tonsurans* was the most predominant etiologic agent of seborrheoid and forms backdot in CBS, while in HBS *M. canis* was the predominant cause. Favus was caused by *T. violaceum*, while kerion was mainly caused by *T. mentagrophytes* var *mentagrophytes* in CBS and by *T. verrucosum* in HBS. The above findings indicate a change in the clinico-etiological correlates in tinea capitis in Iraq, and it is consistent with the shift in epidemiological and clinical characteristics of tinea capitis worldwide. The different dermatophytes causing tinea capitis may present with several different clinical forms and this agreed with reports by others<sup>[15-17,67,84]</sup>.

In conclusion, this study indicated a significant difference in the etiology and the role played by various dermatophytes responsible for tinea capitis in Iraq, between CBS and HBS. In addition, there is a shift in epidemiological patterns of the disease in CBS.

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**Table 1.** Frequency distribution of tinea capitis in community and hospital based studies in relation to gender.

Study Type	Male		Female		P Value <
	No	Percent	No	Percent	
Hospital Based Study	196	61	124	39	0.001
Community Based Study	246	70	104	30	0.001
P Value <	0.025		0.025		

**Table 2.** Frequency distribution of tinea capitis in community and hospital based studies in relation to gender and age.

Study Type		Age 6 -10 Year			Age 11 – 15 Years			P Value <
		Male	Female	Total	Male	Female	Total	
Hospital Based Study	Number	171	112	283	25	12	37	0.0001
	Percent	60.4	39.6	88	67.6	32.4	12	
Community Based Study	Number	211	91	302	35	13	48	0.0001
	Percent	69.9	30.1	86	72.9	27.1	14	
P Value <		NS			NS			

**Table 3.** Frequency distribution of tinea capitis clinical forms in community and hospital based studies.

Clinical form	Hospital based study		Community based study		P Value <
	Number	Percent	Number	Percent	
Seborrhoid	165	51.5	283	81	
Gray patch	3	1	15	4.3	
Black dot	60	18.7	10	2.8	
Kerion	92	28.7	36	10.3	
Favus	0	0	6	1.7	

**Table 4.** Frequency distribution of dermatophytes in tinea capitis in community and hospital based studies.

Dermatophytes	Hospital based study	Community based study	P Value <
	Number [%]	Number [%]	
T. tonsurans	16 [ 7 ]	91 [27.6]	
T. verrucosum	36 [15.8]	88 [26.7]	
T. interdigitale	0	77 [23.4]	
T. violaceium	18 [ 7.9 ]	26 [7.9 ]	
T. rubrum	0	22 [6.7 ]	
T. mentagrophytes	40 [17.5]	17 [5.2 ]	
T. auudonii	10 [ 4.4]	8 [2.4 ]	
T. schoenlini	7 [ 3 ]	0	
M. canis	96 [42.1]	0	
M. nanum	5 [ 2.2]	0	

**Table 5.** Ecology of dermatophytes in hospital and community based studies.

Study type	Anthrophilic Fungi	Zoophilic Fungi	P Value <
	Number [%]	Number [%]	
Hospital Based Study	88 [26.7]	241 [73.3]	0.0001
Community Based Study	177 [77.6]	51 [22.4]	0.0001
P Value <	0.0001	0.0001	

**Table 7.** Infection type frequency in hospital and community based studies.

Study type	Inflammatory Infection	Non inflammatory Infection	P Value <
	Number [%]	Number [%]	
Hospital Based Study	53 [23.2]	175 [76.8]	0.0001
Community Based Study	41 [12.5]	288 [87.5]	0.0001
P Value <			

**Table.6.** Clinico–etiologic correlation.

Fungus	Seborrhoid		Gray patch		Kerion		Black dot		Favus	
	CBS	HBS	CBS	HBS	CBS	HBS	CBS	HBS	CBS	HBS
<i>T. tonsurans</i>										
Number	81	7				3	10	6		
Percent	30.2	5.5				5.7	100	12.5		
<i>T. mentagrophytes</i> *										
Number	69	22			25	14		4		
Percent	25.7	17.3			69	26.4		8.4		
<i>T. verrucosum</i>										
Number	71	5	6		11	26		5		
Percent	27.6	3.9	60		31	49		10.4		
<i>T. violaceum</i>										
Number	21	7						11	5	
Percent	7.8	5.5						30	100	
<i>T. rubrum</i>										
Number	22									
Percent	8.2									
<i>T. schoenleinii</i>										
Number		7								
Percent		5.5								
<i>M. audouinii</i>										
Number	4	3	4					7		
Percent	1.5	2.4	40					14.6		
<i>M. canis</i>										
Number		71				10		15		
Percent		55.9				18.8		31.3		

This include both species variant of mentagrophytes [mentagrophytes and interdigitale].

# Smoking Among Boys: The Role of Family and Environment On Amoking In A Rapidly Developed Country

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**Keywords:** Cigarette smoking in boys; Student; Adolescents; Friends; Television, Media, School; Family members; quit smoking; smoking cessation; Qatar.

## Abstract

**Objectives:** The aim of this study is to determine the prevalence of smoking habits, and explore the attitudes toward cigarette smoking among high school boys aged 15-24 years in the State of Qatar.

**Methodology:** A Cross-sectional study was designed and subjects were randomly selected from high school and universities using a multistage stratified cluster sampling procedure and data were collected using World Health Organization (WHO) questionnaire on smoking. The questionnaire was adapted and a modified version of standard from an instrument developed by World Health Organization (WHO/SMO), was anonymous, self-administered, and applied collectively in the classroom questionnaire regarding surveying of smoking habits. A multi-stage stratified cluster sampling method was used. Univariate and multivariate statistical analysis were performed.

**Results:** 2128 subjects aged between 15-24 years were approached randomly. A total of 1685 individuals (79.2%) participated in the study. The prevalence of smoking significantly increased with increasing age, 25.6% in 15-18 years old category and 43.3% in children between 19 and 24 years old. The commonest source of the first cigarette was friends; nearly 60.8% reported this as the first source of their cigarette while 31.6% bought it from stores. The regression analysis revealed that age and family member smoking, wpecially father and siblings, were statistically significant predictors for smoking among boys.

**Conclusion:** This study concluded that one third of the high school students and those studying at university are already regular smokers. This percentage is likely to increase as the students exit university, and move forward to begin work or an academic career. Special intervention and health awareness programs are required to early screen, detect and treat young smokers from developing the habit.

## Introduction

Tobacco use and its health-related consequences are considered the most important public health problem and the single largest cause of avoidable death in our times. Unfortunately, smoking continues to be a threat to global health, while actions to prevent and control it are priorities for the World Health Organization (WHO)<sup>1,2</sup>. It was suggested that the best way to discourage smoking is by approaching children and adolescents, since most people start smoking in their teenage years<sup>3-9</sup>. Parents may influence the likelihood that their children will smoke cigarettes not only through their own smoking behaviour but also by their attitudes towards smoking<sup>4-10</sup>. Similarly children and adolescents can reject smoking if it was offered to them if only they recognize that it is harmful to health<sup>5-7</sup>. Of the 54 million Americans who smoke 90% began smoking as a teenager<sup>9-10</sup>, even with anti-smoking campaigns targeted towards youth, slightly more than one fourth of the high school seniors remain smokers<sup>9</sup>. Approximately 1 million young Americans each year become regular smokers in spite of the legal prescriptions on the purchase of tobacco products in 43 of the states<sup>1,9,10</sup> but, in Europe<sup>11,12</sup> nearly one million people give up smoking every year. There is a substantial decline in smoking prevalence in the developed countries but the opposite is true in the developing countries<sup>1,4-6</sup>. This can be due to the lack of proper educational programs<sup>13</sup> and the lack of effective measures for controlling such epidemics. Children of parents who smoke have a higher frequency of respiratory infections and decreasing lung capacity as the lung matures<sup>14</sup>. Previous studies from the Arab world have shown that smoking among girls is very rare when compared to boys<sup>15,16</sup>. Therefore this study focuses on boys as no previous population based studies are available

on the evolution of consumption of cigarette smoking and sheesha (water pipe) among Qatari youth.

The aim of this study is to determine the prevalence of the smoking habits, and explore their attitudes toward cigarette smoking among students aged 15-24 years in the State of Qatar.

## Subjects and Methods

This is a cross-sectional study in which a WHO questionnaire on smoking was distributed among Qatari high school children and university boy students aged between 15-24 years of age. The questionnaire included socio-demographic information items to determine the practice, knowledge, attitudes, and the perception of smoking among the high school boys aged 15-24 years attending their schools and the survey was conducted during the period of January-May 2005.

The questionnaire was an adapted and modified version of a standard from an instrument developed by WHO/SMO, 1984<sup>4,17,18</sup>. The questionnaire was self-administered, and applied collectively in the classroom for surveying smoking habits. A multi-stage stratified cluster sampling method was used. At the first stage high schools were classified into two strata: High school and university students. Schools were randomly selected by simple random sampling technique. Then the classes were selected randomly, in alphabetical order and the students in each selected class were taken randomly. The number of students taken from each class was proportional to the total number of the students in each school.

Children/adolescents were considered as smokers if they were currently smoking or smoke as much as one cigarette per week.

To fulfill the requirement of the objectives the required sample size was estimated to be approximately 2128 using the formula provided by EPI-INFO Computer Program calculating sample size, but during the survey 443 were excluded because of incorrect completion of the questionnaires or absence during the survey. The effective sample size was 1685, giving a response rate of 79.2%.

Chi-square analysis was performed to test for differences in proportions of categorical variables between two or more groups. In 2X2 tables, the Fisher's exact test (two-tailed) replaced the chi-square test where the expected frequency is less than 5 in any of the cells. Odds ratios (OR) and 95% confidence intervals (CI) for current smokers versus never smoking were estimated using unconditional logistic regression models. Stepwise multiple logistic regression analysis was performed to evaluate and extract the best predictor of the smoking. The level  $p < 0.05$  was considered as the cut-off value for significance.

## Results

Of the 1685 students surveyed in the study the prevalence of smoking significantly increased with increasing age. It is 25.6% in 15-18 years old, rising to 43.3% in students aged 21-24 years. The mean age of the students was  $18.9 \pm 3.1$  years.

Table 1 shows the characteristics of smokers and non smokers. About 60.8% of smokers got their first cigarette from their friend. Also smokers in family was highly associated with smoking among children  $p < 0.001$ .

**Table 1.** Socio-demographics and characteristics of the students according to smoking habits.

Variables	Smokers* n(%) n=583	Non Smokers* n(%) n=1102	p-value
Age group			
15-18	212(36.4)	616(55.9)	
19-24	371(63.6)	486(44.1)	<0.001
Type of smoke			
Cigarette	493(84.6)	-	
Cigar	39(6.7)	-	-
Sheesha	205(35.2)	-	
First smoke given by			
House	40(6.8)	-	
Friends	354(60.8)	-	
Bought it myself	184(31.6)	-	-
Others	5(0.8)	-	
Smoker in Family			
Father	215(36.8)	201(18.2)	
Any other member	184(31.6)	258(23.4)	<0.001
None	184(31.6)	643(58.4)	

\* Percentages displayed are column percentages

Table 2 shows the present opinion of students concerning "How to quit smoking". According to many smoking students the best way to quit smoking was counseling session/clinics (53.0%), stop advertisements (40.3%), increasing the price of cigarettes (32.8%) and banning smoking in public places (28.9%).

The main cause of why students like to smoke is that they are inspired by friends (42.3%), for enjoyment (37.2%) and when they are feeling bored (24.9%). The commonest source of the first cigarette was friends and nearly 60.8% reported this as the first source of their cigarette while 31.6% bought it from stores (Table 2)

Table 3 gives the results of stepwise multiple regression analysis for the smoking habits associated as risk factors with some confounding or explanatory variables. The regression model showed that only, friend, father education level, age of student and parental smoking habits variables were found statistically significant predictors for smoking.

**Table 2.** Attitudes and opinions towards smoking habits among boys.

Variables	Smokers* n(%) n=583	Non Smokers* n(%) n=1102	p-value
Reason for smoking‡			
Feeling bored	145(24.9)	-	-
Copying the habit from father	72(12.3)	-	-
For enjoyment	217(37.2)	-	-
Every one is smoking at home	65(11.1)	-	-
Inspired by friends	247(42.3)	-	-
Feeling tense and nervous	134(22.9)	-	-
To become a mature man	34(5.9)	-	-
To be accepted in society	9(1.6)	-	-
How to stop smoking‡			
Putting danger sign on cigarette pack	90(15.4)	171(15.5)	0.981
Stop advertising smoking	235(40.3)	534(48.5)	0.034
Prohibiting smoking in public places	168(28.9)	484(43.9)	<0.001
Increasing price of cigarettes	191(32.8)	558(50.6)	<0.001
Making stickers and books	51(8.7)	166(15.1)	0.014
Health Education about smoking on TV	87(15)	314(28.5)	<0.001
Health education at schools	141(24.1)	380(34.5)	0.004
Opening stop smoking clinics	309(53.0)	636(57.7)	0.216

\* Percentages displayed are column percentages

‡ Multiple choice questions the percentages will not add to 100%

**Table 3.** Factors contributing to smoking among boys using multiple logistic regression analysis.

Independent Variables	Odds Ratio	95% Confidence Interval	P Value
Age	1.18	1.12-1.25	<0.001
Father smoking	3.79	2.55-5.62	<0.001
Siblings smoking	2.38	1.61-3.52	<0.001

**Table 4.** The prevalence of youth smoking in different countries according to age.

Country	Reference, Year	Age group	Prevalence
Australia <sup>29</sup>	Hill et al., 2002	14-19	33.0
Canada <sup>11</sup>	Hublet et al., 2006	11-15	10.5
China <sup>30</sup>	Anderson et al., 2006	13-18	17.0
Egypt <sup>31</sup>	Gadalla et al., 2003	11-18	26.0
Finland <sup>11</sup>	Hublet et al., 2006	11-15	16.5
Germany <sup>12</sup>	Richter et al., 2007	11-15	15.2
Greece <sup>32</sup>	Kyrlesi et al., 2007	13-15	16.2
India <sup>16</sup>	Gajalakshmi et al., 2006	13-15	10.0
Iran <sup>34</sup>	Kelishadi et al., 2006	11-18	18.5
Japan <sup>20</sup>	Washio et al., 2003	12-15	10.9
Jordan <sup>35</sup>	Awadi, 1991	16	16.7
Latvia <sup>11</sup>	Hublet et al., 2006	11-15	20.0
Kuwait <sup>6</sup>	Moody et al., 1996	18-19	30.0
Russia <sup>36</sup>	Prokhorov et al., 1994	11-15	21.6
Philippines <sup>37</sup>	CDC, 2005	13-15	21.8
Poland <sup>11</sup>	Hublet et al., 2006	11-15	19.1
Portuga <sup>11</sup>	WHO, 2006	13-15	17.1

Qatar	Current Study, 2005	15-18 19-24	25.6 43.3
Saudi Arabia <sup>18</sup>	Al-Damegh et al., 1996	13-19	29.8
Sweden <sup>11</sup>	Hublet et al., 2006	11-15	5.5
Turkey <sup>38</sup>	Erbaydar et al., 2006	13-17	25.2
United Kingdom <sup>11</sup>	Hublet et al., 2006	11-15	10.2
United Arab Emirates <sup>4</sup>	Bener et al., 1998	15-19	18.9
Yemen <sup>5</sup>	Bawazeer et al, 1999	18-19	21.9

## Discussion

Cigarette smoking and tobacco consumption has risen in the last few years by as much as 25% in the middle east region<sup>4</sup>. The prevalence among the studied group was 34.6% and is also increasing with age.

In a Qatar study<sup>19</sup> smoking is directly related with 32% of myocardial infarctions, 27.9% hypertension and 36.8% stroke and cerebro-vascular diseases among adults. Table 4 shows the prevalence of smoking in different countries. The results of smoking prevalence studies of young people that have been undertaken during recent decades and have demonstrated major variations, primarily resulting from the age groups being studied and the definition of smokers adopted makes comparison of their results difficult<sup>1,9,20,21</sup>.

Previous studies have identified a large number of factors that are associated with school children and adolescent smoking. Findings have documented the importance of peer influence on adolescent smoking<sup>4,6,7,11,20-24</sup> and our findings are consistent with the previous reported studies. The role of the family<sup>4,6,7,11,20-24</sup> is also seen, in that the existence of a smoking member of the family provides an important model in learning smoking behaviour and the child or the teenager in such a family will have both the risk of passive smoking and the higher risk of acquiring such behaviour<sup>14</sup>. Most probably the parent here is the father since, culturally, in the State of Qatar female smoking is totally unaccepted and the percentage of smokers is expected to be very low among mothers.

Friend's role is a crucial one in influencing the smoking habits of the students<sup>4,12</sup>. Most studies indicate that the source of the first cigarette is most often a friend<sup>24,25</sup>. In this study in nearly three-quarters of the students the source of the first cigarette was friends and in 17% it was bought to be shared also with friends. In this study nearly two-thirds of the studied group start smoking before the age of 15 years. In most reported studies the smokers started before the age of 15 years. Western studies show that early experimentation with cigarettes tends to increase the likelihood of smoking when older<sup>3,9,11,12</sup>.

Religion can be an effective motive to stop smoking and can play a fundamental role in any anti-smoking campaign since Islam considers smoking unlawful<sup>4,18</sup>.

But also there are the millions of Dollars spent every year

by the cigarette manufacturers on advertising and other promotional activities that encourage people to smoke<sup>26</sup>. In 1999, the total annual costs of smoking in California were \$15.9 billion and \$475 per resident. Banning tobacco advertising and promotion has significantly reduced exposure to pro-tobacco marketing influences in UK<sup>26</sup> and Brazil<sup>28</sup>. These findings support the effectiveness of comprehensive bans on advertising and promotion.

In addition our study also highlighted the fact that smokers were less concerned about the effect of smoking on their health and that about 36% of them strongly or slightly disagree with enforcing law against smoking indicate the lack of proper health education among this age group and the deficiency of effective measures in the community in general against smoking.

## Conclusion

Well-organized anti-smoking programs are needed in schools health and universities in Qatar. One third of the high school students at their graduation from high school are already regular smokers as concluded from this study. This percentage is liable to increase as they begin to work and advance their academic carrier, but this percentage can be decreased if effective measures are undertaken at an early stage of school life.

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## Association Between Stages of Liver Fibrosis and Some Chronic Diseases [Thalassemia, Chronic Renal Failure and Diabetes] In Patients with Chronic Viral Hepatitis

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### Abstract

**Background:** Viral hepatitis represents a public health problem in patients with chronic diseases, specifically those receiving multiple blood transfusions.

**Objectives:** To clarify the frequency of hepatitis (HBV, HCV) in patients with thalassemia, hemodialysis and diabetes.

**Patients and Methods:** The study included 133 patients with chronic liver disease who attended the Gastroenterology and Hepatology Center Medical City in Baghdad, during the period from the beginning of March 2004 until the end of September 2005. All patients were asked for name, age, gender, date of illness, and other chronic diseases if present. A blood sample of 5 ml was drawn from each patient for detection of HBsAg and anti-HCV. Liver biopsy was taken from patients who have HBsAg or anti-HCV or both. At the time of liver biopsy, a blood sample was drawn to check for biochemical tests. Detection of HBsAg and anti-HCV were performed using ELISA test. Alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase were determined by colorimetric method using commercial kits. Microscopic examination was done by a pathologist to assess the grade of necroinflammation and stage of fibrosis according to Knodell Histology Activity Index (HAI). The HAI classify fibrosis into 4 stages of increasing severity; stage 4 represents cirrhosis. Another finding including fatty changes and iron deposition was reported.

**Results:** Thalassemia was found in one patient with HBsAg (2%) and 30 out of 83 (36.1 %) patients with anti-HCV. No patients with HBsAg/ anti-HCV had thalassemia. The patient with HBsAg revealed stage IV fibrosis on liver biopsy. Patients with anti-HCV revealed variable stages of fibrosis. Chronic renal failure was found in 9 out of 50 (18%) patients with HBsAg, 15 out of 53 (28.3%) patients

with anti-HCV (thalassemic patients were excluded) and 3 out of 8 (37.5%) patients with HBsAg/anti-HCV. Diabetes mellitus was found in 6% of patients with HBsAg, 11.3% of anti-HCV- infected patients and 12.5% of patients with both HBsAg and anti-HCV. There were different patterns of association between stages of liver diseases, age groups and chronic diseases. Iron deposition was found in all thalassemic patients and in 3 out of 53 (5.7%) non-thalassemic patients with anti-HCV infection. The total number of patients with thalassemia was 31 patients; 30 patients had anti-HCV and only one had HBsAg.

**Conclusion:** Iron deposition was found in all thalassemic patients and in 5.7% of HCV-infected patients without thalassemia. Iron deposition is associated with advanced stages of fibrosis. The score of fibrosis increased with grade of necroinflammation in non-thalassemic patients while in thalassemic patients, there were advanced stages of fibrosis associated with decreasing grades of necroinflammation. Most patients with hemodialysis (in both HBV and HCV cases) revealed stage II fibrosis. Diabetes mellitus was found in a higher rate in HCV-infected patients than that in HBV- infected patients. These patients were found to have advanced stages of fibrosis.

### Introduction

Patients with thalassemia acquire hepatitis most often from viruses contracted with blood transfusions. Fortunately, advances in detection of blood-borne viruses has greatly diminished the risk of infection with blood transfusion. Different types of hepatitis viruses exist, of which a number have been characterized. Over time, key problematic hepatitis virus for patients with thalassemia has changed<sup>[1]</sup>. For many years, the hepatitis B virus was the major incubus for patients with thalassemia (or any

disorder requiring chronic transfusion). The advent of new screening techniques reduced substantially the incidence of infection with this virus. The development of a new, effective vaccine has further reduced the magnitude of the problem of hepatitis B<sup>[2]</sup>.

As medical science overcame many of the difficulties that made hepatitis B such a challenge, another viral agent moved to the forefront. Hepatitis C was present in the blood supply all along, but there was a lack of means of detecting it reliably until recently. Prior to its identification, hepatitis C was included in the group of viruses that we called “non-A, non-B”. The key problem with the hepatitis C virus is its propensity to produce chronic, active hepatitis. The virus smolders along, slowly damaging an increasing number of hepatocytes<sup>[1]</sup>. Over the course of many years, fibrosis and cirrhosis commonly develops. End-stage liver disease commonly develops. The slow progression does give time to intervene with antiviral agents, however. A recent report from Italy found that about 15% of patients had been exposed to hepatitis C<sup>[1]</sup>. The conversion rate was about 5 per 1,000 person-years. Patients who had substantial iron overload (ferritin levels greater than 3,000) had a much greater incidence of active liver injury than those with lesser iron burdens<sup>[3]</sup>.

Another viral agent called hepatitis virus G has recently been identified<sup>[4]</sup>. Little is known about the long-term effects of this virus. However, studies to date suggest that the agent may not produce significant liver damage<sup>[5]</sup>. Further work is needed to better characterize this new virus and its possible interaction with other hepatitis viruses.

Hepatitis B virus (HBV) was the first significant hepatotropic virus to be identified in hemodialysis centers. HBV infection has been effectively controlled by active vaccination, screening of blood donors, the use of erythropoietin, and segregation of HBV carriers. To date, HBV remains an important cause of morbidity in endemic areas. Hepatitis delta virus is a defective virus that can only infect HBV-positive individuals. Hepatitis C virus is the most significant cause of non-A, non-B hepatitis and is mainly transmitted by blood transfusion. The introduction in 1990 of routine screening of blood donors for HCV contributed significantly to the control of HCV transmission. Although epidemiologic analyses revealed high prevalence rates of both viruses in the hemodialysis population, their exact role in liver disease has yet to be determined. The vigilant observation of guidelines on universal precaution and regular virologic testing are the cornerstones of the effective control of chronic hepatitis in the setting of hemodialysis<sup>[6]</sup>

Hepatitis C virus (HCV) infections are frequent in hemodialyzed patients and are mainly related to transfusions and nosocomial contamination. HCV-related infection may result in cirrhosis in 10% of dialysis patients and is worsened by transplantation because of

the immunosuppressive therapy for prevention of graft rejection. Because there is a risk for significant liver disease and because cirrhosis contraindicates a renal transplantation, a liver biopsy should be performed early in HCV-RNA positive hemodialysis patients to evaluate histologic impact of the liver disease<sup>[7]</sup>.

A link between hepatitis C virus infection and development of diabetes mellitus has been suggested by many investigators; however, this remains controversial. The mechanisms underlying the association between hepatitis C virus and diabetes mellitus are unclear but a great majority of clinical surveys have found a significant and independent relationship between hepatitis C virus and diabetes mellitus after renal transplantation and orthotopic liver transplantation<sup>[8]</sup>.

Since the hepatitis C virus (HCV) was identified, numerous epidemiological studies have reported a higher prevalence of type 2 diabetes mellitus (DM2) in subjects infected by HCV<sup>[9-11]</sup>. Although the initial associations of diabetes and liver disease were made in subjects with advanced liver disease<sup>[9-12]</sup>, more recent reports have described an increase in DM2 before the development of advanced liver cirrhosis<sup>[13]</sup>. Furthermore, the epidemiological link has been established between DM2 and HCV infection, rather than other causes of liver diseases, such as hepatitis B viral infection (HBV) and alcohol abuse<sup>[14]</sup>. The increase in the number of cases of DM2 among people infected by HCV has been reported to be as much as four times higher than in the general population<sup>[15]</sup>. Other factors, such as obesity, which is characterized by a high body mass index (BMI); advanced age and family history of diabetes, are also associated with the higher incidence of diabetes in the HCV-infected population<sup>[16-18]</sup>.

In addition to infection by HCV, other viral agents such as Coxsackie's virus, congenital rubella and cytomegalovirus have been proposed as being capable of triggering the development of diabetes mellitus type 1 (DM1) or juvenile diabetes mellitus<sup>[19-21]</sup>. It is unclear as to why some patients with HCV infection develop diabetes. However, it is tempting to speculate that the HCV infection is able to trigger autoimmune mechanism(s) against the insulin producing pancreatic beta cells in susceptible individuals.

The mechanisms proposed for the development of DM1 following viral infection are generally based on findings of specific humoral and cellular immunity against viral antigens as well as insulin producing pancreatic cells in some diabetic children<sup>[19-23]</sup>. In HCV infection, the use of interferon alfa, a well-known immune enhancer for the treatment of HCV infection, has been observed to be associated with the development of diabetes<sup>[24-25]</sup>. Contrary to DM1 that occurs mainly in children, the diabetes associated with HCV infection has so far

been observed mainly in adults<sup>[9-11]</sup>. This may be due to the low incidence of HCV infection in children since the mechanisms of infection by HCV are associated with adult lifestyle. For example, sharing needles by intravenous drug users, tattooing and sexually transmitted diseases<sup>[26-28]</sup>. Furthermore, risks for transmission of HCV infection in children, such as blood transfusion, have been dramatically reduced since the introduction of the screening tests for HCV antibodies in blood donors.

Presently, it is unknown what may make an individual susceptible to the development of diabetes after a viral infection. A genetic susceptibility for the development of DM1 has been well documented in some individuals<sup>[29]</sup>. Whatever the trigger mechanism(s) for the development of diabetes in susceptible individuals, DM1 or insulin dependent diabetes has been associated with genetic markers known as human histocompatibility antigens (HLA). Resistance to the development of diabetes has also been associated with HLA antigens.

A better understanding of the immunogenetics of HCV infection is needed. During the last few years, we have learned that the viral and clinical outcome of HCV infection is associated with the HLA type of the individual. Most HCV infected individuals develop chronic HCV infection, which is characterized by the presence of the HCV ribonucleic acid (RNA) in the blood and a high probability for the development of chronic liver disease including liver cirrhosis and liver cancer. However, some 20-30% of the infected individuals develop an immune response that is able to spontaneously overcome the infection<sup>[30,31]</sup>. These individuals become negative for HCV RNA and do not develop HCV-associated liver diseases. All of the above findings suggest that the genetic makeup of an individual is a determining factor in the outcome of the HCV infection, in which the development of diabetes is one of the possible outcomes.

## Material and Methods

### Patients:

The study included 133 patients with chronic liver disease who attended the Gastroenterology and Hepatology Centre Medical City in Baghdad, during the period from the beginning of March 2004 until the end of September 2005. All patients were asked for name, age, gender, date of illness, and other chronic diseases if present. Blood sample 5 ml was drawn from each patient for detection of HBsAg and anti-HCV.

The patients were assured to be compatible for liver biopsy by prothrombin time and serum protein, that showed normal levels in all patients involved in the study. Liver biopsy was taken from patients who have HBsAg or anti-HCV or both. At the time of liver biopsy, a blood sample was drawn to check for biochemical tests. The study was approved by the ethical committee of the center

and written informed consent was taken from patients included in the study.

### Detection of HBsAg

Hepanostika HBsAg Uni- Form II (bioMerieux Bv/ Boseind 15, 5281 RM Boxtel, The Netherlands) was used for detection of HBsAg. Hepanostika HBsAgUni-Form II is an enzyme-linked immunosorbent assay (ELISA) based on a one- step "sandwich" principle. Antibody to HBsAg (anti-HBs) coupled to horseradish peroxidase (HRP) serves as the conjugate with tetramethylbenzidine (TMB) and peroxide as the substrate. Upon completion of the assay, the development of color indicates the presence of HBsAg, while no or low color development suggests the absence of HBsAg.

Specifically, microelisa wells are coated with anti-HBs (murine monoclonal). Each microelisa well contains an HRP- labeled anti-HBs (ovine) conjugate sphere. The test sample or appropriate control containing HBsAg is incubated in the microelisa wells. The conjugate sphere dissolves in the sample and a solid phase antibody/ HBsAg/ enzyme- labeled antibody complex is formed. Following wash and incubation with TMB (tetramethylbenzidine) substrate, a blue color is produced. The enzyme reaction is stopped by the addition of a sulfuric acid solution, which changes the color to yellow. When HBsAg is present in the sample, an intense color develops. However, if the sample is free of HBsAg, no or little color forms after the addition of substrate. Within limits, the amount of HBsAg in the sample is proportional to the degree of color development.

### Detection of anti-HCV

The anti- HCV was detected using Bioelisa HCV kit (Biokit, S.A. Spain), which is an immunoenzymatic method. The wells of a microplate are coated with recombinant antigens representing epitopes of HCV. Serum or plasma samples are added to the wells. If antibodies specific for HCV are present in the sample, they will form stable complexes with the HCV antigen on the well. After washing to remove the unbound material a rabbit anti-human IgG labeled with horse-radish peroxidase is added and, if the antigen/antibody complex is present, the conjugate will bind to the complex. After a second wash, an enzyme substrate solution containing a chromogen is added. This solution will develop a blue color if the sample is positive. The blue color changes to yellow after blocking the reaction with sulfuric acid. The intensity of the color is proportional to anti-HCV antibody concentration in the sample. Wells containing negative samples remain colorless.

### Biochemical Tests

#### Alanine aminotransferase

The coloric determination of ALT activity according

to the Reitman and Frankel method was followed using Transaminases- Kit (bioMérieux®sa/ France).

### Aspartate aminotransferase

The coloric determination of AST activity according to the Reitman and Frankel method was followed using Transaminases- Kit (bioMérieux®sa/ France).

### Alkaline phosphatase

Colorimetric determination of ALP activity was followed using Phosphatase alkaline-Kit (bioMérieux®sa/ France).

### Liver Biopsy:

Liver biopsy was performed percutaneously (through the skin). During a percutaneous biopsy, the patient will be lying on his or her back near the right edge of the bed. The right arm of patient will be under his or her head. A local anesthetic will be injected into the skin. A tiny incision will be made into the skin. The biopsy itself takes one second, during which the biopsy needle is passed quickly in and out of the liver, suctioning a small cylindrical sample of the liver tissue. The patient will be asked to lie on his or her right side for two hours to place pressure against the biopsy site to decrease the possibility of bleeding.

The liver biopsies were processed in usual steps in paraffin embedding technique. Slices of 5 mm- thick were prepared from blocks of liver biopsy by using microtome. Slices were put on slides and allowed to dry. The slides were stained by hematoxylin and eosin.

### Microscopic Examination

Microscopic examination was done by a pathologist to assess the grade of necroinflammation and stage of fibrosis according to Knodell Histology Activity Index (HAI). The HAI classifies fibrosis into 4 stages of increasing severity, stage 4 represents cirrhosis. Other findings including fatty changes and iron deposition were reported.

### Statistical Analysis

The results were statistically analyzed using Chi-square test.

## Results

### Chronic Diseases in Patients With Viral Hepatitis

These diseases included thalassemia, chronic renal failure (C.R.F.) and diabetes mellitus (DM). Thalassemia was found in one patient with HBsAg (2%) and 30 out of 83 (36.1%) patients with anti-HCV. No patients with HBsAg/ anti-HCV had thalassemia. The patient with HBsAg revealed stage IV fibrosis on liver biopsy. Patients with anti-HCV revealed variable stages of fibrosis. Chronic renal failure was found in 9 out of 50 (18%) patients with HBsAg, 15 out of 53 (28.3%) patients with

anti-HCV (thalassemic patients were excluded) and 3 out of 8 (37.5%) patients with HBsAg/anti-HCV. Diabetes mellitus was found in 6% of patients with HBsAg, 11.3% of anti-HCV- infected patients and 12.5% of patients with both HBsAg and anti-HCV (Table 1).

### Stages of liver disease in thalassemic and non-thalassemic patients with anti-HCV

The highest rate of thalassemic patients with anti-HCV (63.3%) had stage III fibrosis. All these patients had fibrosis, while about 15.1% of non-thalassemic patients showed no fibrosis and the highest rate of these patients (35.8%) had stage II fibrosis (Table 2)

### Association between stages of liver disease and age group in non-thalassemic patients with anti-HCV

Patients within the age groups 10-19yr, 20-29yr, 40-49yr, 50- 59yr and 60 yr comprised 12.5% of cases without fibrosis. Rate 16.7% of patients under ten years and the same rate of patients within the age group 20-29yr had stage I fibrosis. The age groups 30-39yr and 40-49 yr had stage I fibrosis with rates 33.3% of cases. Patients with stage II fibrosis were from the groups: 20-29 yr, 30-39 yr, 40-49 yr, 50-59 yr and 60 yr with rates 25%, 15%, 25%, 25 % and 10% respectively.

Patients with stage III fibrosis were within the age groups: 20-29yr, 30-39yr, 40-49yr, 50-59yr and 60 yr which comprised 7.1%, 21.4%, 14.3% 42.9% and 14.3% respectively. While patients with stage IV fibrosis were from the groups: 40-49yr, 50-59yr and 60 yr with a rates: 20%, 40% and 40% respectively, it was non-significant ( $X^2 = 28.06, P > 0.05$ ) (Table 3).

### Association between stages of liver disease and age group in thalassemic patients with anti-HCV

All thalassemic patients had fibrosis on liver biopsy. Only one patient had stage I fibrosis; this patient was within the age group 20-29yr. Patients fewer than ten years had stage II and stage III fibrosis with a rate of 33.3% and 30% respectively of cases. Stage II fibrosis was found in 66.7% of patients from the age group 10-19 yr. Patients within the age groups: 10-19 yr, 20-29 yr and 30-39 yr had stage III fibrosis in rates of 50%, 10%, and 5% respectively. Also the age group 50-59 yr represented 5% of cases. All patients who had stage IV fibrosis were from the age group 10-19 yr (Table 4).

### Association between stages of fibrosis and grades of necroinflammation in patients with anti-HCV

#### *Non-thalassemic patients*

Minimal and mild grades of necroinflammation were found in the absence of fibrosis in 75% and 25% of patients respectively. In stage I fibrosis: 33.3% and 66.7% of patients had minimal and mild grades of necroinflammation respectively. The difference between two rates was higher with stage II fibrosis: 5%, 85 % and 10% of patients had minimal, mild and moderate grades

of necroinflammation respectively. Mild and moderate grades of necroinflammation were found in 28.6% and 71.4% of patients with stage III fibrosis. In cirrhotic patients, mild and moderate grades of necroinflammation were found 40 % and 60% respectively (Table 5).

### **Thalassemic patients**

All thalassemic patients revealed fibrosis on liver biopsy. Only one patient had stage I fibrosis and he was found to have mild grade of necroinflammation. Patients with stage II fibrosis had mild and moderate grades of necroinflammation with rates 71.4% and 28.6% respectively. In stage III fibrosis: 5.3%, 42.1% and 52.6% of patients had minimal, mild and moderate grades of necroinflammation respectively. Mild and moderate grades of necroinflammation were detected in 66.7% and 33.3% of cirrhotic patients respectively (Table 6).

## **Chronic Renal Failure**

### **Stages of liver disease in patients with HBsAg**

Patients with HBsAg who suffered from chronic renal failure had stage II fibrosis with a rate of 44. %. Patients with stage I fibrosis comprised 22.2% of cases. The same rate of patients had stage III fibrosis. Only 11.1% of patients had stage IV fibrosis. No patients with HCC or patients without fibrosis had chronic renal failure (Table 7).

### **Stages of liver disease in patients with anti-HCV**

According to patients with anti-HCV, the highest rate of patients (66.7%) had stage II fibrosis. Patients without fibrosis represented 13.3% of patients with chronic renal failure. The same rate of patients had stage I fibrosis. None of these patients had stage IV fibrosis and only 6.7% had stage III fibrosis (Table 8).

## **Diabetes Mellitus**

### **Stages of liver disease in patients with HBsAg**

Diabetes mellitus was found in 6 % of patients with HBsAg. The DM was found in 22.2% of patients who had stage IV fibrosis and in 25% of patients with HCC (Table 9).

### **Stages of liver disease in patients with anti-HCV**

Diabetes mellitus was found in 11.3% of patients with anti-HCV. The DM was found in 5.3% of patients with stage II fibrosis and 20% of patients with stage III fibrosis while 4 % of patients with stage IV fibrosis were found to have (Table 10).

### **Iron deposition**

Iron deposition was found in all thalassemic patients and in 3 out of 53 (5.7%) non-thalassemic patients with anti-HCV infection. The total number of patients with thalassemia was 31 patients; 30 patients had anti-HCV and only one had HBsA (Fig 1).

## **Discussion**

The present study revealed that thalassemic patients had HBsAg and anti-HCV with rates 2% and 36.1% respectively. In anti-HCV-cases, some differences were found between thalassemic and non-thalassemic patients: all thalassemic patients had fibrosis while 15.1% of non-thalassemic patients had no fibrosis on liver biopsy. The highest rate of thalassemic patients was 63.3% found to have stage III fibrosis while the highest rate of non-thalassemic patients was 35.8% found to have stage II fibrosis. The score of fibrosis increased with the grade of necroinflammation in non-thalassemic patients while in thalassemic patients, the advanced stages of fibrosis were associated with decreasing grades of necroinflammation. According to non-thalassemic patients, only one patient was under ten years and his liver biopsy revealed stage I fibrosis. Another patient was within the age group 10-19 yr and had no fibrosis. Thalassemic patients younger than ten years comprised 33.3% and 30% of patients with stage II and stage III fibrosis respectively, while patients within the age group 10-19 yr comprised 66.7% and 50% of patients with stage II and stage III fibrosis respectively.

Hepatitis C virus is considered to be the main etiological agent responsible for the occurrence of post-transfusion hepatitis. Patients with thalassemia acquire hepatitis most often from viruses contracted through blood transfusions<sup>[32]</sup>. A study conducted in India revealed that in thalassemic subjects, HBV and HCV prevalence was found to be 3.84% and 21.5% respectively. This finding suggested that HCV had overtaken HBV in multitransfused subjects<sup>[33]</sup>.

Siagris et al[34] conducted a study that showed adult thalassemic patients, compared with other patients with HCV infection, present lower necroinflammatory activity and lower viral load but higher staging scores. Okada et al<sup>[35]</sup> found that 35% and 39% of patients with thalassemia were HBsAg positive and anti-HCV positive respectively.

The current findings revealed that patients with chronic renal failure comprised 18% of patients with HBsAg and 28.3 % of patients with anti-HCV. All these patients had a history of hemodialysis. In both HBsAg and anti-HCV cases, the highest rate of patients was found to have stage II fibrosis and only a low rate of patients had advanced stages of fibrosis.

Blood transfusion or hemodialysis exposes individuals to HCV more than HBV<sup>[36]</sup>. Hemodialysis patients remain a high-risk group for HCV infection<sup>[37]</sup>. Hepatitis C virus infection is common in patients undergoing chronic hemodialysis, with an estimated yearly incidence of 0.2% and prevalence 8% and 10%<sup>[38]</sup>. Another study confirmed that the prevalence of HCV infection at hemodialysis units varies from 8 % to 51%, and this variation results from the

region in which the hemodialysis unit is located<sup>[39]</sup>.

In Jordan, HCV acquisition is a serious risk for multitransfused patients. Hepatitis B virus is relatively less common<sup>[40]</sup>. In India among multitransfused chronic renal failure subjects, HBV and HCV prevalence was detected in 10% and 27.5% of cases<sup>[33]</sup>. A similar result was obtained by Naaman et al<sup>[41]</sup> who reported a 25.6% prevalence of anti-HCV among individuals who have undergone hemodialysis. Another study revealed that 15.58% of patients on chronic hemodialysis were HCV-antibody positive. The relative risk for hepatitis C was about 8 times greater for those with chronic renal failure compared with normal controls, which makes chronic renal failure an important risk factor. This risk further increases two folds in those on chronic hemodialysis<sup>[42]</sup>.

The HBsAg has been detected in dialysis centers on clamps, scissors, dialysis machine control knobs, and doorknobs<sup>[43]</sup>. Contaminated environmental surfaces have been a major source for HBV transmission among hemodialysis patients. The HBV transmission among hemodialysis patients is consistently associated with the presence of a chronically infected patient, failure to dialyze that patient in a separate room using dedicated equipment and staff, and failure to vaccinate patients against HBV<sup>[44,45]</sup>. However, HBV infections continue to occur in adult hemodialysis units. A possible contributing factor is the presence of occult HBV<sup>[46]</sup>.

It has been shown that a smaller viral load occurs in patients in dialysis than in non-nephropathic infected patients. There is no clear explanation for this phenomenon<sup>[47]</sup>. It has been proposed that it might be related to the fact that hemodialysis significantly increases the production of hepatocyte growth factor (HGF) in such a way that the hemodialysis mimics the administration of this factor as a drug<sup>[48]</sup>.

A report confirmed that hemodialysis increases markedly the serum level of HGF so that regular dialysis treatment mimics the regular administration of HGF as a drug. The report revealed that HCV-related liver disease is more benign in patients on regular dialysis treatment. The phenomenon may depend on the marked and prolonged HGF release caused by dialysis<sup>[49]</sup>. Another study demonstrated that serum HGF levels in patients with chronic hepatitis B were correlated with fibrosis scores and hepatic activity, suggesting that serum HGF level might reflect viral load, necro-inflammatory activity in the liver and degree of structural progression<sup>[50]</sup>.

In the current study, DM was found in 6% of patients with HBsAg and all these patients were found to have advanced stages of liver disease (cirrhosis or HCC). In HCV-infected patients, DM was found in a higher rate than that in HBV-infected patients. However, DM was found in 10.5%, 20% and 40% of patients with stage II, III and IV fibrosis respectively.

The association between chronic HCV infection and DM exists<sup>[51]</sup>. Diabetes mellitus is associated with increased fibrosis in chronic HCV. The HCV patients were more than 11 times as likely as those without infection to develop diabetes<sup>[52]</sup>. In patients with comparable liver damage due to HBV or other causes of liver disease, the risk of DM is lower than in patients with HCV related liver disease. Among patients with cirrhosis, HCV was associated with a higher prevalence of DM than HBV<sup>[53]</sup>. On the other hand, DM occurs at higher rates even among patients with milder forms of HCV infection<sup>[54]</sup>. It has been reported that HCV-infected subjects were four times more likely to have DM than those without HCV infection. No association between HBV infection and DM was found<sup>[55]</sup>.

A study that was performed in Iran revealed that patients with cirrhosis and chronic hepatitis are at increased risk of DM occurrence, and development of DM in chronic hepatitis patients was correlated to the severity of the liver fibrosis suggesting that liver fibrosis itself is the event associated with glucose intolerance<sup>[56]</sup>. Another study suggested that insulin resistance occurred already in the early stages of the chronic hepatitis course<sup>[57]</sup>. A strong relationship was found between insulin sensitivity and fibrosis score<sup>[58]</sup>. Another hypothesis indicated that chronic liver disease as a consequence of DM. This theory stated that occurrence of insulin resistance initially facilitated lipolysis, and increased fatty acid deposition in the liver, which increased products of lipid peroxidation inducing oxidative stress. This resulted in cytokine-mediated hepatic inflammatory damage that induced collagen deposition and eventually fibrosis<sup>[59,60]</sup>.

In this study, iron overload was found in all thalassemic patients and in 5.7 % of HCV-infected patients without thalassemia. Iron can accumulate in the liver as a result of repeated blood transfusions. Iron overload is associated with liver injury, including fibrosis, cirrhosis and liver cancer<sup>[61]</sup>.

Marked iron overload and HCV infection in thalassemic patients have a potentiating effect on hepatic fibrogenesis<sup>[62]</sup>. Enhanced liver fibrosis has been reported in HCV infected patients with stainable iron on liver biopsy compared with controls with no detectable liver iron. The mechanism by which iron accumulated in chronic HCV may be in part the result of iron release from damaged hepatocytes. Hepatic iron may promote liver injury<sup>[63]</sup>. However, Katoh et al<sup>[64]</sup> confirmed that a low iron diet appears to be safe and effective in patients with chronic hepatitis C. Iron overload and liver steatosis are thought to increase the risk of HCC among patients with HCV-related cirrhosis<sup>[65]</sup>. Iron overload and HCV infection are independent risk factors for liver fibrosis progression, and their concomitant presence results in a striking increase in risk<sup>[66]</sup>.

## Conclusion

1. Iron deposition was found in all thalassemic patients and in 5.7 % of HCV-infected patients without thalassemia. Iron deposition was associated with advanced stages of fibrosis.
2. The score of fibrosis increased with the grade of necroinflammation in non-thalassemic patients while in thalassemic patients, the advanced stages of fibrosis were associated with decreasing grades of necroinflammation.
3. Most patients with hemodialysis (in both HBV and HCV cases) revealed stage II fibrosis.
4. Diabetes mellitus was found in a higher rate in HCV-infected patients than that in HBV-infected patients. These patients were found to have advanced stages of fibrosis.

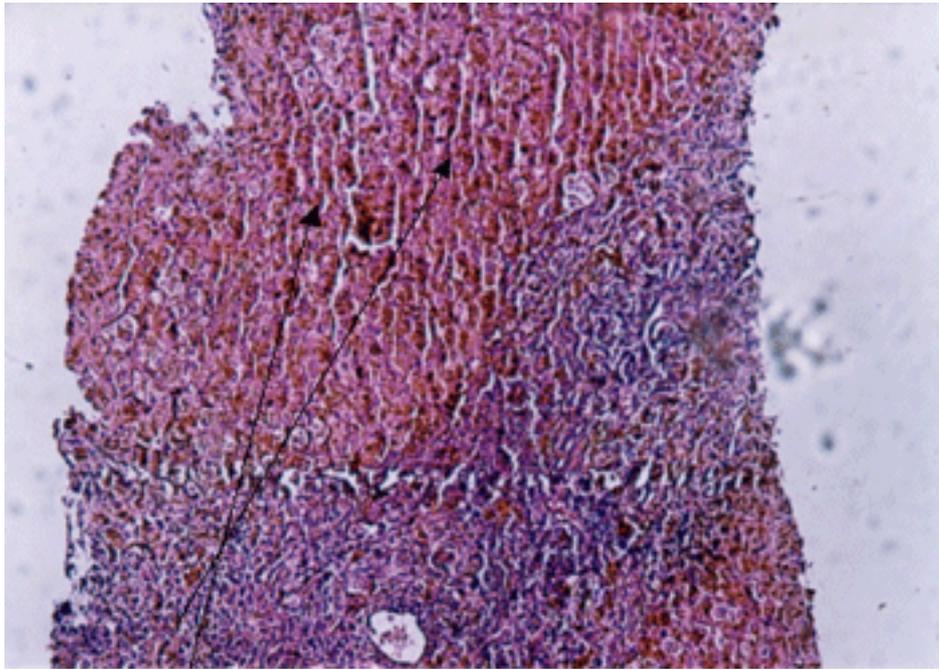
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**Fig 1:** Liver biopsy from a patient with iron deposition.

Stain: hematoxylin and eosin. X100



Iron deposition

**Table 1.** Chronic diseases in patients with viral hepatitis.

Chronic disease	Viral infection					
	HBsAg		anti-HCV		HBsAg/ anti-HCV	
	No.	%	No.	%	No.	%
Thalassemia	1/50	2	30/83	36.1	0	0
Chronic renal failure	9/50	18	15/53	28.3	3/8	37.5
Diabetes mellitus	3/50	6	6/53	11.3	1/8	12.5

**Table 2.** Stages of liver disease in thalassemic and non-thalassemic patients with anti-HCV.

Stage of liver disease (fibrosis)	Thalassemic patients		Non-thalassemic patients	
	No.	%	No.	%
0	0	0	8	15.1
I	1	3.3	6	11.3
II	7	23.3	19	35.8
III	19	63.3	15	28.3
IV	3	10	5	9.4
Total	30	36.1	53	63.9

**Table 3.** Association between stages of liver disease and age groups in non-thalassemic patients with anti-HCV.

Stage of liver disease (fibrosis)	No. of patients	Age group (yr)													
		<10		10-19		20-29		30-39		40-49		50-59		≥60	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	8	0	0	1	12.5	1	12.5	3	37.5	1	12.5	1	12.5	1	12.5
I	6	1	16.7	0	0	1	16.7	2	33.3	2	33.3	0	0	0	0
II	20	0	0	0	0	5	25	3	15	5	25	5	25	2	10
III	14	0	0	0	0	1	7.1	3	21.4	2	14.3	6	42.9	2	14.3
IV	5	0	0	0	0	0	0	0	0	1	20	2	40	2	40
Total	53	1	1.9	1	1.9	8	15.1	11	20.8	11	20.8	14	26.4	7	13.2

X<sup>2</sup> = 28.06

P &gt; 0.05

**Table 4:** Association between stages of liver disease and age groups in thalassemic patients with anti-HCV.

Stage of liver disease (fibrosis)	No. of patients	Age group (yr)													
		<10		10-19		20-29		30-39		40-49		50-59		≥60	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

I	1	0	0	0	0	1	100	0	0	0	0	0	0	0	0
II	6	2	33.3	4	66.7	0	0	0	0	0	0	0	0	0	0
III	20	6	30	10	50	2	10	1	5	0	0	1	5	0	0
IV	3	0	0	3	100	0	0	0	0	0	0	0	0	0	0
Total	30	8	26.7	17	56.6	3	10	3	3.3	0	0	1	3.3	0	0

**Table 5:** Stages of fibrosis and grades of necroinflammation in non-thalassemic patients with anti-HCV

Stage of fibrosis	No. of patients	Grade of necroinflammation					
		Minimal		Mild		Moderate	
		No.	%	No.	%	No.	%
0	8	6	75	2	25	0	0
I	6	2	33.3	4	66.7	0	0
II	20	1	5	17	85	2	10
III	14	0	0	4	28.6	10	71.4
IV	5	0	0	2	40	3	60
Total	53	9	17	29	54.7	15	28.3

**Table 6:** Stages of fibrosis and grades of necroinflammation in thalassemic patients with anti-HCV.

Stage of fibrosis	No. of patients	Grade of necroinflammation					
		Minimal		Mild		Moderate	
		No.	%	No.	%	No.	%
0	0	0	0	0	0	0	0
I	1	0	0	1	100	0	0
II	7	0	0	5	71.4	2	28.6
III	19	1	5.3	8	42.1	10	52.6
IV	3	0	0	2	66.7	1	33.3
Total	30	1	3.3	16	53.3	13	43.3

**Table 7:** Stages of liver disease in chronic renal failure patients with HBsAg.

Stage of liver disease		Total No. of patients	Patients with chronic renal failure	
			No.	%
Fibrosis	0	4	0	0
	I	12	2	22.2
	II	10	4	44.4
	III	11	2	22.2
	IV	9	1	11.1
HCC*		4	0	0
Total		50	9	18

\* Hepatocellular carcinoma

**Table 8:** Stages of liver disease in chronic renal failure patients with anti-HCV.

Stage of liver disease (fibrosis)	Total No. of patients	Patients with chronic renal failure	
		No.	%
0	8	2	13.3
I	6	2	13.3
II	19	10	66.7
III	15	1	6.7
IV	5	0	0
Total	53	15	28.3

**Table 9:** Stages of liver disease in diabetes mellitus patients with HBsAg.

Stage of liver disease		Total No. of patients	Patients with diabetes mellitus	
			No.	%
Fibrosis	0	4	0	0
	I	12	0	0
	II	10	0	0
	III	11	0	0
	IV	9	2	22.2
HCC*		4	1	25

Total	50	3	6
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**Table 10:** Stages of liver disease in diabetes mellitus patients with anti-HCV.

Stage of liver disease (fibrosis)	Total No. of patients	Patients with Diabetes mellitus	
		No.	%
0	8	0	0
I	6	0	0
II	19	1	5.3
III	15	3	20
IV	5	2	40
Total	53	6	11.3

## Anti-Infectives from The Sea

The oceans are a unique resource that provide a diverse array of natural products primarily from invertebrates such as sponges, tunicates, bryozoans, and molluscs, to marine bacteria and cyanobacteria. As infectious diseases evolve and develop resistance to existing pharmaceuticals, the marine environment provides novel leads against fungal, parasitic, bacterial and viral diseases. Although the diversity of terrestrial life is extraordinary, the greatest biodiversity is in the world's oceans with 34 of 36 phyla of life represented. The oceans cover more than 70% of the earth's surface and contain more than 30,000 described species of plants and animals. Macroscopic plants and animals have adapted to all regions of oceans, including polar, temperate and tropical areas. The diversity in species is extraordinarily rich on coral reefs, where there are around 1000 species per square meter in some areas, and the Indian-pacific ocean has the world's greatest tropical marine biodiversity. The marine environment presents a treasure of useful products awaiting discovery for the treatment of infectious diseases. Ecological pressures, including competition for space, the fouling of the surface, predation and successful reproduction have led to the evolution of unique secondary metabolites with various biological activities. The importance that these secondary metabolites play in the control of infectious and parasitic organisms was for many years largely overlooked. In the past 30-40 years, marine plants and animals have been the focus of a worldwide effort to define the natural products of the marine environment. A small number of marine plants animals, and microbes have already yielded more than 12,000 novel chemicals, with hundreds of new compounds still being discovered every year.

### Antifungal activities:

The antifungal screening of marine amoles has led to the characterization of many unprecedented natural products in regard to antifungal activity and chemical

structures. The frequency of invasive antifungals has risen substantially with the increasing numbers of immunocompromised patients, such as those infected with HIV, receiving cancer chemotherapy, immunosuppressive therapy, or treatment with broad spectrum antibiotics. Evidence is mounting that fungi display highly specific adaptations in the marine environment that include the production of unique secondary metabolites. The fact that marine organisms contain secondary metabolites different from their terrestrial counterparts in structure and biological activity, has led to the hypothesis that marine organisms may contain efficient antifungal compounds with different modes of action and selective antifungal activity compared with human cells. Jasplakinolide is the first example of a cyclodepsipeptide isolated from a sponge and was identified from a *Jaspis* sp collected in Fiji. Gambieric acids are extremely potent antifungal metabolites isolated from a strain of the epiphytic marine dinoflagellate *Gambierdiscus toxicus*

Gambieric acid A inhibits the growth of *Aspergillus niger* at a concentration of 10ng/disk. The potency of gambieric acids exceeds that of amphotericin B by 2000-fold.

### Antituberculosis Activity

The alkaloid (+)-8-hydroxymanzamine A is characterised by complex heterocyclic ring system attached to B carboline moiety. (+)-8-hydroxymanzamine A was first isolated from a sponge *Pachypellina* sp and later from an undescribed *Petrosiidae* genus. This alkaloid exhibits potent inhibitory activity against *M tuberculosis* H37Rv, with a minimum inhibitory concentration (MIC) of 0.91 microgram/mL.

Axisonitrile-3 is a cyanosesquiterpene isolated from the sponge *Acanthella klethra* and shows potent inhibitory activity against *M tuberculosis* with an MIC of 2.0

microgram/mL.

Pseudopteroxazole, a benzaxazole diterpine alkaloid isolated from the West Indian gorgonian *Pseudopteroergorgia elisabethae*, induces 97% growth inhibition for *M tuberculosis H37Rv* at a concentration 12.5 microgram/mL without substantial toxic effects. Ergorgiaene, a serrulatane -based diterpine (also known as biflorane) was isolated from the hexane extract of the same West Indian gorgonian and induce 96% growth inhibition for *M tuberculosis H37Rv* at a concentration of 12.5microgram/mL. Litosterol is a C-19 hydroxysteroid isolated from an Okinawan soft coral *Litophyton viridis*. It inhibited 90% growth of *M tuberculosis* with an MIC of 3.13microgram/mL. The poor solubility of litosterol in the aqueous tissue culture media obscured assessment of cytotoxic effects.

Puuphenone induce 99% inhibition of *M tuberculosis* of 12.5microgram/mL and 50% inhibitory concentration (IC 50 ) of 2.0 microgram/mL. The Puuphenones are shikimate-sesquiterpene derived metabolites isolated from sponges of the order Verongida and Dictyoceratida, collected from the Hawaiian Islands.

### Antihelminthic activity

Antihelminthics are drugs used to rid host organisms of helminthes parasites. Parasitism by nematodes (unsegmented worms that constitute the phylum Nematoda) represent a major issue in the commercial livestock industry, and contributes substantially to malnutrition and diseases in human beings. Particularly difficult to eradicate is *Ascaris lambricoides* the large gut worms, which causes malnutrition and obstructive bowel diseases and the soil transmitted blood-sucking hookworms *Ancylostoma dudonale* and *Necator Americans*, which lead to severe blood loss and iron deficiency-anaemia, decreased food intake impaired digestion, malabsorption and poor growth rate. Despite the availability of excellent commercial antihelminthics growing resistance to key structural classes (benzimidazoles and macrolides ) necessitate the search for new bioactive agents.

Jasplakinoids represent a potent anti-parasitic as well as antifungal agent. It exhibited an in vitro 50% effective dose of less than 1 microgram/mL against the nematode *Nippostrongylus braziliences* A Dihydroxytetrahydrofuran from the South Australian marine brown lga. *Nothiea anomala* exhibits potent and selective nematocidal activity against *Haemonchus contorous* and *Trichostrongylus colubriformis*, with a lethal dose in 50% (LD50) of 1.8and 9.9 microgram/mL, respectively.

The Amphilactams, isolated from a sponge of *Amphimedon* sp collected in the Great Australian Bight, features an unusual carbon skeleton and an emanimo lacton or lactum moiety. *Amphilactum D* has an in vitro nematocidal activity against the free-living stages of

the parasitic nematode *H contouruos*, with an (LD99) of 0.39microgram/mL. A sponge, *Geodia* sp, collected from Southern Australia has yielded a potent nematocidal agent *geodi A* magnesium salt, which is a macro cyclic polyketide lactum tetramic acid showing a LD99 value f 1.0 microgram/mL.

### Antiprotozoal activity

Diseases caused by protozoans lead to a high rate of mortality and morbidity worldwide. *Leishmania* is a disease caused by obligate intracellular parasite of the genus *Leishmania*. Types of disease range from self-healing ulcers (cutaneous leishmaniasis) to progressive nasopharyngeal infection (mucocutaneous leishmaniasis) to disseminating visceral leishmaniasis) which is generally fatal if left untreated. In Mediterranean countries adult visceral leishmaniasis is recognized as an AIDS related opportunistic disease largely due to reactivation of latent infections by immunosuppression. The most common drugs for treatment of leishmaniasis contain pentavalent antimonials, such as sodium stibogluconate and meglumine antimonite, that have cardio toxic effects at the recommended doses and consequently signify the urgent need for alternative treatments. Sponges of the genus *Plakortis* are well known for their production of cyclic peroxides. Two peroxides produced by the PLUNAN sponge *Plakortis aff angulospiculatus* are active against leishmania mexicans. Toxoplasmosis can be transmitted to human beings from cats infected with the parasite *Toxoplasma gondii*. The severity ranges from a self-limiting adenopathy to fatal encephalitis. This infection is particularly dangerous for pregnant women and immunocompromised individuals. Congenital infection in infants is fatal in most cases. New drugs or drug combinations that can eradicate the tissue cysts that cause relapses are urgently needed, particularly for patients intolerant offolate inhibitors (pyrimethamine, trimethoprim), which frequently cause undesirable side effects. The remaining drugs used for the treatment of toxoplasmosis include the macrolids, which act only on /Tachyzoit, leaving the cysts unaffected.

The alkaloid menzamine A displays 70% inhibition of the *T gondii* parasite, at 0.054 microgram/mL concentration without toxic effects. The activity increases notably at concentrations of 0.54 microgram/mL and 5.40 microgram/mL, even though it is accompanied by an increase in the cytotoxic effects for the host cells and was therefore selected in vivo-assessment. A daily intraperitoneal dose of 8mg/kg of manzamines A for 8 consecutive days, started one day one after infection, prolonged the survival of a Swiss Webster mouse to 20 days compared with 16 days for untreated controls.

The flagellated protozoa *Trypanosoma cruzi* and *Ttrypanosoma brucci* are, respectively the causal agents of South American Trypanosomiasis (Chagas disease) and

human African trypanosomiasis (sleeping sickness). The drugs used to treat these diseases, including pentamidine and suramine require parenteral administration and are effective only against the early haemolymphatics stage of the disease. The arsenical drug melarsoprol is available for late stage central nerve system infection, but it causes reactive encephalopathy and it is difficult to administer. The nitroheterocyclic drug benznidazole, used to treat the acute stage of Chaga's disease, is not effective against the chronic phase of the disease and is poorly tolerated, which clearly indicates the need for new drugs with different structures and mechanisms of action, from those that are presently used. From the green alga *Ulva* sp the endophytic and obligate marine fungus *Ascochyta salicorniae* was isolated and cultivated on a preparative scale, producing a structurally unusual tetracyclic alkaloid metabolite ascosalipyrrolidinone A which shows activity against *T. cruzi* with an MIC of 1.1 microgram/mL, whereas the control (benzimidazole) has an MIC of 30.0 microgram/mL. Malaria is a serious disease in Sub-Saharan Africa but it is a serious public health issue in certain regions of South East Asia and South America. Most malaria cases and deaths are caused by the parasite *malaria falciparum*. Since the removal of the vector of transmission (the anopheles mosquito) is almost impossible, new anti-malarial agents providing novel mechanisms of action, will always be needed to combat resistance to drugs such as chloroquine, quinine and sulfadoxine-pyrimethamine.

Menzamine A exhibits potent in vitro activity against *P. falciparum* (D60 clone), with an MIC of 0.0045 microgram/mL compared with control drug (chloroquine and artemisinin) MICs of 0.0155 microgram/mL respectively. Menzamine A inhibits the growth of rodent malaria parasite *plasmodium berghei* in vivo, with more than 90% of asexual erythrocytic stages of *P. berghei* inhibited after one intraperitoneal injection of 50 or 100 micromol/kg A into infected mice. Menzamine A and selected derivatives have a rapid onset of action of high bioavailability and sustained parasitic activity with no apparent toxic effects. Menzamine has a similar therapeutic index to chloroquine, whose toxic dose at 500 micromol/kg is ten times higher than the dose required (50 micromol/kg) to clear the parasite, if administered three times with 2 day intervals. The effectiveness of menzamine A and selected analogues against malaria makes them one of the most promising anti-infective leads to be discovered from the oceans, and understanding the structure active relation of this unique class of alkaloids is certain to lead to more effective and safer menzamine related antimalarial drugs. The previously mentioned antifungal macrolide halichondromide also has notable activity against *P. falciparum* (D6 clone), with an IC<sub>50</sub> of 0.002 microgram/mL, which is approaching the value for the most active clinically used compounds (mefloquine 0.0003 microgram/mL). Although halichromide has a

much lower selectivity index than currently used drugs it represents a potential new class of compounds in the development of alternative chemotherapy for the treatment of malaria after structure activity relation investigations. An example of a marine secondary metabolite containing the isonitril group and eliciting significant anti-malarial activity is di-isocyanoadociane, a tetracyclic diterpene with an isocycloamphilectane skeleton. Di-isocyanoadociane has been isolated from the sponge *Cymbastela hooperi* (axinellidae, halichondrida) and displayed antiplasmodial potency, with IC<sub>50</sub> values of 0.00 microgram/mL and selectivity that rivals the in vitro results obtained from clinically used antimalarial drugs (chloroquine and artemisinin). The kalihinane diterpenoids exhibit several types of biological activities, of which the anti-malarial activity of kalihinol A is the most noteworthy. Kalihinol is isolated from an Okinawan marine sponge, *Acanthella* sp, and it possesses notable in-vitro anti-malarial activity and selectivity similar to those of mefloquine.

## Antibacterial activity

The development of resistance to current antimicrobials continues to be a serious problem in the treatment of infectious diseases, and therefore the discovery and development of new antibiotics has become a high priority in biomedical research. In the continuing effort by the marine natural products community, many antibacterial agents have been identified. Squalmine is the first aminosterol isolated from the dogfish shark *Squalus acanthias* (squalidae). It has potent antimicrobial activity with an MIC of 1.0 microgram/mL, against *Staphylococcus aureus*, and antiangiogenic and antitumour properties. Cribostatins were isolated from a blue sponge *Cribochlina* sp and showed anti-neoplastic and antimicrobial activities.

Criboston 3 has potent inhibitory activity against *Neisseria gonorrhoeae*, with an MIC of 0.09 microgram/mL. Cribostatin 3 is also active against penicillin resistant *N. gonorrhoeae* (clinically isolated) with an MIC of 0.39 microgram/mL.

*Sphaerococcus coronopifolius*, a cosmopolitan red alga collected along the Atlantic coast of Morocco, contains the potent anti bacterial diterpene, bromosphaerone. It shows antibacterial activity against *S. aureus*, with an MIC of 0.47 microgram/mL.

A marine fungus isolated from the surface of the brown alga *Rosenvingea* sp, of the genus *Pestalotica*, collected in the Bahamas, was co-cultured with a unicellular marine bacteria to yield pestalone. Pestalone has potent antibiotic activity against methicillin resistant *S. aureus*, with an MIC of 0.037 microgram/mL and vancomycin resistant *Enterococcus faecium*, with an MIC of 0.078 microgram/mL. These results represent an important achievement in showing that mixed fermentation can induce the

biosynthesis of novel antibiotics, suggesting that this method may have use for drug discovery in the future.

Jourumycin is a dimeric isoquinolone alkaloid that was isolated from the mantle and the mucous of the Pacific nudibranch *Jorunna funebris*. It inhibits the growth of various gram positive bacteria e.g. *Bacillus subtilis*, *S aureus*, at a concentration of 0.050 microgram/mL, with an inhibition zone of 16mm.

#### Antiviral activity

Viruses have remained resistant to treatment or prophylaxis longer than any other infectious organism. The search for viral chemotherapeutic agents from marine sources has yielded several promising therapeutic leads. Perhaps the most important lead of marine origin reported thus far is the nucleoside ara-A. Ara-A is a semi synthetic compound based on the arabinosyl nucleosides isolated from the sponge *Cryptotethia crypta*. Once it was realised that biological systems would recognize the nucleoside base after modifications of the sugar moiety, chemists began to substitute the typical pentoses with acyclic entities or with substituted sugars, leading to the drug azidothymidine (azidovudine). Ara-A (vidarabin) and ara-C (1-beta-D-abinosylcytosine; cytarabine), acyclovir and azidothymidine are in clinical use and are all examples of products of semi synthetic modifications or the arbinosyl nucleosides.

In summary, the world's oceans will play an important part in the future control of the global infectious disease burden. Although substantial progress has been done in identifying novel drug leads from the ocean's resources, great efforts are still needed to advance clinical applications.

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**Table 1.** Antifungal natural products:

Compound	Type	Source
Aurantioside B	Polyketide	<i>Siliquiaspongia japonica</i> sponge
Phorboxazole B	Macrolide	<i>Phorbas</i> sp sponge
Halishigamide A	Macrolide	<i>Halichondria</i> sp sponge
Halichondramide	Macrolide	<i>Halichondria</i> sp sponge
Fascaplysin	Bis (indol) alkaloid	<i>Fascaplysinopsis</i> sp sponge
Meridine	Polycyclic alkaloid	<i>Corticum</i> sp sponge
Bengazole A	Oxazole containing fatty acid	<i>Jaspis</i> sp sponge
Ptilomycalin A	ester Polycyclic guanidine alkaloid	<i>Ptilocaullis Spiculifer</i> sponge
Haliclonadamine	Alkaloids	<i>Haliclona</i> sp

# Validity and Reliability In Measuring Health Professions Competencies for Undergraduate Medical Students

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## Introduction

Plans for assessment should be made during planning for instruction. Instruction is most effective when directed towards clearly defined learning outcomes designed to fit characteristics and needs of students, and methods and materials of instruction are congruent with outcomes to be achieved, and periodically reviewed and modified as needed. During instructional programs the main concern is with the learning progress being made by students. Tests used to monitor students during instruction are called formative tests and are typically designed to measure the extent to which students have mastered the learning outcomes of the specified course with feedback to students concerning strengths and weaknesses. Results of formative assessment are used to improve learning rather than to assign grades.

Summative assessment at the end of instruction is concerned primarily with the extent to which students have achieved Intended Learning Objectives (ILOs) of instruction. Results are used primarily for grading, and should be used for evaluating effectiveness of instruction. Effective assessment should be designed to assess a clear set of ILOs, to fit relevant student characteristics and be fair to everyone, provide meaningful, dependable and relevant information, give students early feedback, and provide a tool for evaluating appropriateness of objectives(1).

## The learning objectives

The first step in planning for assessment is to have clear objectives (ILOs) upon which tests will be based. The intended learning outcomes are important for clarifying the desired outcomes of teaching. They might include concepts, skills, theories, techniques or other types of information or competencies, including attitudes, such as respect for the patients. It should reflect the educational objectives of a presentation.

If we plan for Assessment of a hematological course as an example, then we shall expect by the end of the course, that students are able to:

- Take an adequate history (cognitive, affective) to assess presence of hematological disorder and any associated complications.
- Examine the patient and elicit the presence/absence of

important signs (psychomotor domains) such as:

- anemia
- jaundice
- growth retardation
- splenomegaly
- hepatomegaly
- lymphadenopathy
- Bleeding tendency: petechia, purpura and ecchymosis.
- Full description of a mass.
- Compensated or in heart failure
- Presence of other problems (e.g., coetaneous rash, CNS leukemia, gallstone, endocrine disorders)
- Demonstrate knowledge (cognitive domain) of the etiologies of both anemia and bleeding tendency.
- Demonstrate knowledge (cognitive) of the patho-physiology of the various types of anemia (deficiency, hypo plastic and hemolytic).
- Demonstrate knowledge of the patho-physiology of the various types of bleeding tendency (normal and abnormal hemostasis; vascular, platelet, and clotting factors disorders).
- Demonstrate knowledge (cognitive) of common pediatric malignancy; leukemia and lymphoma.
- Demonstrate knowledge (cognitive) of common hematological tests; appropriate laboratory studies and their interpretation.
- Explain principles of transfusion therapy (cognitive); the rationale for use, composition, way to prepare, amount, and frequency of administration of various blood products.
- State the indications for hospitalization (cognitive).
- State indications for stem cell transplantation (cognitive).
- Decide and apply a plan of management and follow up (cognitive) for individual cases of:
  - Acute hemolytic anemia
  - Chronic hemolytic anemia
  - Iron deficiency anemia
  - Hypo plastic anemia
  - Hemophilia
  - Platelet disorders
- Explain when and what other medications may be needed (cognitive), (antibiotics, vitamin K, vaccination, etc).

- Counsel the parents about care of patients (cognitive, affective) with bleeding tendency, chronic hemolytic anemia with respect to activity, feeding as well as genetic counseling for hereditary diseases.

## I- Formative Tests:

- **Direct observation** is the most valid way to assess students' skills utilizing a standardized checklist to reduce variations in scoring among different observers and increase the reliability of the assessment. Questioning students during observation can further assess their ability to integrate knowledge, skills, and attitudes. Direct observation can be done in the clinical setting while students interact with patients - this is the best method for formative assessment. Each student is observed performing a history and physical exam by residents and/or faculty on the wards, and in the ambulatory care setting.

- **A structured feedback report** is a standardized way to give feedback to students on their performance during a specific period of time. Teachers, clinical instructors, or staff working with or alongside students can complete these feedback reports. The reports can cover areas such as overall performance, demonstrated attitudes, and essential healthcare delivery skills. They are particularly useful for assessing characteristics such as personal attributes, attitudes, and professional values, which are difficult to test by other methods. Most feedback reports include objective rating scales to allow the assessor to quickly provide a formative assessment of the student's performance.

- **A care plan** is used to document the patient's problems, care required, and expected outcomes. Students are often required to create care plans to demonstrate their understanding of and ability to explain management required for a specific problem. The teacher may use care plans to assess the students' ability to select appropriate interventions and expected outcomes for the different problems presented.

- **Scored assignments;** students work in groups and are asked to give a speech (presentation) on one of Hematology/Oncology topics e.g. approach to a patient with severe epistaxis<sup>(2)</sup>.

- **The logbook** (also called a casebook) contains a list of skills or tasks that students should be able to perform. These tasks reflect the learning objectives for the course. The students are responsible for learning how to do each of the tasks, and when they believe they are ready, they can ask a teacher, tutor, or clinical instructor to assess their performance. During the session or course, students must perform all of the tasks to a satisfactory standard. The logbook contains as well a direct observation result, a structured feedback, care plans and assignments.

## II- Summative Assessment (end of course

### examination):

Authentic assessment derives its name from the idea that it tests students in skills and knowledge needed to succeed in the real world. Authentic assessment focuses on student task performance and is often used to improve learning in practical areas. An advantage of authentic assessment is that students may be able to see how they would perform in a practical, non-educational setting and thus may be motivated to work to improve. Authentic assessment (real life tasks) with both paper-and-pencil testing, and performance-based tasks are required for a complete assessment of student achievement to ensure the ability of the student to recognize, diagnose, and manage common pediatric problems in the area of hematology. The proposed plan assessment of student achievement will focus on a student's knowledge base, clinical skills and interpersonal/non-cognitive skills as stated in the objectives (ILOs)(1).

### Components of final exam:

#### a) Written examination: (blend of different types)

- Selected response tests require student to choose the correct answer, as in multiple-choice, true-false, and matching tests.
- Supply-response tests require students to respond with a word, short phrase, or complete essay answer.
- Restricted performance assessments are concerned with performance of a limited task that is highly structured, such as writing a brief paragraph on a given topic.
- Extended performance assessment involves more comprehensive and less structured tasks, such as writing an essay on a topic.
- Judgment in scoring; each selected item in selected- and supply-response is marked right or wrong so that scoring is completely objective. The essay provides more freedom of response with greater subjectivity in scoring. Two types of interpretation are likely to be most meaningful; norm-referenced and criterion referenced interpretations<sup>(1)</sup>.

#### b) Clinical examination

To prepare skills assessments, direct observation is the most valid method. However, because reliability of direct observation may be low or inconsistent due to observer bias, an assessor needs tools to standardize the assessment results. It is essential that the students have access to and be familiar with the instruments that will be used to assess their skills.

- **Checklists:** A checklist requires minimal judgment on the part of the assessor. It simply indicates whether a specific characteristic is present or absent, or if a particular action was taken or not taken. The checklist is a list of steps needed to perform a skill correctly. The assessor must indicate if each step was performed or not performed and may also have to indicate the quality of the performance.

Each step must be clearly and quickly defined to make the tool easy to use. Checklists contain only the key steps or tasks of a skill or procedure. It is essential that the students have access to and be familiar with the instruments that will be used to assess their skills.

A structured practical examination can be developed to assess a wide range of knowledge, skills, and attitudes such as history taking, physical examination, data interpretation, communication, decision-making, and demonstrated attitudes toward patients. The following are some of the basic components of a structured practical exam:

- All students rotate through multiple stations and are tested on the same knowledge, skills, and attitudes, such as:
  - history taking
  - examination of abdomen of patient with an abdominal mass
  - assessment of growth of a child with chronic hemolytic anemia
  - examination of lymph nodes
  - interpretation of a complete blood count of a patient with anemia
  - care plan to a patient with hemoarthrosis
- There is a limit to the amount of time each student can remain at a station. Each station is 15 minutes in duration; 10 minutes are allotted for testing and 5 minutes for feedback.
- There is an assessor at each station that requires observation.
- All students are assessed according to the same standards (check lists)(3)
- The checklists for the various stations contain eight to ten items corresponding to key skills. At any given station, a “pass” decision was taken for the student fulfilling at least 50% of the checklist items, a level that was set in order to conform to local regulations. Students failing in more than three stations were regarded as having failed the overall examination.

The requirements for learner success should be made clear, and the overall strategy should be to develop in students the ability to evaluate the quality of their own work in order to equip them to function as professionals with a commitment to life-long learning.

## Educational Assessment

The choice of an assessment tool depends on the purpose or goal of the assessment. Assessment might be made to establish rankings among individual students, to determine the amount of information students have retained, to provide feedback to students on their levels of achievement, to motivate students by recognizing and rewarding good performance, to assess the need for remedial education, and to evaluate students for class placement or ability grouping.

Criterion-Referenced Assessment allows interpretation of a test-taker’s score in relation to a specific standard or criterion. Candidates are measured against defined (and objective) criteria. Criterion-referenced assessment is often, but not always, used to establish a person’s competence (whether she/he can do something). The individual’s score is based not on how he or she does in comparison to how others perform, but on how the individual does in relation to absolute expectations about what he or she is supposed to know. Criterion-referenced tests measure what information an individual has retained and they give teachers feedback on the effectiveness of their teaching of particular concepts.

Norm-referenced assessment (colloquially known as “grading on the curve”), is not measured against defined criteria. This type of assessment is relative to the student body undertaking the assessment. It is effectively a way of comparing students. This means that standards may vary from year to year, depending on the quality of the cohort<sup>(1)</sup>.

For most instructional purposes, criterion referenced assessments are to be favored. They help students improve learning by determining what tasks they can and cannot perform. Criterion referenced interpretation is facilitated by assessment tasks that provide a detailed description of student performance. In testing, this means a larger number of test items per task.

At first glance, the criterion-referenced system presented may seem cumbersome or too time-consuming. However, one must consider its advantages.

- Criterion-referenced system has set objective standards for student performance (mastery testing).
- Criterion-referenced assessment does not vary from year to year (unless the criteria change).
- It helps to guide teachers; as to how effective was their method of teaching.
- It fosters feedback to students, as to which areas need remediation.
- It helps identify students with deficiencies, allowing teachers to focus on individual students.

## Validity and Reliability

After we do planning for assessment and having clear objectives toward clear intended learning outcomes upon which our test will be based, and to make sure that our students achieved these objectives (which are related to hematological and oncology disorders and associated complications).

The role of validity will be vital, to ensure the relevance and representative measures of our planned assessment.

A validity of a test (or) examination is that which tests exactly what is supposed to be measured, as it is directed toward interpretation and the use of assessment results.

It is crucial to remember that validity of test results must always be the primary objective, because it is clearly not possible to generalize any invalid findings (Hennekins.C 1987).

Validity will provide the necessary evidence for good student reasoning ability if they are already achieved.

We deal with validity as a unitary concept that is composed and relies on many forms of evidence, including content, criterion related and construct?

The Content Related Evidence deals with assessment that tests in a proper way the content and the objectives of the intended learning outcome. This proper way could be figured and achieved through good analysis, to the topic of hematology and oncology under study, identification of clear specific learning objectives, proper item sampling and tabulation description and in preparing an assessment procedure and most importantly, issues related to content validity, is the matter of adequate sampling. The sample that is under study should be representative sampling that represents the true picture (measured domain tasks). So proper sampling will ensure high validity. On the other hand there are many factors that may lower the validity regarding assessment results and that includes inadequate sampling which will affect the achievement results. On the other hand absence of relevance or presence of ambiguity or unnecessary clues and bias sampling will lead to improper outcomes as intended.

Sometimes low validity may arise due to less interpretation by objectives, which rely on few tests, inadequate time allowed, or inadequate scoring guides. These points beside many others will lead to lower validity. So careful logical analysis will ensure the best content related evidence of validity.

Validity could be provided best by balancing the test or examination items in relation to the aspects to be measured, having clear and definite instructions about the task and or examination, using clear correct language, making sure that students understand the importance of dealing with different items of the test or task under study, and most importantly is to provide an accurate assessment of students responses and answers. On the other hand Criterion-Related Evidence deals mainly with two measures set, i.e. relationship between the scoring we gave and the degree of achievement of intended learning outcomes. This type of validity is mainly of 2 types; the first type is called predictive study dealing with criterion, using test performance for predicting future performance and the second type, which is called concurrent as both measures i.e. the criterion and the test, are measured at the same time as when we intend to measure the skills of students using adequate test to estimate the level of performance during actual study.

We can estimate this type of validity using either

correlation coefficient test or expectancy table data presentation.

In correlation coefficient test, the item of measurement used is  $r$  with range from (-1 to +1) indicating highly negative and positive association. This type of measurement is usually used in correlation studies when we intend to find the relationship between 2 variables or sets of measures as we are intending to estimate the relationship between scoring available and criterion measured. The positive and negative relationship depends on whether there is inverse or reverse relationship between the 2 measures.

On the other hand expectancy table is another type of measurement, and is so useful for test score prediction. The table is simple and can be represented as follows: (Gronlund N 2006)

It is evident that the expectancy table is more valuable when dealing with practical events to provide information on the predictive efficiency of the test.

Regarding the Construct-Related Evidence, it is concerned mainly in assessing hypothetical qualities or what is called construct i.e. variables related to ability of students regarding reasoning, reading aptitude and or comprehension etc. Such a type of validity depends mainly on describing theoretical issues under assessment which has a relation to the construct nature, describing properly the aspects of the test, possible correlation between variables and estimating the predictive effectiveness of the test under assessment.

Combination of these factors will provide a well constructed related evidence.

We can conclude from this review that obtaining good validity will rely on how much we are considering some important consequences of assessment of students. These are mainly focusing on the degree of ability of assessment toward improving motivation, performance, self assessment skills, transfer of learning to related areas, focusing on independent learning, good study habits encouragement, students attitude toward school work and whether positive changes were achieved, as well as any negative impact toward each item mentioned above, were detected.

## Reliability

To have a reliable test is to obtain good quality test results, besides being able to get repeatable results that can be compared, in other words obtaining the same results using different samples of the same test or task and at a different time.

Achieving this target will assure more generalizability of our test assessment. So reliability is really concerned with the consistency of test score from one measurement to another, and is subjected to mainly 2 types of error, the random error which is related to the effect of so-called

measurement test score errors, which are characterized by their difficulty to control and lead sometimes to inconsistency from one measurement to another, thus leading to lower or higher results than should be, but in spite of their difficulty to controlling and that they cannot be predicted with accuracy, they still could be estimated using some statistical methods and they are considered as normal variations, contrary to systemic error which is the second type, and this error if present will affect the results by inflating the scores or lowering them affecting the validity of test score and undependable results as a consequence.

Test score reliability is usually measured by reliability of coefficient or the standard error as a derivative.

The reliability coefficient is more concerned with test quality besides relative merits of different test comparisons. While the standard error of measurement deals with interpretation of student test scores, that is directly applied. And that is why standard error is more informative and useful than the other test.

Depending on the type of reliability evidence we are searching for, reliability has four basic methods for estimation: test-retest method which mainly provides stability of our test score in relation to a time period; Equivalent-form method concerned with consistency of test scoring using different sample items; Test-retest equivalent form gathering both the consistency and different forms of a test and the fourth type of reliability is the internal-consistency methods which provide consistency of test scores over different parts of the test.

The traditional reliability is known to be of value if we are dealing with norm referenced tests, but this will provide misleading results if we are dealing with criterion-referenced tests pertaining to the consistency of our test results but with more low correlation estimates simply because in criterion-referenced tests are not concerned with individual differences, but in determining mastery and this could be achieved by measuring percentages among mastery and non mastery decisions over the 2 forms of the test using the proper equation listed below:

$$\% \text{ consistency} = \frac{\text{Masters (both forms)} + \text{Non masters (both forms)}}{\text{Total number in group}} \times 100$$

As is shown here we need to have two forms of tests in order to apply this procedure, otherwise it is a simple one. Still issues of the minimum acceptable level of consistency represents a kind of limitation in using this procedure.

So in order to estimate and evaluate the variability of our performance assessment, it is better done by the use of scoring rubrics, where level of performance is described and categorized from high to low and to be judged and categorized according to the degree of quality performance,

depending on 2 judges' scores. The Performance Ratings by two Independent Judges table illustrates this type of estimation.

There are many factors that may affect reliability including on particular, the length of the examination where it is known that a many item test is preferable and more valid, taking into consideration not exhausting the students. The more time allowed for the test the more it is proper and the more we are confident of achieving better reliability of the test. Another factor is the matter of difficulty items, where reliability will be affected by both increased or decreased difficulty.

An additional important factor is the validity of the test, as the relationship between validity and reliability can be illustrated in the diagram listed below, where we can obtain a reliable and valid test at the same time (sometimes called accurate and precise test where we get an accurate test and repeatable results), or we may obtain a reliable(repeatable) test but not valid(systemic error may be one of the causes that play part) and lastly possibility in which our test will be neither valid(not accurate) nor reliable(cannot obtain the same results on different occasions). The diagram below illustrates these possibilities(Swinscow and Campbell 2002).

In conclusion we should ensure the achievement of valid and reliable tests for successful assessment during planning for measuring health profession competencies.

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**Expectancy Table:**

Grouped Scholastic Aptitude Scores (Stanines)	Percentage in Each Score Category Receiving Each Grade				
	F	D	C	B	A
Above Average (7, 8, 9)			X3	X2	X1
Average (4, 5, 6)		X4	X3	X2	X1
Below Average (1, 2, 3)	X3	X2	X1		

**Performance Ratings by two Independent Judges:**

Ratings by Judge 1						
Ratings by Judge 2	Scores	1	2	3	4	Raw Totals
4				2	6	8
3			3	7	1	11
2	2		6			8
1	5					5
Column Totals		7	9	9	7	32