

Lifestyle Risk Factors Associated with Tuberculosis Patients in Asir Region of Saudi Arabia

Abstract

Background: Tuberculosis remains to be a major public health problem. Lifestyle factors that have indirectly influence to the burden of tuberculosis. The aim of this study is to determine the lifestyle risk factors associated with tuberculosis patients in Asir region of KSA. **Methods:** We conducted a case-control study at the military hospital of Asir region of KSA. A total of 135 sample which is divided into 67 cases and 67 controls. Cases were included from hospital database between 2017 and 2018. Control were selected from patient attending the same hospital with respiratory disease other than tuberculosis. Data collection done through interview using a structured questionnaire. Lifestyle factors and socio-demographic factors associated with tuberculosis were analyzed using logistic regression. **Results:** Mean age of study participants (cases and control) are 38.04 ± 9.66 and 40.16 ± 7.72 respectively. Most important factors associated with tuberculosis patients are overweight and obese [OR = 4.40, 95% CI 1.27-15.25 and 2.38 (1.61-9.22)], Smoker [OR = 1.34, 95% CI 0.52-3.43], abnormal sleep at night (<8 hours) [OR = 5.03, 95% CI 1.57-16.10], blue color job worker [OR = 2.69, 95% CI 1.02-7.28], physical exercise <3 days/week [OR = 1.41, 95% CI 1.21-3.47]. **Conclusions:** In Saudi Arabia, a person's lifestyle and socioeconomic condition are associated with tuberculosis. Interventions focused on improving the quality of life through a reduction of risky lifestyle which prevent the spread of Tuberculosis in Saudi society and improve the efficiency of Saudi national tuberculosis control programme.

Keywords: Lifestyle, prevention, risk factors, Saudi Arabia, tuberculosis

Introduction

Tuberculosis (TB) remains a public health concern worldwide.^[1-4] According to World Health Organization (WHO), tuberculosis caused 1.7 million deaths per year and more than 9 million deaths globally till 2019.

In developing countries including Asia, Africa and Latin America, the prevalence of TB averages from 10-30%. In African countries, the HV and TB prevalence is very high; from 30-40%. In Middle East and North Africa region, the TB prevalence ranges from 10-15%. It is estimated that annual TB a prevalence of 3.2 per 100,000 populations in Saudi Arabia in 2018. Total mortality of TB in KSA around 2-5% of cases, and most of the TB death due to drug resistance in KSA. Most of the TB cases in the southern region.^[1]

Saudi Arabia has a rapidly growing economy with a presence of high numbers of expatriates. Most of these workers belongs to countries, high prevalence of

TB such as India, Pakistan, Bangladesh, Indonesia, and Yemen. Presence of high risk cases has adversely affected TB control in the kingdom, which has started National TB Control Program (NTP) for over 30 years. In 2000, the National TB Control Programme was started to directly observe treatment, short course (DOTS) in all regions of the Saudi Arabia.

Efforts to control this disease have been largely focused on improving treatment and diagnosis of patients with active disease. However, despite those intensive efforts, high per capita rates of TB are still common, particularly in developed countries, due to certain lifestyle factors contribute to increase its prevalence.^[1,2] WHO recognizes the importance of including healthy lifestyles as one of the most efficient and cost-effective methods of preventing communicable diseases including tuberculosis at a higher level in the political agenda of member states. It urges member states to formulate policies, strategies and action plans aimed at the prevention of health risks managing these risks and developing systems to monitor health risks.^[1]

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Lifestyle risk factors which include eating habits, living conditions, educations, overcrowding, smoking, alcohol and occupation, etc. has been contributed to burden of tuberculosis.^[3,4] These factors that have been shown to influence the burden of tuberculosis,. Many previous studies exploring risk factors for TB, bacteria and human related lifestyle risk factors generally focused on single risk factors, using most commonly cross sectional and therefore is impossible to determine their association with TB.^[5-9] Many previous studies were conducted in developing countries, very few were carried in middle eastern countries.^[10-13]

Another study conducted in Canada, housing density, income level associated with TB. Congested housing has associated with TB, and isolation from health services due to lack of accessibility and affordability may increase the likelihood of TB.^[14]

Another study conducted in Spain, the result of study showed that incidence of TB cases has increases among joblessness (RR = 1.68, CI95%: 1.51-1.88), social disharmony (RR = 1.29, CI 95%: 1. 04-1.58), overpopulation (RR = 1.36, CI 95%: 1.19-1.55). Regions with extreme poverty and inner-city neighborhoods showed a higher risk of tuberculosis (RR = 1.11, CI 95% 1.08-1.135 and RR = 1.80, CI95%: 1.51-2.14).^[15]

Another study conducted in Hong Kong showed that smokers were increased risk of TB (OR, 2.87; 95% confidence interval, 2.00-4.11; $P < 0.001$). In the smokers, persons who had TB, smoked additional cigarettes per day, (13.43, SD 8.76 vs. 10.96, SD 7.87, $P = 0.01$).^[16]

TB is associated with the human immune-deficiency virus (HIV) in Saudi Arabia, as in other endemic countries.^[15-19] However, there are few comprehensive data on the association of smoking, alcohol, occupation and other lifestyle risk factors with TB. Few studies have been performed in Arab countries to clarify how lifestyle factors interact in the development of active TB. Studies^[20-24] that address risk groups help to priorities TB research and intervention among the most vulnerable in the community, enabling effective and efficient TB control. The objective of study is to determine the association of lifestyle risk factors with tuberculosis patients in Asir region of KSA.

Methods

Study setting and target population

The setting of the study is Military Hospital of the Armed Forces in the South in Khamis Mushait and target population is all tuberculosis patients in Saudi Arabia This hospital has 500 beds. Annual incidence of TB cases in hospital is 2000 cases. In the hospital, OPD cases of TB were seen and free of cost medicine delivered to TB patients.

Study design

A case control study design was utilized.

Data source and population

• Inclusion criteria

Cases

All TB patients with confirm diagnosis of Hospital record were included

Control

All patients other than respiratory disease were included from medical department OPD

• Exclusion criteria

Cases

Those Patients who are Laboratory negative were excluded. And age less than 18 years were also excluded

Control

Age less than 18 years were excluded.

Sample size and sampling technique

The sample size was calculated by Epi info, 95% CI, 40% relative accuracy, the expected probability of exposure to a disease is 0.34, the expected probability of exposure from non-disease 0.30 and the expected individual odds ratio is 1.25, the total sample size is 135 and divided equally (67) in cases and (68) in controls.^[9] Simple Random Sampling was used to select the study participants (both cases and control).

Data collection tool and technique: (Data collection tool should be valid and reliable)

The questionnaire consists of two main parts:

1. Part 1: Socio-demographic characteristics of study participants
2. Part 2: Consists of life style questions. It includes smoking, alcohol use, nutrition, fitness, physical activity, education and employment history, social and outside activities, and medical history.

To validate the questionnaire, a jury of ten specialists was asked to examine it. They suggested editing some of the items. The researcher edited them accordingly.

Study variables

Dependent variables is Tuberculosis and independent variables is age, gender, education, marital status, work status, income, housing, person per household, nutrition status, physical exercise, and smoking.

Ethical consideration

The study protocol was approved by from ethical committee of Armed Forces Hospital in Southern Region. Permission was taken from respective departments, consent form signed from each participant before conducting an interview. Participation should be voluntary. Participants are free to withdraw at any time without any explanations.

Table 1: Socio-demographic characteristics of study participants (n=135)

Characteristics	Cases (%) n=67	Control (%) n=68	P*
Age (years) (Mean±SD)	38.04±9.66	40.16±7.72	0.16
Gender			
Male	39 (58.2)	38 (55.5)	0.75
Female	28 (41.8)	30 (44.1)	
Education			
Secondary	34 (49.3)	40 (58.8)	0.34
Bachelor	33 (50.7)	28 (41.2)	
Resident			
City	30 (44.8)	32 (47.1)	0.79
Village	37 (55.2)	36 (52.9)	
Marital status			0.65
Single	10 (14.9)	07 (10.3)	
Divorce	5 (7.5)	4 (5.9)	
Married	52 (77.6)	57 (83.8)	
Type of Housing			0.96
Popular House	33 (49.3)	32 (47.1)	
Apartment	32 (47.8)	34 (50)	
Villa	02 (003)	02 (2.9)	
Ownership of housing			0.93
Owner	37 (55.2)	38 (55.9)	
Rent	30 (44.8)	30 (44.1)	
Income (Saudi Riyal)			0.43
≤7000 SR	31 (46.3)	36 (52.9)	
>7000 SR	36 (53.7)	32 (47.1)	
Family Size			0.91
6≥ Members	26 (38.8)	27 (39.7)	
6≤ Members	41 (61.2)	41 (60.3)	
BMI (Body Mass Index)			0.04
Normal (18.5-24.5)	19 (28.4)	9 (13.2)	
Overweight (25-29.9)	31 (46.3)	40 (58.8)	
Obese (>30)	17 (25.4)	19 (27.9)	
Smoke			0.34
Yes	31 (46.3)	37 (54.4)	
No	36 (53.7)	31 (45.6)	
Family history of obesity			0.23
Yes	30 (44.8)	24 (35.3)	
No	46 (68.7)	40 (58.8)	

*Chi-square test

The confidentiality and privacy of the subjects were maintained and there was no financial benefit to either the subject or the researcher.

Data collection procedure

Secondary data for the study population was abstracted from TB treatment registers in selected treatment facilities. These included demographic data (age, sex, residence, marital status) and medical and treatment data. To obtain primary data, control were selected from the outpatient department and questionnaire were filled by interviewer.

Statistical analysis

Data was double entered using SPSS version 24. Cases were compared with control with lifestyle and demographic

factors by Chi square test. Odds ratios (OR) were calculated by logistic regression, with TB as an outcome. Univariate analysis was performed to see the effect of each variable on the risk of TB. Multivariate models were developed, that showed a significant statistical effect in the prediction of TB ($P < 0.05$).

Results

Socio-demographic profile of study population

The mean age of cases was 38.0 ± 9.7 years, while for control subjects, the mean age was 40.2 ± 7.7 years. More than half of cases and control subjects were males (58.2% and 55.9%, respectively). More than half of cases and control subjects were university graduates (50.7%

Table 2: Lifestyle risk factors among study participants (n=135)

Characteristics	Cases (%) n=67	Control (%) n=68	P*
Average duration of sleep at night			0.00
Normal (8 h)	27 (40.3)	07 (10.3)	
Abnormal (8 <h)	40 (59.7)	61 (89.7)	
Nature of job			0.52
White collar	24 (35.8)	28 (41.2)	
Blue collar	43 (64.2)	40 (58.8)	
Stress level			0.43
Mild	16 (23.9)	16 (23.5)	
Moderate	21 (31.3)	28 (41.2)	
Severe	30 (44.8)	24 (35.3)	
Regular exercise during the last 3 months			0.66
Yes	45 (67.2)	48 (70.6)	
No	22 (32.8)	20 (29.4)	
Frequency of Junk Food eating (including snacks)			0.005
3> day/week	10 (14.9)	19 (27.9)	
3< day/week	57 (85.1)	49 (72.1)	
Skipping meals during the day			0.80
Yes	48 (71.6)	50 (73.5)	
No	19 (28.4)	18 (26.5)	
Late Night Eating			0.67
Never	32 (47.8)	30 (44.1)	
Sometimes	35 (52.2)	38 (55.1)	
Feeling energy level drop throughout the day			0.31
Yes	21 (31.3)	27 (39.7)	
No	46 (68.7)	41 (60.3)	
Ever taken a multivitamin or food supplements?			0.91
Yes	27 (40.3)	28 (41.2)	
No	40 (59.7)	40 (59.8)	
Eating out per week			0.00
1≥ times per week	17 (25.4)	23 (33.8)	
1≤ times per week	50 (74.6)	45 (66.2)	
Reason for eating besides hunger			0.55
Stressed	36 (53.7)	40 (58.8)	
Social	31 (46.3)	28 (41.2)	
Eating beyond the point of fullness			0.05
Sometimes	47 (70.2)	43 (63.3)	
Never	20 (29.8)	25 (36.7)	
Frequency of physical exercise			0.53
≤3-4 day/week	41 (61.2)	38 (55.9)	
≥3-4 day/week	26 (38.8)	30 (44.1)	
Priority of Health			0.07
Low priority	24 (35.8)	24 (35.3)	
Medium Priority	22 (32.8)	20 (29.4)	
High priority	21 (31.3)	24 (35.3)	

and 58.8% respectively). More than half of cases and control subjects lived in rural areas (55.2% and 52.9%, respectively). Most cases and control subjects were married (77.6% and 83.8%, respectively), while 14.9% of cases and 10.3% of control subjects were single. Most cases and control subjects lived in popular houses (49.3% and 47.1%, respectively) or apartments (48.8% and 50%, respectively). More than half of cases' and control subjects' residence were owned by them (55.2% and 55.9%,

respectively). The monthly of 52.9% of cases and 47.1% of control subjects was more than 7000 SR. Regarding family size, 46.7% of cases and 53.3% of control subjects was more than 6 members. About half of cases (46.3%) and 58.8% of control subjects were overweight, while 25.4% of cases and 27.9% of control subjects were obese. More than half of cases (53.7%) and 45.6% of control subjects were smokers [Table 1].

Lifestyle factors

There was no statistically significant differences between cases and controls with respect to lifestyle factors most cases and control subjects have an average duration of sleep less than 8 hours (61.2% and 89.7%, respectively, $P < 0.001$), The occupation of more than half of cases and control subjects belonged to the “Blue Collar” job type (64.2% and 58.8%, respectively). The prevalence of severe stress was higher among cases than control subjects (44.8% and 35.3%, respectively). Cases had higher family history of obesity than control subjects (68.8% and 41.2%, respectively). Most cases and control subjects practiced regular exercise during the last 3 months (67.2% and 70.6%, respectively). Most cases and control subjects skip meals during the day (71.6% and 73.5%, respectively). More than half of cases and control subjects sometimes eat late at night (52.2% and 55.9%, respectively). However, difference between both groups was not statistically significant. About one third of cases and control subjects experience the feeling of energy drop during the day (31.3% and 39.7%, respectively). Less than half of cases and control subjects take multivitamins or food supplements (40.3% and 41.2%, respectively). Most cases and control subjects sometimes eat out weekly (74.6% and 66.2%, respectively). t. Other than hunger, more than half of cases and control subjects eat because of stress (53.7% and 58.8%, respectively). Most cases and control subjects sometimes eat beyond the point of fullness (70.1% and 72.1%, respectively). More than half of cases and control subjects practice physical exercise less than 3-4 days/week (61.2% and 55.9%, respectively). About one-third of the cases and control subjects consider the priority of their health as high (31.3% and 35.3%, respectively). However, difference between both groups was not statistically significant [Table 2].

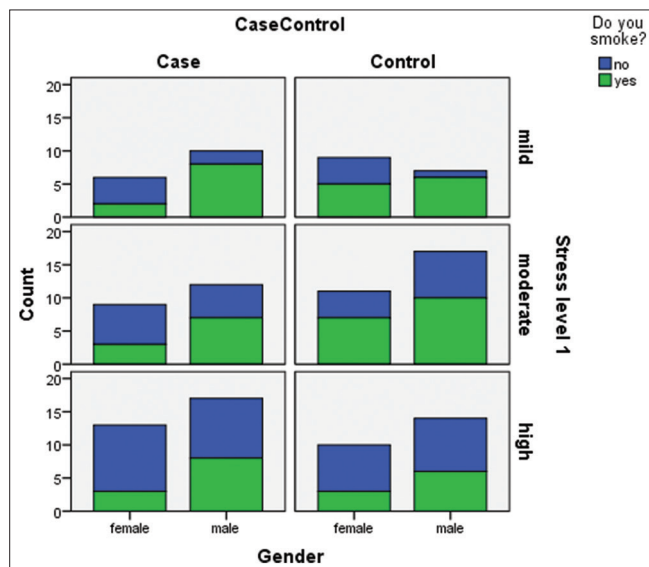


Figure 1: Stress level among cases and control with smoking

Association between socio-demographic factors and tuberculosis

Table 3 shows Univariate analysis between outcome variable and socio-demographic variables. The statistical significant association between tuberculosis and socio-demographic variables as follows. The female gender (crude OR = 1.01 and AOR = 1.65), Secondary level of education (crude OR = 1.38 and AOR = 1.58), Rural residence (crude OR = 1.09 and AOR = 1.16), Being divorced or married (crude OR = 1.14 and 1.56, respectively; and AOR = 1.19 and 1.01, respectively). Having a monthly income of more than 7000 SR (crude OR = 0.76 and AOR = 1.9). Family size of >6 members, (crude OR = 1.03 and AOR = 1.9).

Table 4 shows that both overweight and obesity were significantly positively associated with TB (crude OR = 2.72 and 2.35, respectively and AOR = 4.4 and 2.38, respectively). Smoking also associated with TB OR >1 (crude OR = 5.88 and AOR = 5.03). Those whose average duration of sleep at night for <8 hours was significantly associated (crude OR = 5.88 and AOR = 5.03). Blue-collar jobs workers were associated TB (crude OR = 1.25 and AOR = 2.69). Those who had moderate stress is associated with TB (crude OR = 1.33 and AOR = 1.84). Lack of physical exercise (crude OR = 1.17 and AOR = 1.51), Late night eating is associated OR >1 (crude OR = 1.15 and AOR = 1.33) and physical exercise less than 3-4 days/week is associated with TB (crude OR = 1.24 and AOR = 1.41).

Discussion

The study result has revealed that life style risk factors for tuberculosis are multi-layered. Contact to different lifestyle exposure including smoking, high body mass index, irregular sleep at night, stress level, frequency of junk of food, eating out per week, stress-induced eating, and frequency of physical exercise were associated with in the probability of developing tuberculosis. Despite the discovery of effective and affordable chemotherapy more than five decades ago, tuberculosis remains a major cause of death worldwide [Figures 1 and 2].^[17]

The present study followed a case-control study to design and aimed to explore the association between lifestyles

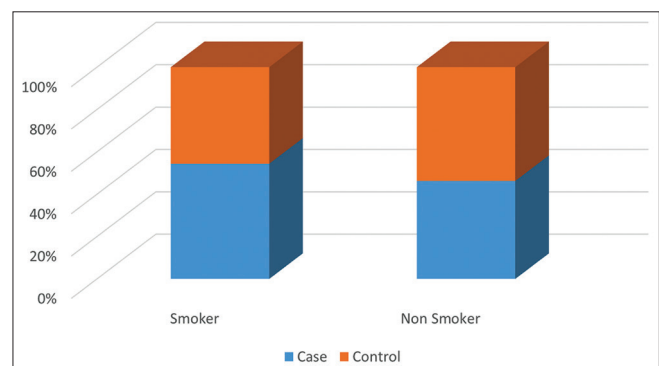


Figure 2: Smoking status among cases and control

Table 3: Association of socio-demographic factors and tuberculosis (n=135)

Characteristics	Cases crude OR (Confidence interval)	Cases adjusted OR (Confidence interval)
Gender		
Male	1	1
Female	1.01 (0.55-1.21)	1.65 (0.61-4.45)
Education		
Bachelor	1	1
Secondary	1.38 (0.70-2.737)	1.58 (0.61-4.45)
Resident		
City	1	1
Village	1.09 (0.55-2.15)	1.16 (0.49-2.75)
Marital Status		
Single	1	1
Divorce	1.14 (0.22-5.84)	1.19 (0.28-4.96)
Married	1.56 (0.55-4.41)	1.01 (0.17-5.73)
Type of Housing		
Villa	1	1
Popular House	1.06 (0.14-7.99)	1.12 (0.34-2.18)
Apartment	0.97 (0.12-7.30)	1.02 (0.13—8.10)
Income		
≤7000 SR	1	1
>7000 SR	0.76 (0.38-1.50)	1.90 (0.67-5.37)
Family Size		
≤6 Members	1	1
>6 Members	1.03 (0.52-2.07)	1.90 (0.54-2.28)
Family History overweight		
No	1	1
Yes	1.53 (0.75-3.10)	1.43 (0.68-3.00)

with tuberculosis. Even though personal characteristics of participants in the study group (with tuberculosis) were comparable to those in the healthy control groups, some lifestyle risk factors differed between them.

Previous study stated that^[18] stated that the capacity to remain healthy is greatly affected by poor sleep and sleep is insignificant modulator of the immune response. The relation between lack of sleep and tuberculosis has been explained by several studies, which described the association lack of sleep and disturbed immunity. Previous study stated that^[19] stated that. sleep demand is increased in most chronic diseases,^[20] and vulnerability to infectious diseases is increased by lack of sleep.^[21,22]

The result of study revealed that those who had sleep deprivation have more likely associated with TB. In Saudi Arabia, most of the people slept late in the night. This finding is consistent with other study results.^[23]

The relation between nutritional status and tuberculosis has been studied worldwide. Previous study noted that^[23] tuberculosis is generally associated with nutrition in both industrialized and emerging countries. Several malnutrition-related lifestyle factors were significantly associated with tuberculosis in the present study, i.e., infrequent meals (<3 meals/day), high calorie intake, wherein lack of nutritional value is the major factor.

Previous study has^[24] found that how body mass index caused the disturbance between human immunity which lead to risk factors of TB. Moreover, the present study showed that having a white collar (office-based sedentary) job, and lack of physical activity (as indicated by practicing physical exercise for less than 3 days/week) were significantly associated with tuberculosis.

Present study shows that smoking habit almost same between cases and control, although it's associated more than one-fold with tuberculosis. In KSA, 30% of young people have smoking habit.

Previous study^[25] determined the association between smoking and pulmonary tuberculosis. The study found that disease rates of 0.42/1000 for male non-smokers and 2.09/1000 for male current smokers with a rate ratio of 1:5. There is association of tobacco and alcohol with TB among ex-servicemen with TB.

Conclusions

Finally, results of the present study identified main categories of lifestyle risk factors significantly associated with tuberculosis among adult patients at the military hospital in Asir Region. These categories are: High body mass index, eating outside, lack of sleep, malnutrition, and physical inactivity. Therefore, it is important that the Saudi

Table 4: Association of life style risk factors and Tuberculosis (n=135)

Characteristics	Cases Crude OR (Confidence Interval)	Cases Adjusted OR (Confidence Interval)
BMI		
Normal (18.5-24.5)	1	1
Overweight (25-29.9)	2.72 (1.08-6.84)	4.40 (1.27-15.25)
Obese (>30)	2.35 (1.84-6.59)	2.38 (0.61-9.22)
Smoking		
No	1	1
Yes	1.38 (0.70-2.72)	1.34 (0.52-3.43)
Regularly sleep at night?		1
Normal (8 h)	1	1
Abnormal (8< h)	5.88 (2.33-14.78)	5.03 (1.57-16.10)
Nature of job		
Blue collar	1	1
White collar	1.25 (0.62-2.51)	2.69 (1.00-7.28)
Stress level		
Mild	1	1
Moderate	1.33 (0.54-3.26)	1.84 (0.56-6.05)
Severe	0.80 (0.33-1.92)	0.75 (0.23-2.39)
Regular Exercise for past 3 month		
Yes	1	1
No	1.17 (0.56-2.43)	1.51 (0.59-3.85)
Frequency of Junk Food eating (including snacks)		
3> days/Week	1	1
3< days/Week	1.50 (0.71-3.16)	1.75 (1.01-3.01)
Skipping meals during day		
No	1	1
Yes	1.10 (0.51-2.34)	1.59 (0.50-5.01)
Late Night Eating		
Never	1	1
Ever	1.03 (0.52-2.06)	1.04 (0.36-2.99)
Ever taken a multivitamin or other food supplements?		
No	1	1
Yes	1.03 (0.52-2.06)	1.04 (0.36-2.99)
Eating out per week		
1≥ times per week	1	1
1< times per week	1.50 (0.71-3.16)	1.30 (1.02-3.98)
Reason of eating besides hunger		
Social	1	1
Stressed	1.23 (0.62-2.43)	2.08 (1.02-5.27)
Frequency of physical exercise		
3-4< day/week	1	1
3-4> day/week	1.24 (0.62-2.47)	1.41 (1.21-3.47)

Ministry of Health should design and implement health education programs addressing these lifestyle risk factors for prevention of tuberculosis.

Compliance with ethical standard

Research involving human participants: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Research involve human participants,

research approved from ethical review committee from hospital, confidentiality of data has maintained.

Declaration of patient consent

Inform consent was obtained from each participant.

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Conflicts of interest

There are no conflicts of interest.

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