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Prevalence of Oral Cancer and Potentially Malignant Lesions among Shammah Users in Yemen

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Summary:

The purpose of this study was to assess the prevalence of oral precancerous lesions and squamous cell carcinoma (OSCC) in Yemeni users of *shammah*, a traditional smokeless tobacco habit known in the Arabian Peninsula. The study group comprised 199 male and one female *shammah* users who were interviewed via a standardized questionnaire and clinically examined in 48 Yemeni villages and cities. Cases with oral leukoplakia (OL) or mucosal burns (MB) were compared with users without any lesion. MB was detected in 31%, of which 46.8% were located on the tongue or floor of the mouth, and OL in 27%, of which 59.2% were located in the same region. In addition, two cases (1%) of apparent OSCC were identified. Statistically significant increased OR (95% CI) of OL were (a) 6.91 (2.66–17.95) for an average duration of the respective *shammah* application >5 min.; (b) 4.90 (1.99–12.08) for a daily frequency of those applications >10; and (c) 4.22 (1.43–12.43) for a daily duration >6 h of chewing qat, also a traditional habit in **Yemen**. Likewise, decreased OR were (a) 0.39 (0.18–0.85) for rinsing the mouth after the *shammah* application; (b) 0.36 (0.17–0.78) for successful attempts to stop the use in the past; and (c) 0.26 (0.09–0.72) for existing knowledge about the carcinogenicity of *shammah* that was present in only 19% overall. In conclusion, evidence was shown for a significant association

Between the prevalence of OL and the daily duration of *shammah* application in a dose-dependent manner. An appropriate public health program might help to reduce this potential OSCC burden in *shammah* users.

Keywords: Mouth mucosa; Chemical burn; Oral leukoplakia; Squamous cell carcinoma; Mouth neoplasm's; Potentially malignant lesions; Smokeless tobacco; Shammah; Qat Yemen

Introduction:

Smokeless tobacco (ST) in the modes of chewing tobacco and snuff is used in a large number of variations worldwide. ST habits have been extensively described from South- and Southeast Asia as the betel quid chewing habit and as snuff dipping or *snus* from the USA and Scandinavia.² and ³ While there is also increasing information on similar habits from Northern Africa,^{5, 6, 7, 8, 9, 10, 11, 12} and ¹³ the use of ST in the Arabian peninsula has less well been studied and reported.^{14, 15, 16, 17, 18, 19, 20, 21, 22} and ²³ One such habit in this area is the use of *shammah*, which is common in some southern parts of the Kingdom of Saudi Arabia (KSA), Algeria, and Yemen. A similar product is referred to as *toombak*, the traditional variation of snuff dipping from Sudan.^{5, 6, 7, 8, 9, 10, 11, 12} and ¹³ *Shammah* is a complex ST mixture consisting of powdered tobacco leaf, slaked lime (calcium carbonate), ash, oil and other substances, e.g. black pepper, mint, and flavours.^{15, 21, 22} and ²³ The use of sodium carbonate in *shammah* has also been described,²⁰ whereas sodium carbonate, sodium sesquicarbonate, or sodium bicarbonate are regular ingredients of *toombak*.^{4, 5, 6, 7, 8, 9, 10, 11, 12} and ¹³ All these products are moist with a strong aroma, highly addictive and their use is widespread among males.^{7, 11} and ¹² *Shammah* in Yemen exists in two varieties as a greenish-yellow (so-called "white") or brownish to black powder or paste.²¹ The material is placed in the buccal lower and sometimes upper labial vestibule. Only a few reports on the use of *shammah* and associated potentially premalignant oral lesions such as oral leukoplakia (OL), and furthermore typical lesions such as alkaline burn and gingival recession, have been published from Yemen and the Jizan Province in the southern KSA, that is directly adjacent to Yemen.²⁰ and ²⁴ In 1982, the prevalence of OL-like lesions in the general population in Jizan was estimated to 15–42% ($n = 661$), the prevalence of *shammah* users was 28.3%, and the prevalence of OL in the latter was 69%.²⁰ In a 2002 study ($n = 2500$), the prevalence of OL in the general Yemeni population was estimated to 1.72%, the prevalence of *shammah* users was 1.6%, and the prevalence of OL in the latter was 72.5%.²⁴ Two cases of Algerian migrants using *shammah* with OL-like lesions were described from Germany Contrary to precancerous lesions, the

association of *shammah* with oral squamous cell carcinoma (OSCC) has been comparatively well documented on an epidemiological base.^{14, 15, 16, 17, 19, 22 and 23} Hannan et al. (1986) described a brand of *shammah* and its potential carcinogenicity based on in vitro bioassays.¹⁸ One experimental study showed that mint in brown *shammah* may prevent *shammah*-induced carcinogenesis in hamster cheek pouch.²¹

Besides the use of *shammah*, the chewing of qat leaves (*Catha edulis*) is common in Yemen. Oral lesions associated with qat chewing have been described.^{24 and 27} Smoking tobacco in different varieties is also known from Yemen. Alcohol consumption on the other hand is not widely used; however, answers regarding its consumption cannot be relied upon because of legal, social and religious implications.⁵

Due to the small number of available publications on the use of *shammah* in Yemen, it was the purpose of the present study to examine the effects of this particular habit on the oral mucosa.

Patients and methods:

A total of 200 voluntary Yemeni *shammah* users were examined for oral mucosal lesions between April and October 2004 in 48 different Yemeni villages and cities. Individual interviews were performed via standardized questionnaires and comprised: (1) basic data on age, gender, residence, marital status and education, (2) present medical status, (3) smoking history, (4) qat use history, and (5) detailed *shammah* use history. One examiner (AN), in natural light with additional flashlight, using two mouth mirrors, performed all oral examinations. Oral lesions were recorded using a digital camera.

The guidelines for epidemiology and diagnosis of oral mucosal diseases and conditions proposed by WHO were used.²⁸ Oral leukoplakia (OL) was defined according to the Uppsala agreement of the WHO definition.²⁹ Oral mucosal burns (MB) were defined as: (1) clinically white or white-yellow lesions that could not or only partly be wiped off, (2) a history of burning sensation during 48 h before examination, and (3) an individual experience that comparable lesions normally quickly disappeared, when *shammah* had been placed elsewhere or the use had been temporarily stopped.

Two case-control comparisons were performed. The first compared individuals with the diagnosis "mucosal burn" (MB) with those without any mucosal lesion. The second compared those with the diagnosis "oral leukoplakia" (OL) with the same control group. The explanatory variables

assessed were age, education, attitude towards *shammah*, smoking and qat history, type, duration and intensity of *shammah* use, and mouth rinse after *shammah* use. In addition, correlation with objective findings of *shammah* use, e.g. localized gingival recessions or tooth staining, was assessed.

Statistical analysis comprised basic descriptive statistics, Mann–Whitney *U*-test, and logistic regression for age-adjusted odds ratios (OR), when appropriate. SPSS 13 was used for analyses and $p < 0.05$ considered significant.

Results:

• Basic data

The study group comprised 199 males and one 82-year-old female. As most individuals could only remember their year of birth, age was ascertained as complete years at January 1, 2004. For males, the median (mean, SD) age was 30 (33.2 ± 13.3) years. With a range from 11 to 74 years. Of all individuals, 125 (62.5%) were resident in northern, 50 (25%) in central, and 25 (12.5%) in southern Yemen. The number of illiterates was 86 (43%), and 125 (62.5%) were married. The most frequent diseases were renal diseases ($n = 9$; 4.5%), diabetes ($n = 5$; 2.5%), heart diseases ($n = 4$; 2%), and rheumatic diseases and nutritional disorders with two (1%) cases each. The number of those in outpatient medical treatment was 16 (8%).

• Smoking and qat history

Of all individuals, 122 (61%) were non-smokers, 38 (19%) smoked <10, 7 (3.5%) 10–20, and 33 (16.5%) >20 cigarettes per day. Of all smokers, 35 (45.4%) smoked before, 5 (6.5%) simultaneous to, and 37 (48.1%) after the use of *shammah*. Qat was used by 183 individuals (91.5%). One hundred (50%) individuals used qat for more than six, 37 (18.5%) for more than three, and 46 (23%) for fewer than 3 h per day.

• Shammah history

White *shammah* was used by 143 (71.5%) and black *shammah* by 57 (28.5%) of all individuals. Ninety-one individuals (45.5%) had started the use of *shammah* in childhood, 35 (17.5%) during puberty, and 74 (37%) as adults. *Shammah* was placed under the tongue by 139 individuals (69.5%), in the left vestibule by 32 (16%), under the lower lip by 14 (7%), in the right vestibule by nine (4.5%), onto the tongue by four (2%), and in one case each (0.5%) under the upper lip or all over the mouth. A burning sensation in these areas

was reported by 76 (38%) and resulting pain by 65 (32.5%) of all users. Eighty-three individuals (41.5%) described themselves as unable to quit the use of *shammah*. Knowledge of the disadvantages of *shammah* was stated by 38 (19%) of all.

• Clinical examination

Table 1 shows the distribution of detected lesions by type. Overall, the prevalence of MB was 31% and that of OL 27%, while no user was diagnosed with both MB and OL. When taken together as *shammah*-associated lesions, the prevalence was 58%. The 82-year-old female ([Fig. 1](#)) and a 39-year-old male ([Fig. 2](#)) presented with apparent OSCC. Both were heavy *shammah* users with a frequency of >10/day and duration of each application >5 min. The woman was a heavy smoker (>20 cigarettes/day) and moderate qat user (3–6 h) in addition, the male was a non-smoker and heavy qat user (>6 h).

Table 1

Distribution of oral lesions in the study group ($n = 200$)

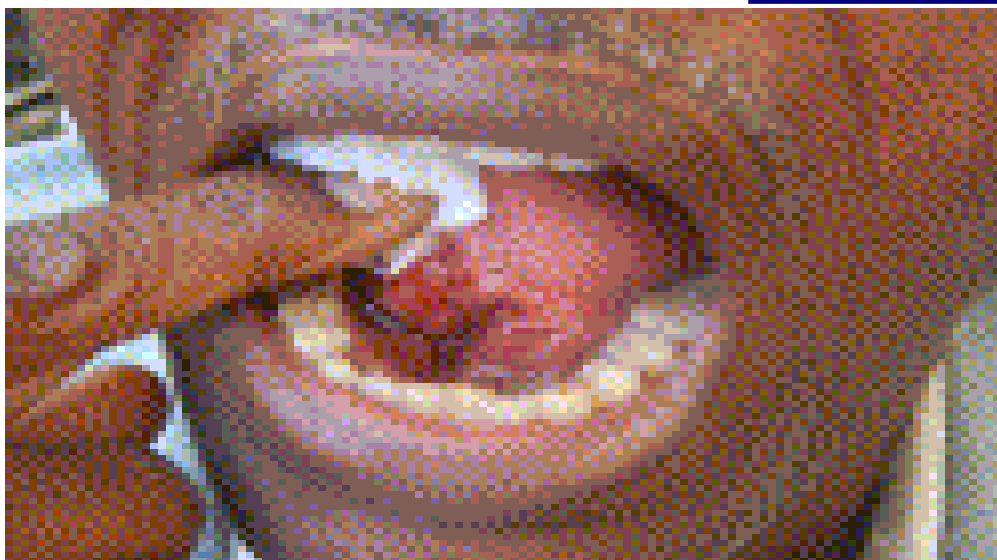
	n	% of category	% of total
Mucosal Burns (mb)	62	100.0	31.0
Oral Leukoplakias (ol)	54	100.0	27.0
Homogeneous	40	74.1	20.0
Flat	25	46.3	12.5
Wrinkled	15	27.8	7.5
Non-Homogeneous	14	25.9	7.0
Verrucuous	13	24.1	6.5
Erythroleukoplakia	1	1.9	0.5
Total of mb and ol	116	100.0	58.0
Other Lesions	26	100.0	13.0

	n	% of category	% of total
Frictional Keratosis	8	30.8	4.0
Oral Lichenoid Reaction	8	30.8	4.0
Pseudomembraneous Candidiasis	5	19.2	2.5
Oral Squamous Cell Carcinoma	2	7.7	1.0
Morsicatio Buccarum	1	3.8	0.5
Oral Lichen Planus	1	3.8	0.5
White Sponge Nevus	1	3.8	0.5
Total of Lesions	142	100.0	71.0



(127K)

Figure 1. Apparent oral squamous cell carcinoma (OSCC) in the left retromolar and buccal region of an 82-year-old female, who used *shammah* with a frequency of >10/day and >5 min per application, in addition >20 cigarettes/day, and chewed qat for 3–6 h/day.



(128K)

Figure 2. Apparent oral squamous cell carcinoma (OSCC) in the floor of the mouth of a 39-year-old male, who used shammah with a frequency of >10/day and >5 min per application, in addition chewed qat for >6 h/day, but was a non-smoker. (Clinical photographs: A.N.)

Table 2 shows the distribution of MB and OL by location. In homogeneous OL, which accounted for 74.1% of all OL, the vestibule and buccal mucosa were the most frequent location with 20 (50%) cases. Inhomogeneous OL were found most frequently on the ventral tongue in eight (57.1%) cases. Overall, OL were most frequent on the tongue in 24 (44.4%), followed by the vestibule and buccal mucosa in 21 (38.9%) cases. In contrast, MB were most frequent at the floor of the mouth with 20 (32.3%), followed by vestibule and buccal mucosa with 19 (30.6%), and gingiva with 14 (22.6%) cases.

Table 2.

Local distribution of oral leukoplakias (OL) and mucosal burns (MB)

	OL (n = 54) [n(%)]	MB (n = 62) [n(%)]

	Homogeneous		Inhomogeneous		Total		Total	
Vestibule and Buccal Mucosa	20	(50.0)	1	(7.1)	21	(38.9)	19	(30.6)
Tongue (dorsal, Lateral, Base)	3	(7.5)	3	(21.4)	6	(11.1)	4	(6.5)
Tongue, Ventral	10	(25.0)	8	(57.1)	18	(33.3)	5	(8.1)
Floor of the Mouth	6	(15.0)	2	(14.3)	8	(14.8)	20	(32.3)
Gingiva	1	(2.5)	–	–	1	(1.9)	14	(22.6)

Case-control comparisons

Table 3 compares the MB cases with the individuals without any lesion as control group. MB cases were significantly older than controls with a median (mean, SD) of 31 (36.4 ± 13.9) versus 25 (29.1 ± 12.4) years ($p = 0.001$) and demonstrated a lesser knowledge about *shammah* disadvantages ($p = 0.022$). Within all other explanatory variables, no significant differences were detected. Only the numbers of gingival recessions and localized tooth staining due to *shammah* use were significantly increased ($p < 0.001$).

Table 3.

Characteristics of individuals with the diagnosis of mucosal burn (MB) ^a OR: Odds ratio, age-adjusted.

Variables	MB cases (n = 62)[n(%)]	Without any lesion controls (n = 58)[n(%)]	OR _± (95% CI)	p value
Marital status				
Married	46 (74.2)	27 (46.6)	2.24(0.90–5.58)	0.084
Not married	16 (25.8)	31 (53.4)	1	
Education				
At least primary school	33 (53.2)	37 (63.8)	0.78(0.36–1.69)	0.534
Illiterate	29 (46.8)	21 (36.2)	1	
First use of shammah				
Childhood	32 (51.6)	23 (39.7)	1.85(0.80–4.27)	0.152
Puberty	9 (14.5)	11 (19.0)	1.22(0.41–3.65)	0.726
Adulthood	21 (33.9)	24 (41.4)	1	

Variables	MB cases (n = 62)[n(%)]	Without any lesion controls (n = 58)[n(%)]	OR _± (95% CI)	p value
Knowledge about shammah disadvantages				
Yes	9 (14.5)	18 (31.0)	0.33(0.13–0.85)	0.022
No	53 (85.5)	40 (69.0)	1	
Able to quit shammah				
Yes	38 (61.3)	37 (63.8)	0.86(0.40–1.85)	0.698
No	24 (38.7)	21 (36.2)	1	
Smoker				
Yes	26 (41.9)	20 (34.5)	1.58(0.73–3.41)	0.247
No	36 (58.1)	38 (65.5)	1	
Qat chewer				
Yes	57 (91.9)	51 (87.9)	1.20 (0.34–4.17)	0.778

Variables	MB cases (n = 62)[n(%)]	Without any lesion controls (n = 58)[n(%)]	OR _± (95% CI)	p value
No	5 (8.1)	7 (12.1)	1	
Qat chewing per day				
>6 h	27 (47.4)	25 (49.0)	1.42 (0.57–3.59)	0.453
3–6 h	12 (21.1)	9 (17.6)	1.42 (0.45–4.45)	0.545
<3 h	18 (31.6)	17 (33.3)	1	
Type of shamamah				
Black	17 (27.4)	14 (24.1)	1.44 (0.61–3.38)	0.402
White	45 (72.6)	44 (75.9)	1	
Frequency of shamamah use per day				
>10	25 (40.3)	21 (36.2)	1.07 (0.48–2.39)	0.867
5–10	7 (11.3)	9 (15.5)	0.67 (0.21–2.14)	0.495

Variables	MB cases (n = 62) [n(%)]	Without any lesion controls (n = 58) [n(%)]	OR _± (95% CI)	p value
1-5	30 (48.4)	28 (48.3)	1	
Duration of shammah use per serving				
>5 min.	17 (27.4)	13 (22.4)	1.58 (0.63–3.97)	0.331
1–5 min.	20 (32.3)	13 (22.4)	2.00 (0.81–4.97)	0.134
<1 min.	25 (40.3)	32 (55.2)	1	
Mouthrinse after shammah use				
Yes	36 (58.1)	39 (67.2)	0.56 (0.29–1.23)	0.150
No	26 (41.9)	19 (32.8)	1	
Gingival recessions >3 mm				
Yes	23 (37.1)	10 (17.2)	2.06 (0.83–5.09)	0.119
No	39 (62.9)	48 (82.8)	1	

Variables	MB cases (n = 62) [n(%)]	Without any lesion controls (n = 58) [n(%)]	OR _{adj} (95% CI)	p value
Tooth staining				
Localized	47 (75.8)	16 (27.6)	7.83 (3.38–18.16)	<0.001
No or generalized	15 (24.2)	42 (72.4)	1	

Table 4 compares the OL cases with the identical control group. The difference of median age (mean, SD) in OL cases with 28.5 (31.6 ± 12) versus 25 (29.1 ± 12.4) years was not significant ($p = 0.063$). OL cases were significantly more often married ($p = 0.035$), showed a lesser knowledge about the disadvantages ($p = 0.010$) and less ability to quit *shammah* use ($p = 0.09$). Smoking history, type of *shammah* or duration of its use with regard to lifetime did not demonstrate significant differences. OL was significantly more likely in heavy qat users (>6 h/day; $p = 0.009$) and in heavy *shammah* users with >10 applications/day ($p = 0.001$) or > 5 min. per application ($p < 0.001$), the latter indicating the highest risk with an odds ratio of 6.91. In addition, OL cases had significantly less frequently rinsed their mouth after *shammah* application ($p = 0.018$). The numbers of gingival recessions ($p = 0.038$) and localized tooth staining were significantly increased ($p < 0.001$).

Table 4.

Characteristics of individuals with the diagnosis of oral leukoplakia (OL) an OR: Odds ratio, age-adjusted.

Variables	OI cases (n = 54)[n(%)]	Without any lesion controls (n = 58)[n(%)]	Ora (95% ci)	P value
Marital status				
Married	37 (68.5)	27 (46.6)	2.87 (1.08–7.65)	0.035
Not Married	17 (31.5)	31 (53.4)	1	
Education				
At least primary school	30 (55.6)	37 (63.8)	0.75 (0.35–1.61)	0.457
Illiterate	24 (44.4)	21 (36.2)	1	
First use of shamamah				
Childhood	27 (50.0)	23 (39.7)	2.27 (0.93–5.50)	0.071
Puberty	14 (25.9)	11 (19.0)	2.63 (0.91–7.60)	0.074
Adulthood	13 (24.1)	24 (41.4)	1	
Knowledge about shamamah disadvantages				
Yes	6 (11.1)	18 (31.0)	0.26 (0.09–0.72)	0.010
No	48 (88.9)	40 (69.0)	1	
Able to quit shamamah				

Variables	Ol cases (n = 54)[n(%)]	Without any lesion controls (n = 58)[n(%)]	Ora (95% ci)	P value
Yes	21 (38.9)	37 (63.8)	0.36 (0.17–0.78)	0.009
No	33 (61.1)	21 (36.2)	1	
Smoker				
Yes	19 (35.2)	20 (34.5)	1.03 (0.47–2.25)	0.973
No	35 (64.8)	38 (65.5)	1	
Qat chewer				
Yes	52 (96.3)	51 (87.9)	3.22 (0.63–16.56)	0.163
No	2 (3.7)	7 (12.1)	1	
Qat chewing per day				
>6 h	35 (67.3)	25 (49.0)	4.22 (1.43–12.43)	0.009
3-6 h	10 (19.2)	9 (17.6)	3.38 (0.90–12.65)	0.071
<3 h	7 (13.5)	17 (33.3)	1	
Type of shammah				
Black	21 (38.9)	14 (24.1)	2.17 (0.95–4.96)	0.068
White	33 (61.1)	44 (75.9)	1	

Variables	OI cases (n = 54)[n(%)]	Without any lesion controls (n = 58)[n(%)]	Ora (95% ci)	P value
Frequency of shamamah use per day				
>10	37 (68.5)	21 (36.2)	4.90 (1.99–12.08)	0.001
5–10	7 (13.0)	9 (15.5)	1.93 (0.55–6.74)	0.301
1–5	10 (18.5)	28 (48.3)	1	
Duration of shamamah use per serving				
>5 min.	30 (55.6)	13 (22.4)	6.91 (2.66–17.95)	<0.001
1–5 min.	13 (24.1)	13 (22.4)	2.71 (0.96–7.68)	0.061
<1 min.	11 (20.4)	32 (55.2)	1	
Mouthrinse after shamamah use				
Yes	25 (46.3)	39 (67.2)	0.39 (0.18–0.85)	0.018
No	29 (53.7)	19 (32.8)	1	
Gingival recessions >3 mm				
Yes	20 (37.0)	10 (17.2)	2.98 (1.06–8.37)	0.038
No	34 (63.0)	48 (82.8)	1	

Variables	OL cases (n = 54)[n(%)]	Without any lesion controls (n = 58)[n(%)]	Ora (95% ci)	P value
Tooth staining				
Localized	34 (63.0)	16 (27.6)	4.73 (2.10–10.67)	<0.001
No or generalized	20 (37.0)	42 (72.4)	1	

Finally, OL cases were compared to MB cases with regard to these variables. OL cases were significantly less frequently able to quit (38.9 versus 61.3%; OR: 0.45; 95% CI: 0.21–0.96; $p = 0.040$). They demonstrated a longer duration of daily qat use >6 h (67.3 versus 47.4%; OR: 3.02; 95% CI: 1.08–8.38; $p = 0.034$), a higher frequency of *shammah* use >10/day (68.5 versus 40.3%; OR: 4.05; 95% CI: 1.66–9.85; $p = 0.002$), and longer duration per application (>5 min.: 55.6 versus 27.4%; OR: 4.13; 95% CI: 1.61–10.60; $p = 0.003$). No other significant differences were demonstrated between OL and MB cases.

Discussion:

In the present study, we demonstrated a remarkably high prevalence of oral pre-cancerous lesions, namely, OL with 27%, and OSCC (1%) in Yemeni *shammah* users. With regard to the explanatory variables, OL was significantly associated with daily frequency and duration of the respective *shammah* applications, but not lifetime duration, the daily duration of qat use, missing knowledge of *shammah* disadvantages, missing ability to quit *shammah* use, and, interestingly, missing mouth rinse after *shammah* use. It should be clearly emphasized that a non-*shammah* using control group was not yet available for this preliminary study and, therefore, those associations apply only for *shammah*-users.

With regard to methodology, it has been proposed in the literature to classify the clinical appearance of these ST lesions with a four-grade^{and 10} and qat lesions with a three-grade scale,²⁴ while a clear association of these grades

with the amount of dysplasia or malignancy has not yet been demonstrated. The alkaline ingredients of ST preparations like *toombak* or *shammah* have been strongly associated with oral white lesions and can induce alkaline mucosal burns,^{3, 7, 11 and 26} Mucosal burns (MB), however, have been defined as an explicit differential diagnosis of OL,³⁰ as they should disappear within days to weeks after cessation of the habit. Based on these considerations, the working definition of MB cited above was used to differentiate transient (MB) from persistent (OL) oral white lesions. Consequently, the true prevalence of OL in the present study might be even higher than reported and 27% represents a lower limit, as OL possibly could have been reported as MB.

The mean age of *shammah* users of 33.2 ± 13.3 years in the present study was lower than in the population-based studies on *shammah* from Yemen and on *toombak* from Sudan^{and 12} that both described a predominance of these ST habits starting with the fourth decade. Nevertheless, it has also been shown that there is an abrupt increase of *toombak* usage in late adolescence up to 25%.¹² In our sample, as many as 63% had started the use of *shammah* before adulthood. The mean age of OL cases was also lower than in the cited study from Yemen, where the age peak of cases with *shammah* lesions was in the fifth and sixth decades,²⁰ and data from Sudan, where the mean age of cases with *toombak*-associated lesions was 48.4 years.

The proportion of female cases in these studies of ST lesions amounted to 43% in *shammah* and 18% in *toombak* users,^{10 and 20} whereas in the present study only one female volunteer could be evaluated. As (1) this preliminary study used a non-standardized sample, (2) females are known to underreport ST habits for socio-cultural reasons in these ethnicities and (3), both females and/or older females or males might not have been reached during the retrieval process in a representative number, there is a possible selection bias with regard to these differences described above. It should also be emphasized that the geographical distribution of the sample was not representative for the overall Yemeni population, as *shammah* users were identified predominantly in northern Yemen with 62.5%, while presently, the highest population density is found in central Yemen.³¹ In conclusion, these results of the present study can be generalized only with appropriate caution.

Smoking tobacco has been described in up to 12% of adult users of *toombak*,^{10 and 12} while no data are available on *shammah* users. However, when evaluating smoking as a dichotomous variable, no significant association with MB or OL could be demonstrated in the present study. Controversially, an elevated level of qat chewing of > 6 h/day was significantly associated with OL ($p = 0.009$), but not MB ($p = 0.453$), and

could represent a possible confounder of OL. Recently, Ali et al. reported on 1528 qat chewers in a hospital-based study in Yemen, representing a prevalence of 61% ($n = 2500$).²⁴ Of these, 2.4% demonstrated OL, and 78% within this group were *shammah* users.²⁴ In the present study, qat chewing was a nearly ubiquitous finding with 91.5%, suggesting a possible synergistic effect in the formation of OL, when used > 6 h/day.

A possible preventive effect of black *shammah*²¹ was neither demonstrable in the OL cases, where it showed neither a significant effect, nor in the two OSCC cases, which both had used black *shammah*. However, no data on the ingredients of the respective mixtures were available. While the oral vestibule has consistently been described as the location where *toombak*, as well as *shammah*, are commonly placed in the mouth,^{11 and 21} the sublingual space was the predominant location in the present study with 69.5%. Interestingly, the most frequently reported sites of OSCC among *shammah* users were tongue (33%) versus vestibule (32%),²³ tongue and floor of the mouth (33%), retro-molar trigone (18%), and buccal mucosa (49%).¹⁵

Direct contact of *toombak* with adjacent tissue of the lower lip, lower vestibule, and floor of the mouth has been demonstrated as an important factor in carcinogenesis in both *shammah* and *toombak* users.^{8 and 14} In this context, it might be noteworthy that 47.5% of homogeneous OL, 92.9% of

inhomogeneous OL, 59.2% of the total of OL, and 46.8% of MB in the present study were detected on the tongue or the floor of the mouth (Table 2). In addition, it could be demonstrated that, in the predominantly Muslim study group, the habit of frequently washing and rinsing the mouth, as demanded by religious rules,^{7 and 10} was associated with a significant lower prevalence of OL ($p = 0.018$).

In *toombak*-associated lesions, a significant association between lifetime duration of the habit >10 years, but not a daily frequency >10 has been reported, and it was concluded that also the average retention time of the quid should be recorded.¹⁰ In the present study, an average duration of the respective *shammah* applications >5 min represented the highest OR for OL with 6.91 (95% CI: 2.66–17.95; $p < 0.001$), followed by the daily frequency >10 with 4.90 (95% CI: 1.99–12.08; $p = 0.001$). Similarly, the OR in OL versus MB was significantly increased with regard to a duration of the application >5 min. (OR: 4.13; 95% CI: 1.61–10.60; $p = 0.003$) and daily frequency > 10 (OR: 4.05; 95% CI: 1.66–9.85; $p = 0.002$).

Interestingly, and in opposite to OSCC, estimates for the prevalence of oral pre-malignant lesions like OL in *shammah* or *toombak* users seem to be

missing so far. Though it was not the original purpose of those studies, it is possible to calculate some of these estimates from the data reported by Salem et al. (69%),²⁰ reported by Ali et al. (72.5%),²⁴ and from the substantial population-based studies by Idris et al. (22.2%).^{7 and 10} While the prevalence of OL of 27% in the present study matches well to the latter, it seems possible that MB have been reported as OL in the former studies, as the combined prevalence of OL and MB in the present study amounted to 58%.

The fact that none of the 200 volunteers agreed into an originally intended biopsy has to be considered as a certain limitation of the present study. There is only sparse information about the histopathological appearance of *shammah*-induced lesions, describing possible epithelial hyperplasia, dysplasia, and *carcinoma in situ*.^{20 and 26} Therefore, it is presently impossible to delineate the average amount of precancerous alterations in those lesions. In *toombak*-associated lesions, a comparably low prevalence of epithelial dysplasia of 7.1% has been demonstrated,¹⁰ and the number of *toombak* dippers was also not significantly increased in epithelial atypia (ET) detected by exfoliate cytology (38%) versus non-ET (33%).⁴

In *toombak*-associated OSCC, however, a significantly increased incidence of mutations of the *p53* gene has been described,⁶ and it has been postulated that the natural history of these ST-associated carcinomas might bypass the state of dysplasia.^{3 and 6} Thus, potentially malignant oral lesions like OL could play an important role in the natural history of ST-

Associated OSCC in *toombak* and *shammah* users, and there are clinical descriptions that underline this association.⁵ However, these considerations are based on small case numbers and deserve further investigations. Recently, an IARC working group meeting on ST has repeated the conclusion that there is sufficient evidence that ST causes oral cancer.³²

In conclusion, the present study gave evidence for a significant association of the prevalence of OL with the daily duration of the contact of *shammah* with the oral mucosa in a dose-dependent manner. In addition, a lack of knowledge on *shammah* disadvantages and a lack of ability to quit this habit were inversely associated with OL. Clinically, the latter should give reason for an intensive public health care information campaign on the carcinogenicity of *shammah*, as oral carcinomas were found with a prevalence of 1% in this sample of *shammah* users.

Prevalence of Antibodies to Measles and Rubella in Sana'a, Yemen

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Abstract:

Prevalence of antibodies to measles and rubella was tested in sera collected from 1368 subjects in urban and rural Sana'a. Overall, 11.7% had no antibodies to measles and 14.6% had no antibodies to rubella, despite the fact that measles but not rubella vaccine is included in the vaccination program in **Yemen**. Of 89 children <5 years of age 49 (55.1%) had no detectable antibodies to measles, demonstrating that supplementary measles immunization campaigns are required to prevent virus circulation. Assessment of measles immune status among infants in the first year of life is required to determine the optimum age for measles vaccination. Rubella vaccination should be considered with care in **Yemen**.

Keywords: Rubella; Measles; **Yemen**

Introduction:

Measles and rubella share common epidemiological features and common preventive measures. Measles is one of 10 primary causes of death in developing countries [1] although measles immunization has reduced global measles deaths from more than one million in 1990 to 614,000 in 2002 [2]. The World Health Organization has recommended a second opportunity for measles immunization in order to reduce measles deaths [2]. Ninety five percent vaccination coverage is required to eliminate measles [3] and [4]. Supplementary immunization campaigns may be required to increase coverage and efficacy of vaccination. In countries where vaccination coverage is high, measles antibody prevalence among young adults is >98% and >95% among pre-school and 7–18 year-old children [5]. However, measles morbidity and mortality remain high in some developing countries despite immunization programs. This has been attributed to: the early decay of maternal measles antibodies leading to infection in the first year of life [6], interference from maternal antibodies with the vaccine resulting in a low frequency of seroconversion [7], influence of HIV infection [8], low vaccination coverage [9], and inefficient maintenance of the cold chain.

Despite the trivial disease usually caused by rubella, infection in pregnancy may result in congenital rubella syndrome (CRS) [10] and [11]. In the United States, before the development of rubella vaccines, an epidemic resulted in 20,000 infants with permanent damage due to intra-uterine infection with rubella virus [12]. Therefore, it is essential that girls acquire immunity to rubella before childbearing age to prevent such serious consequences.

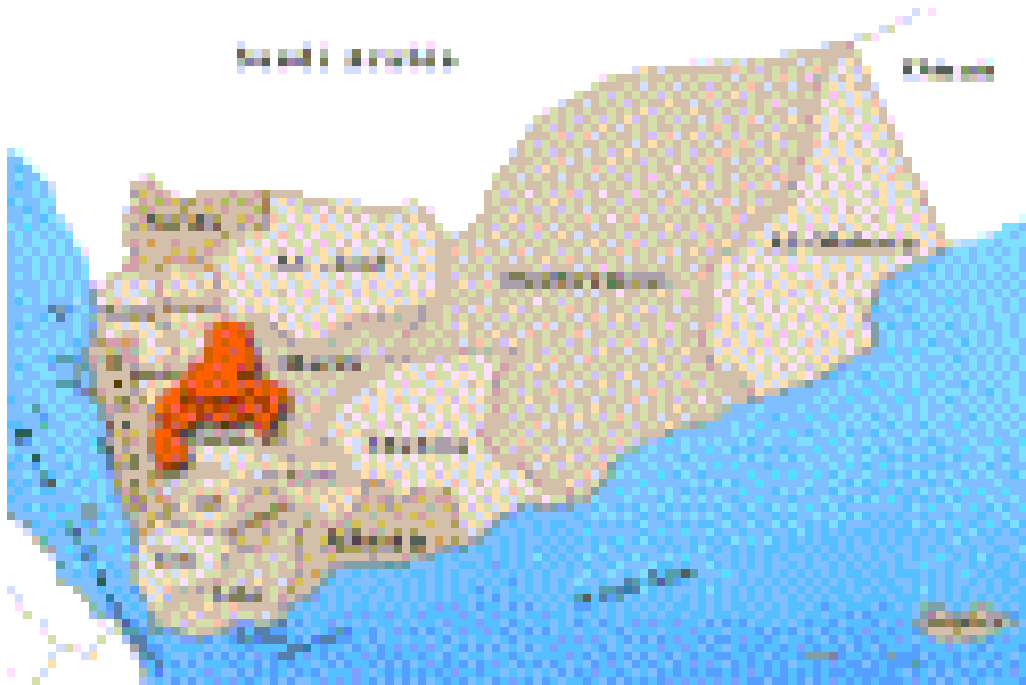
Rubella appears in epidemics in countries without routine immunization Programs. An antibody prevalence of 92% among girls aged between 5 and 25 years was reported in Saudi Arabia [13], 92.7% among adolescents in Turkey [14] and 94.6% among pregnant women in Iran [15]. In many African countries >90.0% prevalence of rubella antibodies among pregnant women and the general population has been reported [16] and [17]. In contrast, a higher rate of susceptibility to rubella (31.5%) was found among Nigerian pregnant women [18] and among pregnant women in Sri Lanka (24%) [19].

The epidemiology of measles in Yemen has not been fully elucidated. However, during an outbreak of rash and fever illness between June and July 2003 in Sana'a, 112 of 249 reported cases were laboratory confirmed as measles (unpublished data). The impact of immunization campaigns on the control of measles in Yemen has not previously been assessed. Rubella vaccination is not part of the expanded program of immunization in Yemen.

Although a previous study among schoolgirls aged 11–21 showed a susceptibility rate of 8.4% [20], the epidemiology of rubella in Yemen remains to be fully elucidated.

This cross-sectional study examines age-specific sera-negativity and antibody levels to measles and rubella among schoolchildren and adults from urban and rural Sana'a. Sana'a is located to the north of the Yemen and consists of the city of Sana'a and the Sana'a governorate which is the outskirts of Sana'a City. Sana'a lies in the centre of the western mountain chain (Fig. 1), which stretches from the north of Yemen to the south at the heart of the Yemeni highlands at a height of 2200 m above sea level. The total population of the great Sana'a, Sana'a city and Sana'a governorate is 1,839,094.

Fig. 1. Map of Yemen showing the location of Sana'a.



Materials and methods:

• Samples

Sera were collected between December 2002 and December 2003, from schoolchildren (age range of boys 5–22 years; age range of girls 6–26 years) and pregnant women from urban and rural Sana'a, and from additional children aged 1.08–6 years of age and adults aged 19–85 years from urban Sana'a (Table 1). Informed consent was obtained from subjects or guardians. One thousand three hundred and ninety-one sera were collected and tested for

measles antibodies. Only 1273 sera were tested for rubella antibodies due to insufficient serum volumes. Data that included age, sex, measles and rubella vaccination status were collected for each subject.

Table 1.

Number of individuals from urban and rural Sana'a tested for measles and rubella antibodies

Group	number Tested for Measles			Number Tested for Rubella Antibodies		
	Male	Female	Total	Male	Female	Total
Urban Schoolchildren	265	87	352	264	90	354
Rural Schoolchildren	145	142	287	146	139	285
Urban Children Aged 1.08–6 years	53	61	114	50	59	109
Urban Adults Aged 19–85	159	225	384	159	225	384
Urban Pregnant Women		145	145		55	55
Rural Pregnant Women		86	86		66	66
Total	622	746	1368	619	634	1253

• Measles- and rubella-specific IgG detection and quantification

Sera were tested for measles- and rubella-specific IgG by ELISA (Human, Gesellschaft für Biochemica und diagnostica mbH, Germany). Testing was performed according to the manufacturer's instructions. Qualitative results were obtained by comparison with cut-off values. All samples with optical density (OD_{450}) \geq cut-off value plus 15% of this value were considered seropositive. Samples with OD_{450} $<$ cut-off value minus 15% of this value were considered seronegative. OD_{450} readings that were above the negative cut-off and below the positive cut-off were regarded as equivocal. All samples with equivocal readings were excluded from the prevalence analysis (23 sera

for measles; 20 for rubella). Determination of measles antibody levels expressed in international units per milliliter (IU/ml) was achieved by a formula provided by the manufacturer. Determination of rubella antibody levels expressed in IU/ml was achieved by knowledge of the OD₄₅₀ and IgG concentrations of the two calibrators provided with the kit.

A statistical computer program was used to compute the formulas that were used in calculating specific IgG levels. All statistical analyses of data were conducted using the statistical SPSS[®] Package 10.05 for Windows. The chi-square test was used to measure the difference in proportions, *t*-test was used to measure difference in means and one-way ANOVA to measure difference in variance of Geometric Mean Titer (GMT) for the various age groups. A *p*-value of ≤ 0.05 was considered statistically significant.

Results:

Overall, 160 of 1368 (11.7%) sera were measles IgG negative, and 183 of 1253 (14.6%) rubella IgG negative. There was a trend of increasing measles and rubella antibody prevalence with increasing age ($p < 0.0001$) (**Table 2**). In addition, measles and rubella-specific IgG concentrations increased significantly with increasing age ($p < 0.0001$) (**Table 2**). The percentage of measles sero-negative individuals decreased from 55.1% among subjects <5 years of age to 1.9% in those 19–85 years of age. Overall, a significantly higher proportion of males were measles sero-negative than females ($p < 0.0001$), the percentage of males who lacked antibodies being more than 2-fold higher than among females (16.2 and 7.9%, respectively), although the difference was only observed in the 9–12 and 13–18 year-old age groups ($p = 0.03$ and 0.01 , respectively). In addition, the antibody concentration among 13–18 year-olds was significantly higher among males than among females ($p = 0.001$).

Table 2.

Measles and rubella sero-prevalence and specific IgG concentrations in different age groups Geometric mean titer.

Age in years	IgG negative		OR	p	χ^2 for trend	IgG GMT ^a ±S.D. IU/ml	F	p
	n	%						
Measles								
1.08–4.92	49/89	55.1	62.7	<0.0001	232.1	1.28 ± 0.30	113.4	<0.0001
5–8	31/113	27.4	19.3			1.55 ± 0.42		
9–12	35/215	16.3	9.9			1.64 ± 0.37		
13–18	33/325	10.2	5.7			1.70 ± 0.33		
19–85	12/626	1.9	1.0			1.89 ± 0.23		
Total	160/1368	11.7						
Rubella								
1.08–4.92	74/94	78.7	82.7	<0.0001	283.0	2.61 ± 3.18	70.6	<0.0001
5–8	33/109	30.3	9.7			5.31 ± 3.56		
9–12	29/217	13.4	3.4			6.71 ± 2.68		
13–18	25/319	7.8	1.9			6.91 ± 2.24		
19–85	22/514	4.3	1.0			6.57 ± 3.17		
Total	183/1253	14.6						

Measles and rubella antibody prevalence was compared in urban and rural populations. Four hundred and ninety-seven of the 870 subjects from urban areas (mean age 16.6 ± 8.0) and 373 from rural areas (mean age 16.8 ± 9.2) were tested for measles antibodies. Of these subjects, 760 were tested for rubella antibodies, 409 from urban areas (mean age 14.3 ± 6.2) and 351 from

rural areas (mean age 15.6 ± 7.2). The rates of urban and rural subjects with no measles antibodies did not differ significantly (10.7 and 12.3%, respectively). However, significantly more rural subjects (14.8%) were susceptible to rubella when compared to their urban counterparts (7.1%; $p = 0.001$). The percentage of rural schoolboys who lacked measles antibodies was significantly higher (35 of 145, 24.1%; $p = 0.02$) than their urban counterparts (39 of 265, 14.7%). The percentage of rural schoolgirls with no rubella antibodies (24 of 139, 17.3%) was significantly higher than that of urban schoolgirls (1 of 90, 1.1%; $p < 0.0001$). The levels of rubella IgG were significantly higher among urban subjects (GMT 6.93 ± 2.43 versus 6.21 ± 2.49 ; $p = 0.0001$) whereas the measles IgG levels were comparable in rural and urban subjects (GMT 1.67 ± 0.33 and 1.73 ± 0.35 , respectively). The rubella IgG levels were significantly higher in urban schoolboys than in rural schoolboys (6.89 ± 2.65 versus 6.02 ± 2.46 ; $p = 0.001$), whereas the only significant difference in measles IgG levels was found between urban and rural schoolgirls (1.67 ± 0.36 versus 1.81 ± 0.31 ; $p = 0.003$).

Eight of 231 (3.5%) pregnant women had no measles antibodies and 8 of 121 (6.6%) had no rubella antibodies. Rubella antibodies were not detected in 19 of 374 (5.1%) of females of childbearing age (15–49 years; mean 28.1 ± 7.4) and those with detectable antibodies had high IgG levels. Of the 1014 who recalled their measles vaccination status, 338 (33.3%) reported measles vaccination. There was no significant difference in IgG concentration between those with a positive history and those with a negative history of vaccination ($p = 0.12$). None of the subjects had a history of rubella vaccination.

Discussion:

Measles immunization was included in the national expanded Program of immunization in Yemen in 1979. One dose of measles vaccine is offered at the age of 9 months. Vaccination coverage of 73.2 and 37.1% has been reported among children aged 12–13 months in urban and rural Sana'a, respectively [21]. Although 11.7% of our subjects had no measles antibodies, a high proportion (55.1%) of children aged 1.08–4.92 years had no antibodies, which poses a major risk of high morbidity and mortality due to measles. The absence of antibodies in a high proportion of 5–18 year-olds (10.2–27.4%) together with the overcrowded schools in Yemen would enable efficient spread of measles virus among children. Measles outbreaks have been reported elsewhere even when vaccination coverage is 98% and seropositivity more than 95% [22] and [23].

Despite the fact that measles neutralizing antibodies are raised against the viral haemagglutinin and our ELISA measures total measles antibodies it is still valid to suggest that majority of our subjects are immune to measles and those with no detectable antibodies are susceptible. The higher measles seronegativity rates of males aged 13–18 years along with their significantly lower IgG concentrations when compared with females of the same age can be attributed to the fact that females at this age are culturally more confined in-doors giving them a greater chance of close contact with other members of the household and a greater chance of infection when compared to boys who tend to spend more time out-doors.

The higher rate of measles seronegativity among rural schoolboys when compared with their urban counterparts could be related to the higher vaccination coverage in the city of Sana'a than in rural Sana'a. Among children aged 12–13 months measles vaccination coverage of 73.2 and 37.1% have been reported in urban and rural Sana'a, respectively [21]. The reason for the significantly higher measles antibody concentrations in rural schoolgirls could be that the rural girls acquired their immunity through natural infection, while urban girls are more likely to have been vaccinated.

Apart from a previous study conducted on schoolgirls [20], this is the first comprehensive study of rubella immune status in the Yemeni population. Of the individuals tested 14.6%, aged from 1.08 to 85 years, were rubella seronegative, in the absence of a rubella vaccination program. The present study also shows that absence of antibodies is age dependent as the rate of seronegativity decreased with increasing age, as previously demonstrated in Yemen [24] and other developing countries [15] and [16]. Among our pregnant women and females of childbearing age, 6.6 and 5.1%, respectively, remain at risk of acquiring rubella during pregnancy. Therefore, women should be advised to have their rubella immune status checked before planning pregnancy. The high rate of seronegativity among our children <5 years of age (78.7%) shows that few children are exposed to rubella virus before the age of five.

Measles and rubella seroepidemiology were very similar in the population tested, despite the inclusion of measles, but not rubella vaccine in the current vaccination program in Yemen. The epidemiology of rubella differs in urban and rural Yemen and merits further investigation. Supplementary measles immunization campaigns targeting children 1–18 years should be considered to prevent measles circulation. Assessment of measles immune status among infants in the first year of life is required to determine the optimum age for measles vaccination in Yemen. Rubella vaccination should be considered with care. A vaccination policy to target women of childbearing age would

be advised, in order to avoid the paradoxical increase in susceptibility among women in this age group that would be seen if only children were vaccinated[24].

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Case-Finding in Tuberculosis Patient Diagnostic and Treatment Delays and their Determinants

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Introduction:

The treatment success rate of the new pulmonary smear-positive tuberculosis cases/2000 was=79% and the case-detection rate was=60.1% in Yemen. In order to improve the case-detection rate .this operational research is designed to analyze the various factors leading to the diagnostic and TX. delays of sputum smear-positive pulmonary TB cases. A total of 598 cases have been already selected by cluster sampling method based on probability and proportionate to size (PPS) and interviewed using the standardized questionnaire. Multivariate logistic regression analysis will be performed on examined factors to find the determinants of diagnostic and treatment delays. By correcting the causes of delays, it is expected that the case detection rate will increase and comprehensive DOTS activities will also be enhanced.

Material and Methods:

- **Study setting:**
The study will take place in the health facilities with diagnostic capacity and implementing DOTS in all over Yemen.
- **Study population:**
Eligibility criteria is a new smear-positive pulmonary tuberculosis patients aged over 15 years old diagnosed in the above mentioned health facilities.
- **Study design:**
Retrospective study. Cases will be interviewed according to a standardized questionnaire which will include information regarding socio-demographic variables, potential risk factors of “patient delays”(such as: educational level, knowledge regarding the disease, HIV-status, health insurance, economic constraints, fear of diagnosis and social isolation, “stigma”), and those for

“health care provider delays” (such as qualification of health providers, process for sputum and Chest X-ray examination).

Results:

More than two-thirds of newly diagnosed TB patients were aged \leq 35 years old, with male to female ratio of 1.36. 55.7% were illiterate, more than half were unemployed or housewives, and 51.0% stated that their income covered their expenses. 45.2% were residing urban areas, compared to 6.7% in suburbs while 46.0% were living in rural areas (Table 1). History of current or past smoking, of whether cigarettes or nargilla was positive in 37.0% of patients. The median daily cigarettes consumption was 20 cig, and for a median duration of 10 years. (Table 2)

Table 3 shows that cough was invariably reported by almost all the patients, followed by fever and chest pain. Cough with any other complaint was the main symptom motivating the patients to seek health care (Table 4). The mean socio-economic (SES) score (education + occupation + income) was significantly lower in females compared to males, while there was no significant difference between them regarding the knowledge score about the disease, stigma score or satisfaction with care score.(Table 5)

Health seeking behavior before diagnosis

In 88.8% of patients, the first health seeking behavior action was to visit a HCP and the second to take self medication, traditional medicine or seek advice from a health worker at home. Before diagnosis, half the patients spend 1500 YR, and the average spend 3696.9 YR. The majority of patients seek care at the public or private health facilities (31.6% and 32.1%, respectively) as first action but then an increasing proportion seek care at the TB centers. The HCPs whom patients first seek care were mainly Chest specialists (34.7%), internists (38.0%), and GPs (25.2%) Half of patients visited one HCP before diagnosis (mean 1.16(0.92), ranging from 0-6).(Table 6-10).

Initial TB Diagnosis in the Health care system

The majority of patients were diagnosed in the TB centers (63.06%), and diagnosis was mainly done by Chest specialists (66.6%). The first action after suspecting TB was to request sputum smear examination (92.1%), while X-Ray was infrequently performed. (Table 11-13)

Accessibility to the Public Health Facilities Providing Treatment:

Regarding the accessibility to the public health facilities providing treatment it was shown that 50.8% of the patients have easy access to the PHFs within less than (30 minutes), 29.9% of the patients have access in (30-60 minutes) and 19.2% of the patients have access in more than (60 minutes). (Table 14)

The Degree of Stigma:

The data in table(15) shows the following:

Ashamed for having TB=33.7%

Hide TB diagnosis from other people=31.9%

TB affects relation with others=39.3%

TB is very costly due to long duration of the disease=26%

Prefer to live isolated since TB diagnosis=40.1%

TB affects work performance=48.8%

TB affects marital relations=34.4%

TB affect family responsibilities=37.4%

Less chances of marriage due to TB diagnosis=32.7%

TB affects family relations=23.5%

Girls unable to decide for getting TB treatment=36.8%

Knowledge of patients:

In Table(16) the percentage of the patients whom previously heard about TB was=(80.0%) and those whom not previously heard was=(20.0%). Regarding source of information it was from MOH campaign(23.9%), Education(7.1%), Friends/Relatives (27.1%), TB Disease in friends/relatives (38.8%) and combination of above (3.1%)

Perception of tuberculosis patients about TB services and their satisfaction with care:

Table (17) shows that

:

Reasons of consultation

-Accessible	30.3			
-Confidence in getting cure	28.8			
-Services available anytime	7.2			
-Referred by previous health service, --Free services	2.5			
-Advised by somebody	4.9			
-Others	24.1			
-Others	2.2			
Reasons of non-consultation				
Too far	31.1			
Too busy/ long waiting time	13.7			
Bad experience	9.8			
Others	45.4			
Satisfaction with care	Best	fair	average	Worst
-Availability of TB services	58.2	10.9	11.9	19
-Prompt action from HCP	45.2	17.8	16.1	20.8
-Well equipped	30.0	16.3	25.8	27.9
-Giving free medicines	33.9	15.9	21.0	29.2

-Enough TB services	25.5	13.1	27.5	33.9
-Health facility workload	27.6	20.0	30.9	21.5
-Waiting time	19.6	19.1	30.4	30.7
reason of delay		N=598		
- no delay		35.1		
-fear		6.2		
-hoped that symptoms would resolve		39.1		
-fear of social isolation		2.2		
-economic constrains		13.5		
-inadequate staff attitude		0.7		
-poor quality of health services		0.5		
others		0.5		

Different delay intervals from onset of symptoms till treatment and in-depth analysis of their determinants

Table 18 shows the different delay durations as follows:

1. Patient related diagnostic delay: the mean duration between onset of symptoms and first health seeking behavior was 39 days and approximately half of patients took 28 days to seek health care (almost 1 month). The significant risk factors for Patient-related diagnostic delay were: female sex (2 folds increased risk) and inadequate knowledge regarding the disease (1.1 fold increased risk of delay for each unit of poor knowledge). (Table 18-19)
2. Diagnostic delay: the mean duration between onset of symptoms and diagnosis was 57.4 days for all patients and approximately half of patients were diagnosed within 35 days. The significant risk factors for diagnostic delay were: female sex (2.2 folds increased risk); living at ½ hr to one hour from the health facility (1.7 increased folds); high degree of stigma (1.7 increased fold for delay for each unit increase in stigma); inadequate knowledge regarding the disease (1.1 fold increased risk of delay for each unit of poor knowledge). (Table 18-20)
3. Treatment delay: the mean duration between diagnosis and treatment was 1.7 days for all patients and approximately half of patients were immediately treated. The significant risk factors for treatment delay were: living in suburbs (3.4 increased folds, compared to urban areas); separated/divorced (3 folds); living at more than an hour away from the health facility (2.9 increased folds); being diagnosed at non-specialized health facility (non NTP)(2 folds increased risk). (Table 18-21)
4. Healthcare system delay: the mean duration between seeking healthcare in the health system and treatment was 20 days for all patients and approximately half of patients were treated within 4 days. The significant risk factors for Healthcare system delay were: seeking care at non-specialized health facility (non NTP)(5.13 fold increased risk); more than one health care encounter before diagnosis (6 folds increased risk). (Table 18-22)
5. Total delay: the mean duration between onset of symptoms and treatment was 59.2 days for all patients and approximately half of patients were treated within 35 days. The significant risk factors for total delay were: female sex (2.3 folds increased risk living at ½ hr to one hour from the health facility (1.8 increased folds); and high degree of stigma (1.7 folds increased risk). (Table 18-23)

Table 1.

Socio-demographic characteristics of TB patients

Characteristics	N=598 (%)
Age	
<=15-35	409(68.48)
>35	189(31.6)
Mean (SD)	32.2 (14.3)
Sex	
Male	345(57.7)
Female	253(42.3)
Male: female	1.36
Education	
University	31(5.2)
Primary-senior	234(39.1)
Illiterate/read & write	330(55.7)
Occupation	
Techno/professional	61(10.2)
Clerical/workers	141(23.62)
Students	85(14.2)
Unemployed/hw	311(52.0)
Income	
Savings	22(3.7)
Income=expenses	305 (51.0)
In debt	271(45.3)
Residence	
Urban	270(45.2)
Suburb	40(6.7)
Rural	275(46.0)
Homeless	13(2.2)
Marital status	
Married	340(56.9)
Single	217(36.3)
Divorced/separated	17(2.8)
Widowed	24(4.0)

Table 2.

Risk factors for TB among newly diagnosed patients in Yemen

Characteristics	No (%)
Smoking	
Never	377(63.0)
Current smoker	64(10.7)
Quitted	157(26.3)
Type of smoking	
Cigarettes	113(71.5)
Nargilla	45(28.5)
Daily consumption	
Mean (SD)	20.7(13.8)
Duration of cig. Smoking (yrs) (current/quitted)	
Mean (SD)	12.5(9.7)

Table 3.

History of the current illness for newly diagnosed TB patients
In the different health facilities in Yemen

Characteristics	No=598*
Cough	589(98.5)
Fever	476(86.23)
Weight loss	319(68.8)
Chest pain	330(82.9)
Haemoptysis	133(36.6)
Others**	32(10.8)

*valid rates (missing cases were excluded).

**sweating; tiredness; loss of appetite, hoarseness of voice; fainting.

Table 4.

Comparison between males and females regarding SES, knowledge, stigma and satisfaction with care

Symptoms	No=598
Cough	475(79.7)
Fever	21(3.5)
Weight loss	5(0.8)
Haemoptysis	64(10.7)
Chest pain	27(4.5)
others	4(0.7)

Table 5.

Comparison between males and females regarding SES, knowledge, stigma and satisfaction with care

Mean percent score Mean (SD)	Male N=345	Female N=252	Z	p
SES	4.3(1.6)	5.9(1.1)	-12.4	0.00
Knowledge	5.4(4.1)	5.95(4.2)	-1.50	0.13
Stigma	3.5(0.7)	3.5(0.7)	-0.51	0.61
Satisfaction with care	6.6(3.97)	6.97(3.8)	-1.53	0.13

Table 6.

Health seeking behavior with the onset of illness

Health seeking behavior	N=598	
First action	598	%
HCP	531	88.8
Self medication	8	1.3
Traditional	5	0.8
Health worker at home	34	5.7
Drug stores	13	2.2
Others	7	1.2
Second action	107	%
HCP	77	72.0
Self medication	6	5.6
Traditional	1	0.9
Health worker at home	12	11.2
Drug stores	7	6.5
Others	4	3.7
Third action	30	%
HCP	24	80.0
Traditional	1	3.3
Health worker at home	1	3.3
Drug stores	3	10.0
Others	1	3.3
Fourth action	11	
HCP	9	81.8
Drug stores	2	18.2

Table 7.

Expenditures for illness before initial diagnosis in Yemeni Ryal

Mean (SD)	3696.86(6845.42)
Median (min-max)	1500 (0-70000)
Sum	2025878
25th Percentiles	450
50th Percentiles	1500
75th Percentiles	4000

Table 8.

Health facility of the HCP whom patients first seek consultation

Health facility	N=598	
First action	580	%
TB center	159	27.4
PHC	10	1.7
Public hospital/outpatient clinic	183	31.6
Private practice	186	32.1
Others	42	7.2
Second action	263	%
TB center	125	47.5
PHC	3	1.1
Public hospital/outpatient clinic	45	17.1
Private practice	79	30.0
Others	11	4.2
Third action	106	%
TB center	47	44.3
PHC	1	0.9
Public hospital/outpatient clinic	25	23.6
Private practice	30	28.3
Others	3	2.8
Fourth action	35	%
TB center	16	45.7
Public hospital/outpatient clinic	10	28.6
Private practice	7	20.0
Others	2	5.7

Fifth action	14	
TB center	10	71.4
Public hospital/outpatient clinic	3	21.4
Private practice	1	7.1

Table 9.

Specialty of the private HCP whom patients first seek consultation

Health facility	N=274	
Chest specialist	95	34.7
Internist	104	38.0
GP	69	25.2
Others	3	2.2

Table 10.

Number of health seeking encounters before initial TB diagnosis

	N=598	
Only at the TB center	14	2.3
One	351	58.7
Two	138	23.1
Three	74	12.4
Four	14	2.3
Five	5	0.8
Six	2	0.3

Mean (SD)= 1.58(0.92), median 1; range: 0-6

Table 11.

Health facility of the HCP who made initial TB diagnosis

Health facility	N=598	
TB center	377	63.0
PHC	18	3.0
Chest hospital	4	0.7

Public hospital/outpatient clinic	138	23.1
Private practice	40	6.7
Others	21	3.5

Table 12.

Specialty of the HCP who made initial diagnosis

HCP specialty	N=595	%
Chest specialist	396	66.6
Internist	87	14.6
GP	89	15.0
Others	23	3.9

Table 13.

Action taken by the HCP who made initial TB diagnosis (to clarify the variables and fill this table)

Action	N= 574	%
Sputum	134	23.3
X-ray	9	1.6
Both	417	72.6
Referral	14	2.4

Table 14.

Accessibility to public health facility providing treatment

Action	N=598	%
<1/2 hr	304	50.8
1/2-1 hr	179	29.9
>1 hr	115	19.2

Table 15.

The degree of stigma (reversed coding)

Stigma	N=598				
	Strongly agree	Agree	Average	Do not agree	Do not agree at all
	(%)	(%)	(%)	(%)	(%)
Ashamed for having TB	15.9	33.7	6.5	35.2	8.6
Hide TB diagnosis from other people	12.4	31.9	10.7	36.9	8.1
TB affects relation with others	8.4	39.3	21.6	27.9	2.9
TB is very costly due to long duration of the disease	5	26	30.5	33.4	5
Prefer to live isolated since TB diagnosis	5.7	40.1	14.8	35.1	4
TB affects work performance	6.2	48.8	20.5	21.6	2.9
TB affects marital relations	4	34.4	36.2	23.2	2.2
TB affect family responsibilities	3.7	37.4	34.2	22.3	2.3
Less chances of marriage due to TB diagnosis	4.4	32.7	42.8	19.1	1
TB affects family relations	2.7	23.5	48.3	24.2	1.3
TB causes female infertility	1.8	4.4	77.5	14.8	1.5
TB leads to serious complications during pregnancy	1.8	7.4	82.5	7.7	0.5
TB affects breast feeding	2.2	8.1	83.7	5.7	0.3
TB affects pregnancy outcome	1.7	7.4	84.4	5.9	0.7

Girl unable to decide for getting TB treatment	3.2	36.8	50.3	8.3	1.2
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Table 16.

Knowledge of TB patients

Patients knowledge on TB	N= 596		
-Previously heard about TB	477(80.0)		
-Not previously heard	119 (20.0)		
Source of information	N=549		
MOH campaign	131(23.9)		
Education	39(7.1)		
Friends/relatives	149(27.1)		
TB Disease in friends/relatives	213(38.8)		
Combinations of the above	17(3.1)		
Correctness of information on TB	right	wrong	Not known
Kind of disease	81.6	8.7	9.7
Hereditary	44.7	15.4	39.7
Contagious	75.4	6.2	18.4
Curable	76.9	5.4	17.8
Vaccine	29.0	15.9	55.1
Duration of treatment	54.4	6.9	37.7
TB drugs	34.4	3.5	61.7

Table 17.

Perception of tuberculosis patients about TB services and their satisfaction with care

	No (%)
Reasons of consultation	N=748

-Accessible	30.3			
-Confidence in getting cure	28.8			
-Services available anytime	7.2			
-Referred by previous health service,	2.5			
--Free services	4.9			
-Advised by somebody	24.1			
-Others	2.2			
Reasons of non-consultation				
Too far Too busy/ long waiting time	31.1			
Bad experience	13.7			
Others	9.8			
	45.4			
Satisfaction with care	Best	fair	average	Worst
-Availability of TB services	58.2	10.9	11.9	19
-Prompt action from HCP	45.2	17.8	16.1	20.8
-Well equipped	30.0	16.3	25.8	27.9
-Giving free medicines	33.9	15.9	21.0	29.2
-Enough TB services	25.5	13.1	27.5	33.9
-Health facility workload	27.6	20.0	30.9	21.5
-Waiting time	19.6	19.1	30.4	30.7
reason of delay	N=598			
- no delay	35.1			
-fear	6.2			
-hoped that symptoms would resolve	39.1			
-fear of social isolation	2.2			
-economic constrains	13.5			
-inadequate staff attitude	0.7			
-poor quality of health services	0.5			
others				

Table 18.

Different types of delay for TB patients in the community and healthcare facilities

	No (%)	Mean (SD)	Median	Min-max	25th perc	75th perc
Patient related diagnostic delay	500	39(50.3)	28	0-502	10	52.8
Healthcare system related diagnostic delay	497	18.4(35.5)	2	0-232	0	21
Total diagnostic delay	501	57.4(62.3)	35	0-720	22.5	62.0
Treatment delay	500	1.7(7.4)	0	0-92	0	1
Total healthcare system delay	498	19.98(37.2)	4	0-244	0	25
Total delay	500	59.2(63.94)	35	0-720	23	64

- Patient related component of diagnostic delay (The duration between onset of symptoms and seeking healthcare)
- Healthcare related component of diagnostic delay (The mean duration between the timing of seeking healthcare and diagnosis).
- Diagnostic delay (time interval between onset of symptoms and diagnosis)
- Treatment delay (time interval between diagnosis and treatment)
- The total delay (diagnostic + treatment delay)
- Healthcare system delay (The mean duration between the timing of seeking healthcare and treatment).

Table 19.

Risk factors for patient-related diagnostic delay among TB patients

Risk factor	<=median (28)		>median		Crude OR and 95% Confidence interval	Adjusted OR and 95% Confidence interval
	No=254	50.8%	No=246	49.2%		
Age						
<=35 ®	186	53.9	159	46.1	1	
>35	68	43.9	87	56.1	1.50(1.02-2.19) **	1.01(0.99-1.03) @
Sex						
Male ®	140	49.0	146	51.0	1	1
female	114	53.3	100	46.7	0.84(0.59-1.20)	2.03(1.14-3.61) **
Education						
Universe ®	14	56	11	44.0	1	1
Prim-senior	105	55.9	83	44.1	1.01(0.40-2.52)	1.23(0.46-3.31)
illiterate	133	46.8	151	53.2	1.44(0.59-3.55)	1.03(0.07-14.73)
Occupation						
Tech ®	31	60.8	20	39.2	1	1
Clerical/workers	60	51.3	57	48.7	1.47(0.72-3.04)	1.11(0.50-2.45)
Students	43	56.6	33	43.4	1.91(0.54-2.61)	1.54(0.66-3.59)
unemployed/hw	120	46.9	136	53.1	1.76(0.91-3.39)	2.21(0.97-5.03)

Residence					1	
Urban ®	128	55.2	104	44.8	0.80(0.36-1.78)	1
Suburb	20	60.6	13	39.4		0.62(0.25-1.54)
Rural	103	45.8	122	54.2	1.46(0.99-2.14)	1.47(0.91-2.39)
homeless	3	30.0	7	70.7	2.87(0.65-14.4)	2.55(0.47-13.74)
Income					1	
Savings	13	68.4	6	31.6	2.32(0.79-7.10)	1
Income=expenses	125	48.3	134	51.7		1.13(0.36-3.51)
In debt	116	52.3	106	47.7	1.98(0.67-6.09)	0.89(0.28-2.84)
Marital status					1	
Married ®	139	47.9	151	52.1	0.82(0.55-1.20)	1
Single	96	53.0	85	47.0		1.05(0.64-1.74)
Separated/div/wid	19		10		0.48(0.20-1.14)	0.51(0.20-1.28)
Crowding index					1	
<=2.5	149	55.8	118	44.2		1
>2.5*	103	45.6	123	54.4	1.51(1.06-2.15)**	1.37(0.90-2.08)

Time to reach health facility					1	
<=1/2 hr	128	52.0	118	48.0	1.27(0.83-1.94)	1
1/2-1hr	71	46.1	83	53.9	1.09(0.67-1.77)	
>1 hr	55	55.0	45	45.0	0.89(0.54-1.45)	0.73(0.39-1.37)
Expenses						
Low cost (<=2500 median)	106	44.5	132	55.5	1	
high cost	128	58.2	92	41.8	0.58(0.40-0.84) **	1.00(1.00-1.00) @
Satisfaction with care*						
Adequate (<=6.8) ®	124	51.5	117	48.5	1	
Inadequate	128	49.8	129	50.2	1.07(0.75-1.52)	1.02(0.97-1.08) @
Stigma*						
Low degree ®	140	55.1	114	44.9	1	
High degree	112	46.3	130	53.7	1.43(1.001-2.03) **	1.25(0.93-1.69) @
Knowledge*						
Good ®	146	60.3	96	39.7	1	
Poor	107	41.6	150	58.4	2.13(1.49-3.05)**	1.10(1.04-1.16)** @

* Median cutoff

** p< 0.05

@ introduced in the model as quantitative variable.

Table 20.

Risk factors for diagnostic delay among TB patients

Risk factor	<=median(35)		>median		Crude OR and 95% Confidence interval	Adjusted OR and 95% Confidence interval
	No=256	51.1%	No=245	48.9%		
Age						
<=35 ®	175	50.7	170	49.3	1	
>35	81	51.9	75	48.1	0.95(0.65-1.39)	1.001(0.98-1.02) @
Sex						
Male ®	138	48.1	149	51.9	1	1
female	118	55.1	96	44.9	0.75(0.53-1.08)	2.20(1.22-3.96) **
Education						
Univers ®	12	48	13	52.0	1	1
Prim-senior	102	54	87	46.0	0.79(0.32-1.95)	0.74(0.27-2.05)
illiterate	139	48.9	145	51.1	0.96(0.40-2.34)	0.97(0.34-2.78)
Occupation						
Tech ®	25	49.0	26	51.0	1	1
Clerical/workers	60	50.8	58	49.2	0.93(0.46-1.89)	0.73(0.32-1.64)
Students	41	53.9	35	46.1	0.82(0.38-1.78)	0.86(0.36-2.04)
unemployed/hw	130	50.8	126	49.2	0.93(0.49-1.77)	1.35(0.58-3.14)

Residence						
Urban ®	127	54.7	105	45.3	1	1
Suburb	23	69.7	10	30.3	0.53(0.22-1.22)	0.56(0.21-1.54)
Rural	102	45.1	124	54.9	1.47(1.00-2.16)	1.001(0.60-1.66)
homeless	4	40.0	6	60.0	1.81(0.44-7.89)	2.59(0.53-12.64)
Income						
Savings	12	63.2	7	36.8	1	1
Income=expenses	136	52.5	123	47.5	1.55(0.55-4.52)	0.97(0.30-3.10)
In debt	108	48.4	115	51.6	1.83(0.64-0.63)	1.22(0.37-3.97)
Marital status						
Married ®	138	47.4	153	52.6	1	1
Single	95	52.5	86	47.5	0.82(0.55-1.20)	1.06(0.63-1.77)
Separated/div/wid	23		6		0.24(0.08-0.63)	0.32(0.11-0.92)
Crowding index						
<=2.5	149	55.8	118	44.2	1	
>2.5*	103	45.4	124	54.6	1.52(1.07-2.17) **	1.23(0.81-1.86)
Time to reach health facility						
<=1/2 hr	141	57.3	105	42.7	1	1
1/2-1hr	66	42.6	89	57.4	1.81(1.18-2.78)	1.67(1.03-2.73) **
>1 hr	49	49.0	51	51.0	1.40(0.85-2.29)	1.30(0.69-2.47)

Expenses						
Low cost (<=2500 median)	129	54.0	110	46.0	1	
high cost	109	49.5	111	50.5	1.19(0.83-1.72)	1.00(1.00-1.00) @
First Health seeking behavior before diagnosis						
HCP	235	52.5	213	47.5	1	
others	21	39.6	32	60.4	1.68(0.94-3.01)	1.55(0.75-3.22)
Health facility first consulted						
NTP	82	57.3	61	42.7	1	
Others	169	49.0	176	51.0	1.40(0.95-2.07)	1.25(0.75-2.09)
Health facility that made initial diagnosis						
NTP	169	49.6	172	50.4	1	
Others	87	54.4	73	45.6	0.82(0.57-1.20)	0.79(0.49-1.28)
No of Health care encounters						
1	171	56.4	132	43.6	1	1
>1	85	42.9	113	57.1	1.72(1.20-2.47)	1.37(0.84-2.21)
Satisfaction with care*						
Adequate (<=6.8) ®	126	52.3	115	47.7	1	
Inadequate	130	50.4	128	49.6	1.08(0.76-1.53)	1.04(0.98-1.11) @

Stigma*						
Low degree ®	151	59.4	103	40.6	1	
High degree	103	42.4	140	57.6	2.00(1.39-2.85) **	1.72(1.25-2.37) **@
Knowledge*						
Good ®	145	59.9	97	40.1	1	
Poor	111	43.0	147	57.0	1.98(1.39-2.83) **	1.09(1.03-1.16) **@

* Median cutoff; **p<0.05; @ introduced in the model as quantitative variable.

Table 21.

Risk factors for treatment delay among TB patients

Risk factor	≤median(0)		>median		Crude OR and 95% Confidence interval	Adjusted OR and 95% Confidence interval
	No=3 73	74.6 %	No= 127	25.4 %		
Age						
≤35 ®	254	73.8	90	26.2	1	
>35	119	76.3	37	23.7	0.88(0.57-1.36)	0.996(0.98-1.02)
Sex						
Male ®	211	73.5	76	26.5	1	1
female	162	76.1	51	23.9	0.87(0.58-1.32)	1.30(0.66-2.55)

Education						
Univers ®	15	60.0	10	40.0	1	1
Prim-senior	141	74.6	48	25.4	0.51(0.20-1.32)	0.42(0.15-1.20)
illiterate	214	75.6	69	24.4	0.48(0.19-1.22)	0.35(0.12-1.06)
Occupation						
Tech ®	35	68.6	16	31.4	1	1
Clerical/workers	88	74.6	30	25.4	0.75(0.34-1.64)	0.64(0.27-1.54)
Students	60	78.9	16	21.1	0.58(0.24-1.41)	0.55(0.21-1.45)
unemployed/hw	190	74.5	65	25.5	0.75(0.37-1.52)	0.60(0.24-1.53)
Residence						
Urban ®	186	80.5	45	19.5	1	1
Suburb	17	51.5	16	48.5	3.86(1.71-8.85)	3.36(1.31-8.60) **
Rural	163	72.1	63	27.9	1.60(1.01-2.53)	0.94(0.51-1.73)
homeless	7	70.0	3	30.0	1.77(0.35-8.03)	1.07(0.19-6.18)
Income						
Savings	15	78.9	4	21.1	1	1
Income=expenses	197	76.4	61	23.6	p=1 fisher exact test	1.86(0.36-9.48)
In debt	161	72.2	62	27.8	1.44(0.43-5.38)	1.89(0.36-9.88)
Marital status						
Married ®	226	77.9	64	22.1	1	1
Single	130	71.8	51	28.2	1.39(0.88-2.17)	1.21(0.66-2.20)
Separated/div/wi d	17		12		2.49(1.05-5.85)	3.01(1.15-7.88) **

Crowding index						
<=2.5	204	76.7	62	23.3	1	1
>2.5*	165	72.7	62	27.3	1.24(0.82-1.86)	1.36(0.83-2.21)
Time to reach health facility						
<=1/2 hr	194	79.2	51	20.8	1	1
1/2-1hr	117	75.5	38	24.5	1.24(0.74-2.05)	1.09(0.597-1.99)
>1 hr	62	62.0	38	38.0	2.33(1.36-4.00)	2.88(1.40-5.92) **
Expenses						
Low cost (<=2500median)	184	77.3	54	22.7	1	
high cost	164	74.5	56	25.5	1.16(0.76-1.79)	1.00(1.00-1.00)
First Health seeking behavior before diagnosis						
HCP	337	75.4	110	24.6	1	
others	36	67.9	17	32.1	1.45(0.78-2.68)	1.91(0.89-4.11)
Health facility first consulted						
NTP	120	84.5	22	15.5	1	
Others	243	70.4	102	29.6	2.29(1.38-3.81)	1.73(0.92-3.25)

Health facility that made initial diagnosis						
NTP	270	79.4	70	20.6	1	
Others	103	64.4	57	35.6	2.14(1.41-3.24)	1.96(1.16-3.30) **
No of Health care encounters						
1	230	76.2	72	23.8	1	
>1	143	72.2	55	27.8	1.23(0.82-1.85)	1.09(0.64-1.86)
Satisfaction with care*						
Adequate (<=6.8) ®	175	72.9	65	27.1	1	
Inadequate	196	76.0	62	24.0	0.85(0.57-1.28)	0.998(0.93-1.07)
Stigma*						
Low degree ®	197	77.9	56	22.1	1	
High degree	174	71.6	69	28.4	1.40(0.93-2.10)	1.03(0.72-1.46)
Knowledge*						
Good ®	186	76.9	56	23.1	1	
Poor	186	72.4	71	27.6	1.27(0.85-1.90)	1.01(0.95-1.08)

* median cutoff; ** p<0.05; @ introduced in the model as quantitative variable

Table 22.

Risk factors for healthcare system delay among TB patients

Risk factor	<=median(4)		>median		Crude OR and 95% Confidence interval	Adjusted OR and 95% Confidence interval
	No=250	50.2%	No=248	49.8%		
Age						
<=35 ®	170	49.6	173	50.4	1	
>35	80	51.6	75	48.4	0.92(0.63-1.35)	0.99(0.97-1.01)
Sex						
Male ®	145	50.7	141	49.3	1	1
female	105	49.5	107	50.5	1.05(0.74-1.50)	1.14(0.58-2.26)
Education						
Universe ®	10	40.0	15	60.0	1	1
Prim-senior	97	51.6	91	48.4	0.63(0.25-1.57)	0.40(0.13-1.29)
illiterate	141	50.0	141	50.0	0.67(0.27-1.64)	0.58(0.18-1.89)
Occupation						
Tech ®	23	45.1	28	54.9	1	1
Clerical/workers	57	48.7	60	51.3	0.86(0.42-1.76)	0.55(0.21-1.48)
Students	40	52.6	36	47.4	0.74(0.34-1.60)	0.67(0.23-1.91)
unemployed/hw	130	51.2	124	48.8	0.78(0.41-1.49)	0.86(0.32-2.33)

Residence						
Urban ®	116	50.2	115	49.8	1	1
Suburb	20	60.6	13	39.4	0.66(0.29-1.46)	1.04(0.38-2.81)
Rural	109	48.7	115	51.3	1.06(0.72-1.56)	0.78(0.41-1.46)
homeless	5	50.0	5	50.0	p=1 fischer	1.83(0.29-11.57)
Income						
Savings	11	57.9	8	42.1	1	1
Income=expenses	143	55.6	114	44.4	1.10(0.39-3.10)	1.99(0.52-7.64)
In debt	96	43.2	126	56.8	1.80(0.64-5.14)	3.59(0.90-14.33)
Marital status						
Married ®	143	49.5	146	50.5	1	1
Single	88	48.9	92	51.1	1.02(0.69-1.51)	0.98(0.52-1.84)
Separated/div/wid	19		10		0.54(0.22-1.30)	0.52(0.19-1.45)
Crowding index						
<=2.5	134	50.4	132	49.6	1	
>2.5*	111	49.3	114	50.7	1.04(0.73-1.49)	0.80(0.48-1.34)
Time to reach health facility						
<=1/2 hr	133	54.3	112	45.7	1	1
1/2-1hr	79	51.6	74	48.4	1.11(0.73-1.70)	1.14(0.63-2.08)
>1 hr	38	38.0	62	62.0	1.94(1.17-3.21)	2.20(0.98-4.92)

Expenses						
Low cost (<=2500 median)	164	69.2	73	30.8	1	
high cost	63	28.8	156	71.2	5.56(3.72-8.32) **	1.00(1.00-1.00)
First Health seeking behavior before diagnosis						
HCP	220	49.4	225	50.6	1	
others	30	56.6	23	43.4	0.75(0.42-1.33)	0.52(0.21-1.25)
Health facility first consulted						
NTP	115	81.6	26	18.4	1	
Others	127	36.9	217	63.1	7.56(4.68-12.20) **	5.13(2.72-9.69) **
Health facility that made initial diagnosis						
NTP	167	49.1	173	50.9	1	
Others	83	52.5	75	47.5	0.87(0.60-1.27)	0.54(0.31-0.95)
No of Health care encounters						
1	209	69.4	92	30.6	1	1
>1	41	20.8	156	79.2	8.64(5.67-13.19) **	5.97(3.39-10.52) **
Satisfaction with care*						
Adequate (<=6.8) ®	118	49.4	121	50.6	1	
Inadequate	132	51.4	125	48.6	0.92(0.65-1.31)	0.97(0.91-1.04)

Stigma*						
Low degree ®	130	51.6	122	48.4	1	
High degree	120	49.6	122	50.4	1.08(0.76-1.54)	0.85(0.59-1.23)
Knowledge*						
Good ®	118	48.8	124	51.2	1	
Poor	132	51.8	123	48.2	0.89(0.62-1.26)	0.99(0.93-1.06)

* Median cutoff; ** p<0.05; @ introduced in the model as quantitative variable

Table 23.

Risk factors for total delay among TB patients

Risk factor	<=median(35)		>median		Crude OR and 95% Confidence interval	Adjusted OR and 95% Confidence interval
	No=253	50.6%	No=247	49.4%		
Age						
<=35 ®	175	50.9	169	49.1	1	
>35	78	50.0	78	50.0	1.04(0.71-1.51)	1.003(0.98-1.02)
Sex						
Male ®	135	47.0	152	53.0	1	
female	118	55.4	95	44.6	0.72(0.50-1.02)	2.29(1.26-4.14) **

Education						
Univers ®	12	48.0	13	52.0	1	1
Prim-senior	100	52.9	89	47.1	0.82(0.33-2.04)	0.77(0.28-2.14)
illiterate	138	48.8	145	51.2	0.97(0.4-2.36)	0.91(0.32-2.60)
Occupation						
Tech ®	25	49.0	26	51.0	1	1
Clerical/workers	58	49.2	60	50.8	0.99(0.49-2.02)	0.77(0.34-1.74)
Students	41	53.9	35	46.1	0.82(0.38-1.78)	0.87(0.37-2.07)
unemployed/hw	129	50.6	126	49.4	0.94(0.49-1.79)	1.44(0.62-3.35)
Residence						
Urban ®	127	55.0	104	45.0	1	1
Suburb	23	69.7	10	30.3	0.53(0.22-1.23)	0.58(0.21-1.60)
Rural	100	44.2	126	55.8	1.54(1.05-2.26)	1.03(0.62-1.72)
homeless	3	30.0	7	70.0	1.85(0.42-9.30)	4.98(0.86-28.77)
Income						
Savings	12	63.2	7	36.8	1	1
Income=expenses	134	51.9	124	48.1	1.59(0.56-4.62)	0.97(0.30-3.11)
In debt	107	48.0	116	52.0	1.86(0.65-5.45)	1.18(0.36-3.85)
Marital status						
Married ®	136	46.9	154	53.1	1	1
Single	94	51.9	87	48.1	0.82(0.55-1.21)	1.03(0.62-1.74)
Separated/div/wid	23		6		0.23(0.08-0.62)	0.31(0.11-0.90)

Crowding index						
<=2.5	147	55.3	119	44.7	1	
>2.5*	102	44.9	125	55.1	1.51(1.06-2.16)	1.25(0.82-1.91)
Time to reach health facility						
<=1/2 hr	141	57.6	104	42.4	1	1
1/2-1hr	64	41.3	91	58.7	1.93(1.26-2.96)	1.79(1.09-2.94) **
>1 hr	48	48.0	52	52.0	1.47(0.90-2.41)	1.44(0.76-2.73)
Expenses						
Low cost (2500 median)	128	53.8	110	46.2	1	
high cost	107	48.6	113	51.4	1.23(0.85-1.77)	1.00(1.00-1.00)
First Health seeking behavior before diagnosis						
HCP	232	51.9	215	48.1	1	
others	21	39.6	32	60.4	1.64(0.92-2.94)	1.52(0.73-3.17)
Health facility first consulted						
NTP	82	57.7	60	42.3	1	
Others	166	48.1	179	51.9	1.47(1.00-2.19)	1.31(0.78-2.21)
Health facility that made initial diagnosis						
NTP	167	49.1	173	50.9	1	
Others	86	53.8	74	46.3	0.83(0.57-1.21)	0.78(0.48-1.26)

No of Healthcare encounters						
1	169	56.0	133	44.0	1	
>1	84	42.4	114	57.6	1.72(0.20-2.48)	1.39(0.85-2.25)
Satisfaction with care*						
Adequate (<=6.8) ®	124	51.7	116	48.3	1	
Inadequate	129	50.0	129	50.0	1.07(0.75-1.52)	1.04(0.98-1.10)
Stigma*						
Low degree ®	150	59.3	103	40.7	1	1.72(1.24-2.37)**
High degree	102	42.0	141	58.0	2.01(1.41-2.88)	
Knowledge*						
Good ®	144	59.5	98	40.5	1	
Poor	109	42.4	148	57.6	2.00(1.40-2.85)	1.09(1.04-1.16)

* Median cutoff; ** p<0.05; @ introduced in the model as quantitative variable

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Bacterial Distribution Analysis Of The Atmosphere Of Two Hospitals In Ibb, Yemen

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Abstract:

A bacteriological distribution analysis of the air was carried out at 8 sites in each of 2 general hospitals in Ibb during the period February–June 2002. Only 3 sites, reception hall, hospital passages and outpatient clinic, gave meaningful values for the distribution of bacteria in the atmospheric air. In these locations, mean values for total plate count, lactose fermenting bacteria, haemolytic bacteria and non-lactose fermenting bacteria were 478.6 colony forming units (cfu)/m³, 24.9 cfu/m³, 6.5 cfu/m³, and 4.8 cfu/m³ respectively. The reception hall had the highest bacterial count, followed by hospital passages and the outpatient clinic. The highest bacterial count was for 08.00, followed by 14.00 and 18.00.

Introduction:

Hospitals have a notorious reputation for infection and septic infection has been well documented [1]. Despite dramatic developments in surgical and medical techniques, infection acquired in hospitals remains a major cause of morbidity and mortality, leading directly or indirectly to an enormous increase in the cost of hospital care and to the emergence of new health hazards for the community [2].

Infection may be spread by airborne transmission from the respiratory tract, from the skin by natural shedding of skin scales, during wound dressing or during bed making, and by aerosols from equipment such as respiratory apparatus and air-conditioning plants. Infectious agents may be dispersed in the air as small particles or droplets over long distances [2]. Quantitative and qualitative microbiological measurements are required in premises where safe working depends on the microorganism content of the air being kept at a very low level, e.g. surgical theatres and premises where certain food and pharmaceutical materials are prepared. In hospital wards in which cross-

Infection is possible, it may be necessary to examine the air for a particular pathogen. The type and number of microorganisms in the air at any time depend on a variety of factors, the most important of which are number of persons present, degree of body movement and amount of disturbance of their clothing [3]. Most of

the data available in this field are concerned with fungi [4]; there is little or no data in the literature concerning bacterial load of hospital air. This survey is, therefore, an attempt to assess the bacterial distribution in ambient air in 2 hospitals.

Methods:

Sampling sites and times Air samples were collected weekly during the period February–June, 2002, from Al- Thawra and Al-Nasir general hospitals, the only government hospitals in Ibb City, Yemen, which is located 190 km south of the capital, Sana'a. Al-Thawra Hospital has a mean of 233 outpatients and 75 admissions per day; the corresponding figures for Al-Nasir Hospital are 60 outpatients and 15 admissions. At both hospitals, air samples were collected from the following sites: operating theatre, male surgical ward, female internal ward, refreshment room, clinical laboratory, outpatient clinic, hospital passages and reception hall. From each site, samples were collected at 3 times, morning (08.00), afternoon (14.00) and evening (18.00).

These times were chosen to correspond with patient crowdedness (which is directly proportional to the bacterial atmospheric pollution) in the hospital wards: before working hours (i.e. morning), rush hours (i.e. afternoon) and after working hours (i.e. evening). At each sampling, 3 replicate samples were collected (1 for each type of plate). The time between sample collection and receiving the sample in the laboratory never exceeded 1 hour. Sample collection and bacteriological media The samples were collected using a microbiological air sampler, MAS-100 (Merck, Darmstadt, Germany).

The air sampler was loaded with Petri dishes that had previously been prepared under sterile condition with the following media: plate count agar (CM0325, for total aerobic bacteria); blood agar base No 2 with horse blood, (PB0114, for haemolytic bacteria); MacConkey agar (CM0007, for lactose fermenting and non lactose fermenting bacteria) (all media were from Oxide, Basingstoke, UK). The height of the air sampler was 1.5 m above the ground level, in a horizontal position. The air sampler was set up to allow the passage of 1000 L (1 m³) of air over the bacteriological media. Sample processing and analysis Microbiological analysis for total plate count, lactose fermenting bacteria, nonlactose fermenting bacteria and haemolytic bacteria was carried out according to the method described by Crichton [5]. The plates were incubated at 37 °C for 24 hours (48 hours in case of poor or no growth).

After incubation, a colony counter (Gallenkamp) was used for counting the bacterial colonies which had developed. Since the data from corresponding sites in each hospital were similar, the original data from both hospitals were combined then processed and expressed as either a mean value or as a percentage.

Results:

At both Al-Thawra and Al-Nasir hospitals, only 3 sites, i.e. reception hall, hospital passages, and outpatient clinic gave values for the distribution of the bacteria in the atmospheric air of the hospital that were compatible enough to allow a reasonable analysis for the distribution of the bacteria at these sites, therefore these 3 are discussed in detail. Ambiguous (disparate) results were found for the other sites. Plate counts are shown in Table 1. Mean bacterial counts were: total plate count 478.6 colony forming units (cfu)/m³, lactose-fermenting bacteria 24.9 cfu/m³, haemolytic bacteria (e.g. *Streptococcus pyogenes*) 6.5cfu/m³ and non-lactose fermenting bacteria 4.8 cfu/m³. The counts were generally highest in the morning (08.00) followed by afternoon and evening. The reception hall had the highest overall count, followed by the hospital passages and the outpatient clinic.

Table 1
Total plate count and counts for lactose fermenting, non-lactose fermenting and hemolytic, bacteria in the air for 2 hospitals in Ibb

Bacteria count	Time	Colony forming units/m ³ air				
		Reception Hall	Hospital Passages	Outpatient Clinic	Mean	Overall Mean
Total plate count	08.00	1190	640	350	726.7	478.7
	14.00	650	480	240	456.7	
	18.00	370	240	148	252.7	
Lactose fermenters	08.00	50	34	12	32.0	22.8
	14.00	35	15	5	18.3	
	18.00	29	13	12	18.0	
Non-lactose fermenters	08.00	22	0	0	7.3	4.9
	14.00	9	0	0	4.3	
	18.00	9	0	0	3.0	
Haemolytic bacteria	08.00	5	11	1	5.7	6.6
	14.00	9	4	0	4.3	
	18.00	14	5	10	9.7	

Discussion:

The highest count, for total plate count, was expected since plate count agar is known to allow the growth of a wide range of saprophytic and other bacteria..The count for lactose-fermenting bacteria was higher than for non-

Lactose fermenting bacteria. This result was also expected since a number of studies have demonstrated that lactose-fomenters are more widely distributed than non-lactose fomenters [6,7].

The count for hemolytic bacteria (6.6 cfu/m³) was fairly high, unfortunately, no data were noted in the literature for comparison with this value. Haemolytic bacteria are known to be involved in infection of the upper respiratory tract [8]. However, Senior reported that in studies concerned with airborne infection in man, the particles encountered are those that carry bacteria capable of growth on blood agar during aerobic incubation for 24 or 48 hours at 37 °C [9], incubation conditions which also applied in our study.

The highest bacterial count was in the reception hall, followed by the hospital passages and finally the outpatient clinic. The variation could be related to differences in the degree of crowding; the reception hall is usually more crowded than the other locations. Moreover, internal movement produces an increase in both humidity and temperature, which are known to be important factors affecting bacterial viability [10]. Ambiguous results that were found for the other sites may be because of the oscillation of the variables that affect bacterial concentration.

Table 1 also shows that counts were highest in the morning, followed by the afternoon and the evening. This observation may be related to the busy period of the day. The hospitals are usually at their busiest at 08.00, gradually becoming less busy through the afternoon and the evening. Unlike the other bacteria examined, the distribution of hemolytic bacteria at different hospital locations and different times of the day did not show a clear pattern.

Since many virulent strains belong to this bacterial group, further, more extensive, studies are required to determine distribution of these bacteria in the ambient air of hospitals. It has been reported that most of the contaminants are harmless saprophytes and commensals, and even when carriers or infected students are present, usually less than 1%, and commonly only 0.01%–0.1%, of the airborne bacteria are pathogens [9]. In rooms occupied by patients with tonsillitis or infected wounds, *Streptococcus pyogenes* may be present at a level of 0.1–50 cfu/m³ [5].

This level of contamination may seem small, but it must be remembered that a normal adult inhales about 15 m³ of air/24 hours. The probability of a person becoming infected will be greater if he is exposed to a high concentration of airborne pathogens, but no level of contamination, however

low, can be regarded as safe. Infection is usually initiated by the deposition of a single infected particle at a favorable site in the respiratory tract, although the probability of any one such particle initiating infection is likely to be low for common pathogens, e.g. 10⁻² to 10⁻⁵ for *Staphylococcus aureus* in the nose [11]. It may be high for some, e.g. for *Mycobacterium tuberculosis* in the lung [12]. Finally, the removal of air contaminants and the control of room temperature and

humidity are necessary. Recommendations for air treatment in hospital ambient air include:

- The use of filtration, electronic cleaners, chemical treatment with activated charcoal or other sorbents;
- Temperature control in the range of 20.0–24.5 °C;
- Humidity control in the range of 20%– 60%.

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Evaluation of a Programme for Control of Schistosoma Haematobium Infection in Yemen

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Abstract:

An intervention study was conducted in Khamir, north of Sana'a, for control of urinary schistosomiasis using chemotherapy and health education. The validity and cost-effectiveness of reagent strips as a rapid diagnostic tool to screen for Schistosoma haematobium infection was also assessed along with visible haematuria. Prevalence of S. haematobium infection 14 months post-intervention fell from 58.9% to 5.8% and frequency of heavy infection from 40.0% to 18.9%. Health education sessions resulted in significant decrease in the frequency of contact with water sources and greater adherence to preventive measures. Mass chemotherapy plus health education is a feasible and effective method for reducing S. haematobium infection in Yemen. Reagent strips and visible haematuria could be cost-effective in remote areas with limited access to health services.

Introduction:

Schistosomiasis is the second most prevalent tropical disease in Yemen after malaria and is one of the most important public health problems. With the unification of the country, total population is now 20 million, of which 2–3 million are estimated to be infected [1–4]. Environmental factors and the expansion of agricultural facilities, with the associated improvement in irrigation systems and construction of dams, have generated the optimal environment for fresh-water snails, the intermediate host, resulting in an increase in the prevalence of schistosomiasis (1–4).

Yemen has so far received little attention from international health organizations even though millions of its inhabitants are at risk. The economy of the country depends mainly on agriculture, most of the population being involved directly or indirectly in this field. During the past few years, many new agricultural projects have been established and many of the previous ones extended, so the irrigation system is extensive. In some places these irrigation projects serve as a source of drinking water for humans. Agricultural workers are at high risk of acquiring

schistosomal infection and schistosomal disease because of their daily work in the fields and a continuing contact with schistosome-infected water. The health and labour of these groups should be of paramount importance since increasing food production to meet the requirements of a rapidly increasing population is a major issue for the developing world, particularly Yemen [5–8].

High infection rates for urinary schistosomiasis were found in the years 1995, 1998 and 1999. An evaluation of the results of control efforts made in Yemen over the past 10 years shows a remarkable success in reducing the scale of the disease. Infection rates have fallen in Hajah, Sana'a and Marib provinces. [5,8]. There have been no previous reports on endemicity of schistosomiasis or other intestinal parasites in Khamir, or on integrated methods for schistosomiasis control in the country. This study was therefore conducted with the aim of evaluating the impact of integrated surveillance and control methods on the burden of schistosomiasis in the north of Sana'a governorate. A further aim was to assess the validity and its cost-effectiveness of using visible haematuria (macroscopic haematuria) and reagent strip tests (microscopic haematuria) as screening tools for *Schistosoma haematobium* infection. School enrolment rates in Yemen are relatively low, especially in females, in whom enrolment is below 30% [9].

To overcome this deficiency, non-enrolled as well as enrolled children (both pre-school and school-age) were targeted in addition to the community. It is envisaged that implementation of integrated methods for surveillance and control of schistosomiasis would assist in the development of an effective, school-based control programme sensitive to local social and cultural conditions. The study will also offer the opportunity to assess the validity of detecting urinary schistosomiasis in Yemen.

Method:

This was an intervention study targeting the community and schoolchildren in Khamir, located 90 km north of Sana'a. This is an agricultural area, depending on rain and groundwater for irrigation and domestic use.

Baseline survey:

The community and school baseline surveys were conducted in October 1999. A list of the houses in the study area (1000) was prepared and a random sample of 100 houses (863 individuals) was selected. Each individual was interviewed by a member of the intervention project team using a questionnaire. A urine sample was collected from each participant for examination.

There were no refusals to participate. The items on the questionnaire included demographic data; medical history, including schistosomiasis infection and treatment, whether participants passed blood in the urine and the results of any laboratory tests; and information on sources of water, use of water and whether they used any preventive measures. Parents supplied information for babies and young children. Urine samples were tested in the field by members of the project team. A

sample of 20% of schoolchildren (287 children), randomly selected from the 14 schools of the area was included in the study. These children were interviewed using the same questionnaire, and urine samples were collected for examination in the same way as for the community survey.

Intervention:

The schistosomiasis control methods consisted of chemotherapy for *S. haematobium* and health education. Mass treatment was administered in October 1999; a total of 8540 individuals were treated with a single dose of praziquantel, 40 mg/kg body weight. These were schoolchildren, non-enrolled school-age children, and preschool children together with their parents and other community members. Health education intervention sessions were given during the period September 1999–December 2001.

Schoolteachers from all 14 schools in the district participated in a 2-day seminar. The teachers were educated about the disease and briefed about the study. They were also given detailed information regarding methods of health education for different groups, chemotherapy for schistosomiasis and dosage and record keeping. One teacher from each school was appointed as coordinator for the control activities in his/her school.

The teachers gave weekly health education classes in schools in which posters were distributed. Health education sessions were also held in schools for non-enrolled children and pre-school children along with their parents. Other classes were given in khat sessions and Friday prayer sessions.

Community evaluation survey (14 months post intervention):

The houses in the study area (1000) were listed and a sample of 100 houses (913 individuals) was randomly selected. The evaluation was performed via questionnaire and urine analysis. The same questionnaire was used with the following items added:

- Have you attended mass chemotherapy?
- Have you attended a health education session?
- How did you hear about the control programme?

School evaluation survey (14 months post intervention):

A post-intervention evaluation via questionnaire and urine analysis was done on 20% of all schoolchildren in the area, 323 schoolchildren. The questionnaire was the same as that for the community evaluation survey.

Validation of reagent strips :

The reagent strips were compared to microscopic urine examination to determine their validity as rapid diagnostic tools for *S. haematobium*. Urine was examined immediately in the field using the Nucleopore® filtration technique. The reagent strips used in this study were Hemastix (Bayer Diagnostics, Fernwald, Germany) and Combur 9 strips (Roche Diagnostics, Mannheim, Germany) [14].

Results:

Community survey

Prevalence of *S. haematobium* infection before the intervention measures and 14 months after intervention is shown in Table 1. Overall prevalence was 58.9% pre-intervention, falling to 5.8% in the post-intervention survey, a significant reduction. The prevalence of infection was 55.2% among people 16–39 years old, compared to 42.9% in older individuals.

The majority of infections overall (60.0%) pre-intervention were light (< 50 eggs/10 mL urine). The frequency of light infection in children ≤ 15 years was significantly higher than heavy infection. In contrast, the frequency of heavy infection was significantly higher than light infection in the older age groups (Table 2).

There was no significant difference between males and females, or between literate and illiterate individuals regarding the prevalence or intensity of

infection (Tables 1 and 2). There was a significant decrease in the prevalence of infection 14 months post-intervention. The overall prevalence dropped to 5.8%, ranging from 4.9% among children 6–15 years old to 7.8% among those aged 16–39 years. Furthermore, the majority of infections post-intervention were light infections (81.1%), regardless of age or sex (Tables 1 and 2).

Community evaluation survey:

Prevalence of infection in participants who were literate was 60.0%; this decreased to 3.9% post-intervention. Heavy infection decreased from 42.0% of those infected to 0%. Similarly, for participants who were illiterate, prevalence of infection decreased from 58.8% to 6.1% and the rate of heavy infection decreased from 39.6% to 20.8% (Tables 1 and 2).

Table 1

Prevalence of *Schistosoma haematobium* infection before and 14 months after intervention for inhabitants of 100 households (community-based study)

Age(years)	Pre-intervention			Post intervention		
	Males%	Females%	Total %	Males%	Females%	Total%
<6	50.5	46.2	48.3	6.5	5.3	5.9
6-15	69.2	65.7	67.6	5.0	4.8	4.9
Enrolled	63.6	56.6	61.3	4.2	3.7	4.1
Non-Enrolled	71.3	67.2	69.3	5.3	5.0	5.2
16-39	56.4	53.7	55.2	8.8	6.8	7.8
Literate	52.9	50.0	52.4	4.3	0	3.8
Illiterate	57.4	54.0	55.6	10.5	7.1	8.7
> 40	48.6	36.4	42.9	6.7	6.7	6.7
Literate	33.3	-	33.3	0	-	0
Illiterate	50.0	36.4	43.3	7.1	6.7	6.9
Total	61.2	56.3	58.9	6.1	5.4	5.8
Literate	60.5	54.8	60.0	4.1	3.3	3.9
Illiterate	61.4	56.4	58.8	6.6	5.6	6.1

Table 2 .

Prevalence of *Schistosoma haematobium* infection classed as heavy infection (> 50 eggs/10 mL urine) before and 14 months after interventions for inhabitants of 100 households (community based study)

Age(years)	Pre-intervention			Post intervention		
	Males%	Females %	Total %	Male %	Females %	Total%
<6	21.6	26.5	24.0	14.3	16.7	15.4
6-15	37.3	36.4	36.9	15.4	20.0	17.4
Enrolled	40.5	40.0	40.4	0	0	0
Non-enrolled	36.3	35.9	36.1	20.0	22.2	21.1
16-39	65.9	63.9	65.0	28.6	20.0	25.0
Literate	44.4	50.0	45.5	0	0	0
Illiterate	71.4	64.7	68.1	33.3	20.0	27.3
> 40	55.6	58.3	56.7	0	50.0	20.0
Literate	100	NONE	100	0	None	0
Illiterate	52.9	58.3	55.2	0	50.0	20.0

Total	40.1	39.7	40.0	16.7	21.7	18.9
Literate	42.3	41.2	42.0	0	0	0
Illiterate	39.6	39.6	39.6	16.7	21.7	18.9
Age(years)	Pre-intervention			Post intervention		
	Males%	Females%	Total %	Males %	Females %	Total%
6-15	71.5	62.9	69.9	5.3	3.6	4.9
≥16	56.1	50.0	55.7	2.9	0	2.6
Total	67.9	61.4	66.9	4.6	3.2	4.3

School Evaluation Survey:

Prevalence and intensity of infection also decreased markedly in the school-based evaluation survey. Overall prevalence was 66.9% pre-intervention and fell to 4.3% 14 months post-intervention (Tables 3 and 4).

Table 3 .

Prevalence of *Schistosoma haematobium* infection before and 14 months after intervention for 20% of schoolchildren (school-based study)

Age(years)	Pre-intervention			Post intervention		
	Males%	Females%	Total %	Male%	Females%	Total%
6-15	71.5	62.5	69.9	5.3	3.6	4.9
≥16	56.1	50.0	55.7	2.9	0	2.6
Total	67.9	61.4	66.9	4.6	3.2	4.3

Table 4.

Prevalence of *Schistosoma haematobium* infection classed as heavy infection (> 50 eggs/10 mL urine) before and 14 months after intervention for 20% of schoolchildren (school-based study)

Age(years)	Pre-intervention			Post intervention		
	Males%	Females%	Total %	Male%	Females%	Total%
6–15	39.1	22.0	38.0	20.0	0	16.7
≥16	37.5	50.0	38.2	0	0	0
Total	38.8	33.3	38.0	16.7	0	14.3

Impact of Health Education:

The frequency of contact with water sources significantly decreased in the community and the school surveys (Table 5). Similarly, adherence to preventive measures rose from almost 0% to well over 80% in both surveys. Almost all the people interviewed had been treated and had attended health education sessions ($\geq 95\%$). Most reported that they knew about the programme from the mobile team of the intervention programme or from leaders of the community; a smaller number reported school sessions as being the source of information (Table 5).

Table 5

Effect of education measures for schistosomiasis control (community-based study and school-based study)

Variable	Pre-intervention (%)	Post-intervention (%)
Contact with water sources		
Community	95.0	9.0
Schoolchildren	98.0	3.6
Application of Preventive Measures		
Community	0.9	97.0
Schoolchildren	0	88.0
Blood Seen in Urine		

Community	55.5	2.3
Schoolchildren	60.0	1.2
Had Chemotherapy		
Community	Na	95.0
Schoolchildren	Na	97.3
Attended Health Education Sessions		
Community	Na	98.6
Schoolchildren	Na	99.4
A heard about the Programme through:		
Mobile Team of the Programme	Na	90.0
School Sessions	Na	25.0
Community Leaders	Na	88.1

Validation and cost-effectiveness of reagent strips:

Compared to parasitological examination of urine, the reagent strips recorded low sensitivity, low specificity, limited positive predictive value and low negative predictive value in both surveys (Tables 6 and 7).

Table 6.

Validation of reagent strips in Khamir, October 1999, community-based study

Eggs	Strip		Total
	NO.+VE	NO.-VE	
Present	252(A)	96(B)	348
Absent	194(c)	129(D)	323
Total	446	225	671

Table 7.

Validation of reagent strips in Khamir, October 1999, school-based study

Eggs	Strip		Total
	NO.+VE	NO.-VE	

Present	86(A)	40(B)	126
Absent	65(C)	45(D)	110
Total	151	85	236

Compared to detection of eggs, using strips as the screening method greatly reduced the cost of the control programme in the study area, which is a remote area with limited facilities (Table 8).

Table 8.

Comparison of total cost of treatment using screening reagent strips (visible haematuria) and the urine filtration method (detection of eggs) for identification of infection in urban and rural areas

Variable	Cost (US\$)			
	Urine filtration		Strips	
	Urban	Rural	Urban	Rural
Screening per person	0.48	4.26	0.58	2.02
Treatment per person	1.85			
Total	2.33	6.11	2.70	3.87
Screening per case detected (infected)	0.92	8.21	1.28	3.04
Treatment per infected person treated	1.00		1.25	
Total	1.92	9.21	2.53	4.29

Discussion:

Carefully targeted and infrequent delivery of mass chemotherapy offers a cheap and effective tool for control of schistosomiasis at low cost [10–12]. For a number of reasons schoolchildren have been the favored target group in chemotherapy programmes for schistosomiasis. They are easy to approach with health education programmes, they usually carry most of the burden of infection in the community and they are easy to reach physically for chemotherapy. Moreover, schoolchildren represent the future of developing countries. Investment in their health will have a bearing on educational performance and their future contribution to development.

Schools also offer an infrastructure for control programmes in areas where infrastructure of health institutions is deficient. Using strips as the screening methods has greatly reduced the cost of control programmes elsewhere [13]. Yet, we need to assess their practicability and validity in Khamir; the findings of previous reports indicate that the validity of these screening methods has varied in

different settings [14,15]. Lu-Guang et al. studied the effect of selected chemotherapy combined with health education to control schistosomiasis in marshland of the Yangtze River in China. The prevalence of schistosomiasis decreased by 82% [16].

In the present study, overall prevalence fell by 90.2% to 5.8%. Mass chemotherapy was found to be a feasible and efficacious approach for schistosomiasis control in a study done in Upper Egypt. Baseline prevalence was reduced by 83.6%, from 23.1% to 3.8% [17]. In Mali, where mass chemotherapy with praziquantel was used to control *S. haematobium* in an area of 87 villages, overall prevalence was reduced from 68.8% to 39.4% [18]. An analysis of cost-effectiveness of *S. haematobium* control by chemotherapy confirmed the cost advantage of school-age targeting over vertical programmes, but emphasized the importance of school attendance in selecting community-based over population-based approaches [19].

The rate of school enrolment and absenteeism from schools seem to be crucial factors in the effectiveness of school-based programmes [20]. In a school-based schistosomiasis control programme in Egypt it was reported that 80% of infected girls were not treated because they were not enrolled in schools [21]. After studying the impact of school based mass chemotherapy on helminth egg production in a community in Kenya, Olsen concluded that school-based chemotherapy misses a significant proportion of transmission of schistosomiasis and intestinal helminthes maintained by pre-school children, non-enrolled school-age children and adults [22].

In another school-based programme to control schistosomiasis and intestinal parasites in Kenya, it was noted that in some schools the prevalence of haematuria was not affected, or actually increased, after the first year of intervention due to enrolment of untreated children after mass treatment was given [23].

Thus, the outcomes of school-based programmes seem to be easily influenced by the pool of untreated children outside the school. Reagent strips and visible haematuria could be cost-effective screening methods for the disease only if employed in remote areas with limited accessibility to health services and limited availability of facilities, such as the study area. Savioli and Mott found the development of a simplified, indirect approach to the diagnosis of *S. haematobium* in Tanzania (based on a combination of observation of grossly bloody urine specimens, reagent strips for measuring haematuria, and treatment with praziquantel) reduced costs of schistosomiasis control compared with the more accurate but time-consuming parasitological methods [24]. Chen-Hong et al. found that the rate of infection of residents in a community was the determining factor for the cost-effectiveness of mass chemotherapy schemes [25].

Taylor et al. found that microhaematuria could be valuable in the diagnosis of *S. haematobium* in national control programmes and could replace parasitological examination as long as sensitivity and specificity continued to be evaluated [26].

The results of this study indicate that an integrated community and school-based programme combining chemotherapy and health education can be effective for control of *S. haematobium* infection in endemic areas. Reagent strips and visible haematuria could be used for screening for the disease in remote areas where there is limited access to health services. There was a significant impact on prevalence. The relative contribution of heavy infection among positive individuals was reduced and there was a change in the behavior of the community, manifested by adopting preventive measures against the disease.

Recommendations:

- Mass chemotherapy should be considered for high prevalence areas.
- Personnel involved in schistosomiasis control activities should be adequately trained to ensure quality of services. An appropriate surveillance system should be in place so that data are carefully recorded in the field and reported. Data analysis should be done at all levels to guide control operations and proper feedback of data ensured.
- Since school enrolment rates are relatively low in Yemen, especially in females, to be effective, any control programme must target non-enrolled as well as enrolled children.
- Health education is an important component of schistosomiasis control. The development of human resources and materials for health education must be ensured to decrease in the frequency of contact with water sources and encourage adherence to preventive measures.
- A national control programme must target both the community and schoolchildren to obtain the best possible sustainable results and community participation should be incorporated into the activities of the national schistosomiasis control programme.
- Primary health care staff should be trained in communication skills in order to conduct health education programmes at community level.
- Support from nongovernmental organizations should be sought for schistosomiasis control activities, including chemotherapy, training, health education, sanitation and water supply.

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Directory of Health , Medical Confereces and Professional Meetings in the Region

Conference name	Specialty	Start date	End date	Country	
28th Annual Scientific Congress	Other: Hospital and Health Care Management	Thursday, April 05, 2007	Friday, April 06, 2007	Egypt	Details
First Egyptian E-medicine International Conference	Other-medicine	Tuesday, March 27, 2007	Friday, March 30, 2007	Egypt	Details
ITI Fourth International Conference on Information and Communications Technology (ICICT 2006)	Other: Information Processing in the Service of Mankind and Health	Sunday, December 10, 2006	Tuesday, December 12, 2006	Egypt	Details
RESEARCH AND DEVELOPMENT IN DRUGS (FUTURE TRENDS)	Other: Pharmaceutical	Sunday, June 03, 2007	Friday, August 03, 2007	Egypt	Details
The 2nd International Conference on Health, Environment, and Development ICHED II 2006	Public Health	Tuesday, November 28, 2006	Thursday, November 30, 2006	Egypt	Details
The Third International Conference of	Other: Drug Research	Tuesday, March 06, 2007	Thursday, March 08, 2007	Egypt	Details

Pharmaceutical & Drug Industries Division, NRC" Research & Development in Drugs (Future Trends).					
18th International Congress of Pediatrics	Pediatrics	Friday, October 27, 2006	Wednesday, November 01, 2006	Iran (Islamic Republic of)	Details
The First Arab Conference on Search and Development of information and Communication in Arab World	Medical Informatics	Sunday, December 10, 2006	Thursday, December 14, 2006	Jordan	Details
The Second International Conference on Medical Education in the Sudan	Other:	Wednesday, March 21, 2007	Monday, March 26, 2007	Sudan	Details
The 8th Asian Oceania International Congress on Skull Base Surgery	Surgery	Wednesday, November 01, 2006	Saturday, November 04, 2006	United Arab Emirates	Details

Neurotic Anxiety and Its Relation to Delay of Marriage of Yemeni Women

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Date: 2003 -2004

Introduction:

Marriage is the most valuable human relation connecting woman and man. It guarantees mercy, cooperation and love between both couples. When life is based on such good feelings, it will be a mean for creating good generations enjoying high morals.

The delay in marriage in both sexes, bachelorhood became a problem and phenomenon suffered by Arab society in general and Yemeni society in particular. There is a public feeling that this phenomenon exists almost in most houses and that its size is increasing. This is reflected by different media means. Therefore, the idea of this study emerged to conduct a study over Yemeni women whose marriage was delayed and resulted in the development of psychological disorders with anxiety one of these disorders as indicated by many studies and researches.

The high costs of marriage and high dowry in Yemen is a major cause of the delayed marriage. Certain studies confirmed that there is increase in the bachelor youth in villages whose age is over 30 years old.

Therefore, this study is important to provide a precise scientific view about the delayed marriage age in the Yemeni society and its consequential psychological impacts either positive or negative. Up to the knowledge of the researcher, this research is considered the first of its kind in Yemen.

Among the Objectives of the Research:

Identify the scope of psychological anxiety spread over unmarried and married women through:

1. Detect the levels of psychological anxiety and its spread among unmarried and married women.
2. Reveal the relationship between psychological anxiety and age of unmarried and married women.
3. Identify whether there is a statistical data for the relation of psychological anxiety and age with unmarried and married women.
4. Identify whether there is a relation between the age of marriage and the level of anxiety with women whose marriage was delayed in comparison to women who were not married in the same age.

The current research was limited to a sample including unmarried and married women having university degree in Sana'a city 25 years old and over working in governmental authorities. The sample was formed of 200 unmarried women, university graduates working in different governmental sectors in Sana'a, 25 years and over, 200 married women, working university graduates 25 years and over.

Researcher used the self-developed anxiety scale due to the lack of measurement scale appropriate for the Yemeni environment. Face validity was calculated , any phrase gaining agreement percentage less than 70% was deleted (20 paragraphs were deleted).

Discrimination ability was used to compare the groups (higher and lower) and results showed that all paragraphs have high discrimination except three paragraphs which were deleted (34, 41 and 48). Paragraphs which have low correlation were also deleted (17) and the remaining measurement items were 80.

For the Reliability of the psychological anxiety scale, it was calculated by Test-Retest method. The test was applied to a sample of 50 women and using the Pearson correlation factor, the test reliability factor was 85%.

The internal consistency indicator was calculated using correlation factors between every paragraph and the overall degree of the indicator and the correlation was

good. Therefore, the indicator became structurally faithful and fit as a measurement of psychological anxiety.

Statistical means used:

Statistical data were analyzed using the SPSS/Pc+ package in order to find the following:

1. Statistical mean and standard deviations.
2. Pearson correlation factor.
3. T - Test.
4. Variance Analysis.

By applying the measure to the sample and statistical analysis, the following results were revealed:

1. Results showed that there are no significant statistical differences between married and unmarried women regarding the level of anxiety. The average calculated for sample women was 130.1 which is less than the hypothetical mean (160.0).
2. Results showed that there is no statistically significant relationship between psychological anxiety and age for both married and unmarried women.
3. Increasing age of Yemeni women, especially university graduates, results in their becoming more adapted with their social situation and reduce anxiety.
4. Increased age of Yemeni women for over 30 years increases their experiences and ability to deal with psychological situations related to the late marriage.
5. The higher educational level woman enjoys, the more she becomes adapted with her social situation.

In the light of these results, researched mentioned a number of recommendations and proposals among which:

First: Recommendations:

1. Change the community view towards spinster woman. Women in general and spinster women are effective element in the society if proper respect and protection is given thereto.
2. Give the opportunity and encourage Yemeni women to get married and continue study and work.

3. Change the impression of Yemeni women towards marriage and that it is not an obstacle before her scientific and work ambitions.
4. Raise the awareness of families of the impacts of high dowry and marriage costs.

Second: Suggestions:

1. Conduct a study to reveal the relationship between the delayed marriage age and the economic suffering of Yemeni society.
2. Conduct similar study for other similar samples such as bachelor non-working women.
3. Conduct a similar study for male bachelor who delay their marriage.
4. Work to hold periodic sessions or conferences concerned with Arab and Yemeni family matters.
5. Circulate the Marriage Fund and develop its work to become a social organization or special ministry to help families. This entity should be belonging to the social affairs or family care association.