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The Effects of Health Belief Model(HBM) based on Health Education and food advised on the Promotion of Self-care Behaviors in Tuberculosis patients

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Introduction and aims: *Tuberculosis (TB) is one of the most prevalent infectious diseases that declared by WHO as urgency due to lack of its sufficient control. The aim of study was to determine the efficacy of the HBM on the promotion of self-care behaviors in patients with smear-positive pulmonary TB.*

Materials and Methods*: The framework of this quasi-experimental study was the HBM. 160 patients were divided equally into the test and control groups. Data were collected by questionnaires. Training materials were enclosed in two pamphlets and a manually. The training plan was performed in the test group in 3 sessions, they also advised for using of different food items. After one month, both groups took the post-test. Data were analyzed by SPSS Ver. 16.*

Findings*: Mean age of the subjects was 55.2 years and treatment duration was 32 days. 53.8% were females, illiterate (76.9%), residents of rural areas (76.9%) and 21.2% of them had a family history of TB. 83.7% of them had been previously trained about TB. Paired T-test indicated a significant difference on the promotion of the model*

construct, knowledge and self-care behaviors in the test group after intervention (P<o.oo1) and T-test showed a significant difference between groups (P<0.05) in all the constructs, knowledge and self-care behaviors with the exception of perceived severity and self-efficacy after the intervention. The correlation test revealed a positive correlation between the model construct and knowledge in the test group (p<0.001). Analysis of data showed an increase on daily intake of food items after intervention in the case group (p<0.05).

Discussion and Conclusion: *Results of current research showed health education highly promotes the knowledge of self-care behaviors in patients through HBM.As poor nutritional status is more common in people with active tuberculosis than in people without tuberculosis. However, it is also advisable in TB patients that encouraged eating a healthy varied diet.*

Key Words: *Health Belief Model (HBM), Smear-positive pulmonary TB, Self-care behaviors, Food advised*

INTRODUCTION

Tuberculosis (TB) is a chronic bacterial disease majorly caused by Mycobacterium tuberculosis, which is spread from person to person by inhalation of respiratory droplets. TB is manifested in two forms of pulmonary (85%) and extra pulmonary [1]. Approximately one third of the world's population (2 billion people) is infected by TB or is at the risk of the disease. Every year, about 9.3 million people show signs of active TB infection and about 1.8 million cases die because of it [2]. In 2004, out of 8.9 million new cases of the disease worldwide, 3.9 million [3] were reported to have smear-positive pulmonary TB as opposed to 2.6 million cases out of 6.2 million [4] which are considered as the main reservoir of the infection [2]. One of the goals of the Millennium Development is to detect 70% of the new cases of smear-positive pulmonary TB as well as to treat at least 85% of them [5]. This will result in the reduction of the incidence and mortality of TB to half the levels in 1990 by 2015.Ultimately, with its incidence lowered to less than one case in a million, this disease will be eliminated by the year 2050 [4]. With 17.9% infection and the incidence of 26% in one hundred thousand people, Iran is ranked as the 17th country affected by TB in the world [6-8].

In 2009, the World Health Organization (WHO) estimated that there were 9.4 million new cases of active tuberculosis worldwide, and 1.3 million deaths (WHO 2010). Most people who get infected never develop symptoms as their immune system manages to control the bacteria. Active tuberculosis occurs when the infection is no longer contained by the immune system, and typical symptoms are cough, chest pain, fever, night sweats, weight loss, and sometimes coughing up blood. Treatment is with a combination of antibiotic drugs, which must be taken for at least six months. People with tuberculosis are often malnourished, and malnourished people are at higher risk of developing tuberculosis as their immune system is weakened. Good nutrition requires a daily intake of macronutrients (carbohydrate, protein, and fat), and micronutrients (essential vitamins and minerals). Understanding about the food habit and food intake of patients is necessary to recover them from the illness by strengthening their immune system, and by improving weight gain, and muscle strength, allowing the patient to return to an active life (Sinclair et al., 2011).

Tuberculosis and malnutrition are linked in a complex relationship. The infection may cause under nutrition through increased metabolic demands and decreased intake, and nutritional deficiencies may worsen the disease, or delay recovery by depressing

important immune functions (Sinclair et al., 2011). Provinces like Sistan-Baluchistan and Golestan are reported to have the highest incidence and prevalence in our country (20.01- 29.2 in a population of one hundred thousand) [9]. In 2008, the incidence of TB was 107 cases per one hundred thousand inhabitants in the region of Sistan, and its average rate was 115 per one hundred thousand inhabitants over the past 5 years before 2008 [10]. The total incidence of TB cases in the region was 109.7 per one hundred thousand in 2009 and the incidence of smear-positive pulmonary TB was 64.3 in a population of one hundred thousand [11]. The overall goals for treatment of tuberculosis are 1) to cure the individual patient, and 2) to minimize the transmission of *Mycobacterium tuberculosis* to other persons. Thus, successful treatment of tuberculosis has benefits both for the individual patient and the community in which the patient resides(CDC,2003).

Self-care is defined as participation and accepting responsibility on behalf of the patient to perform the correct treatment of the disease [12]. Health education is an educational process aiming to bring about desirable health behaviors [13]. Today, behavior-changing models are used for establishing effective health education programs. Selecting a training model keeps the program on the right track from the beginning to the end. Health Belief Model (HBM) was first designed in 1950 and it gradually expanded. It is a principal pattern of showing the relationship between health beliefs and behaviors which provides a useful theoretical framework to study the cognition of a wide range of behavior determinants [13, 14].

This pattern suggests that individuals are willing to make a change in their behavior if they feel it to be practical and feasible as well as economically justifiable and that the change will benefit them in some way. For a change to occur in the individual's behavior, their needs be motivation as well as the individual's feeling threatened by the current behavior. The individual needs to appreciate change as beneficial with few side effects so he could gain the competence to make it happen [13]. According to this model, a person will acquire preventive health behavior if he is affected by the following factors: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action [15], self-efficacy and other variables (deflators) [16].

The need to modify wrong behavior as well as to enhance self-care behaviors in patients with smear-positive pulmonary TB requires changes in the behavioral pattern and viewpoint of the patients. This convinced researchers to make use of this model in order to motivate patients while providing practical health recommendations through the patients' participation in maintaining their own health. HBM emphasizes perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and efficacy in determining the likelihood of behavior. In order to achieve success in changing behavior as intended in HBM, the patients need to feel threatened by their current behavior pattern (perceived susceptibility and severity) and they should also believe that a particular behavior leads to an outcome valued with a reasonable cost (perceived benefits). Furthermore, they have to feel confident (efficacy) in overcoming perceived barriers in this path. This study aimed to determine the effects of education based on HBM in promoting self-care behaviors in patients with smear-positive pulmonary TB in Sistan region.

Materials and Methods

This was a quasi-experimental study which was conducted in accordance with a previous study on the same subject [17] and 160 smear-positive pulmonary TB patients were randomly selected in Sistan region by stratified sampling. They were divided into two groups of 80 control subjects and 80 cases. In sampling, 3 towns of the region (Zabol, Hirmand and Zahak) were each considered as a unique class. From each class, some of the rural and urban health centers were chosen in the following clusters and the samples were selected within these clusters by random sampling.

This framework comprises of the HBM and a two-part questionnaire designated accordingly. The first part was composed of 16 questions on the demographics. The second part contained questions regarding the structure of the model (57 questions in total; 9

questions on perceived susceptibility items, 8 questions on perceived severity, 11 questions on benefits and perceived barriers and 10 questions on efficacy), 26 questions on awareness and 9 questions on self-care behaviors.

The questionnaire was prepared through citing reliable sources. The appearance and content validity of the method was approved by a group of experts (n=6) and in order to assess the reliability of the internal consistency, Cronbach's alpha was used with a value of 7.0 or more. The questionnaires were completed at the patients' residence by an interviewer. Based on the experimental results, objectives of the research and characteristics of the target group, training programs developed within HBM and they were performed on the experimental group. As for the control group, they only received routine training programs in health care centers and there were no interventions. The intervention consisted of 3 sessions, with an average time of 45 minutes, face to face with the researcher at the individual's residence or at the health centers covering the patients. Training materials used for the patients consisted of two pamphlets and a booklet about TB. The guidelines in these materials were elaborated for the subjects during training sessions and they did not interfere with their level of education. At the end of the training sessions, a copy of the training materials was delivered to the patient or the family to study. After one month as the course of the study, we referred to the experimental and control groups and conducted the pre-test. At this stage, the obtained results were compared by SPSS software V.16 and proper analytical and descriptive tests. The scoring process was as follows:

1. the expected response in questions regarding any of the structure pattern scored 3 points;
2. "do not know" or" have no idea" scored 2 points
3. wrong answers scored one point.

Additionally, the questions regarding the patients' knowledge (i.e questions about structures), scored 2 points in case of the expected self-care behavior and one point in case of wrong behaviors. Accordingly, the variables were categorized into three levels of low, medium and high (Table 1)

The parameters that used to assess the nutritional status were body mass index (BMI) and food item intake that was assessed by FFQ questionnaire**.**

Findings

In current research, the mean age was 55.2±4.2 years, Mean BMI was 19.82kg/m^2 in Case group and 21.8kg/m^2 in control group, majority of them, their BMI was between 18.5-25.9kg/m^2 (70 and 80% in case and control groups respectively) (Table 1). Mean duration of treatment was 32 days, the average number of the residence places had 3 rooms and the average family consisted of 5 members. Gender composition was 46.2% male subjects as opposed to 53.8% female subjects.

The majority of the studied patients were illiterate (76.9%), 23.1% were urban and 76.9 % were rural residents. About 83.8% of the subjects had previously received TB training from various sources. Among them, 59.4% had received training by health workers and the majority of the subjects (61.9%) had a monthly income below 2,000,000 Rails and they did not receive any other forms of financial support such as subsidies, from the Relief Committee or other sources.

Table-1: BMI

BMI(kg/m^2)	Case N (%)	Control N(%)
≤ 18.5	9(11.25)	6(7.5)
18.5-25.9	56(70)	64(80)
≥26	15(18.75)	10 (12.5)

Table-2: Distribution of subjects according to the ranking HBM Constructs, knowledge and self-care behaviors in the case and control groups before and after the intervention

Ranking / Variables		case						control					
		Weak		Medium		Good		Weak		Medium		Good	
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
HBM Constructs	Perceived susceptibility	2.5	1.2	37.5	28.8	60	70	0	0	33.8	42.5	66.2	57.5
	Perceived severity	0	0	28.8	20	71.2	80	0	0	27.5	25	72.5	75
	Perceived benefits	0	0	18.8	12.5	81.2	87.5	0	0	28.8	26.2	71.2	73.8
	Perceived barriers	16.2	13.8	66.2	45	17.5	41.2	11.2	8.8	72.5	72.5	16.2	18.8
	Cause to practice	3.8	3.8	62.5	46.2	33.8	50	6.2	6.2	68.8	67.5	25	26.2
	Self efficiency	2.5	1.2	72.5	55	25	43.8	0	0	70	67.5	30	32.5
Knowledge		0	0	0	53.8	53.8	46.2	46.2	0	0	70	70	30
Self-care behaviors		23.8	22.5	22.5	41.2	41.2	36.2	36.2	37.5	37.5	51.2	51.2	11.2

In the experimental group, Mann-Whitney and Kruskal-Wallis tests indicated a relationship between the main variables of age, education, residence and source of education on TB. In general, the results showed a major improvement in the scores of the template structures, knowledge and self-care behavior in the experimental group after the intervention (Table 2).

Table-3: Mean scores of HBM Constructs, knowledge, and self-care behaviors in the case group before and after intervention

Variables			No.	Mean	SD	Range	Means difference	df	*P value
HBM Constructs	Perceived susceptibility	Before	80	22.3	2.63	9-27	1.46	79	<0.001
		After	80	23.76	3.37				
	Perceived severity	Before	80	20.86	2.4	8-24	1	79	<0.001
		After	80	21.86	2.47				
	Perceived benefits	Before	80	29.96	3.17	11-33	0.89	79	<0.001
		After	80	30.86	3.05				
	Perceived barriers	Before	80	21.21	5.76	11-33	3.19	79	<0.001
		After	80	24.4	7.57				
	Cause to practice	Before	80	17.02	3.36	8-24	1.26	79	<0.001
		After	80	18.28	4.08				
	Self-efficiency	Before	80	21.57	4.42	10-30	2.09	79	<0.001
		After	80	23.66	5.65				
Knowledge		Before	80	58.25	7.8	26-78	5.47	79	<0.001
		After	80	63.72	12.1				
Self-care behaviors		Before	80	12.61	1.61	9-18	1.52	79	<0.001
		After	80	14.13	3.04				

***Results are based on paired T-test**

Paired sample T-test proved this change to be significant (P<0.001). By contrast, this change was not considered to be significant in the control group with the exception of the structure of perceived susceptibility (P >0.05) (Table 3).

Table-4: Comparison of Mean scores of HBM Constructs, knowledge and self-care behaviors between case and control group before and after intervention

Variable		Total score	Case M±SD	Control M±SD	*P. value
Perceived susceptibility	Before	27	22.3±2.63	23.08±2.37	0.05
	After		23.76±3.37	22.57±2.81	0.017
Perceived severity	Before	24	20.86±2.4	21.22±2.35	0.33
	After		21.86±2.47	21.38±2.34	0.21
Perceived benefits	Before	33	29.96±3.17	29.55±3.45	0.43
	After		30.86±3.05	29.81±3.44	0.043
Perceived barriers	Before	33	21.21±5.76	21.25±5.49	0.96
	After		24.4±7.57	21.86±5.7	0.018
care to practice	Before	24	17.02±3.36	16.51±3.1	0.31
	After		18.28±4.08	16.67±3.31	0.007
Self-efficiency	Before	30	21.57±4.42	16.51±3.1	0.77
	After		23.66±5.65	22.05±4.78	0.053
Knowledge	Before	78	58.25±7.8	57.22±9.48	0.457
	After		63.72±12.1	57.95±10.2	0.001
Self-care behaviors	Before	18	12.61±1.61	12.22±1.7	0.14
	After		14.13±3.04	12.42±2.06	<0.001

***Based on the results of independent T-test**

Independent T-test also indicated that unlike the phase before the training, there was a statistically significant difference between the two groups regarding all the structures of knowledge and self-care after the training, with the exception of the structure of perceived severity and self-efficacy (P<0.05) (Table 4).

Furthermore, correlation analysis revealed that after the intervention, a positive correlation was found between all model pattern structures and knowledge of self-care behavior in the case group (P<0.001). According to the regression analysis, only the perceived barrier model (P =0.01) and knowledge (P<0.001) were expected to be useful in promoting self-care behaviors. Frequency consumption of food items in the Case and Control groups before and after intervention presented in the Table 5 .

Table-5: Frequency consumption of food items in the Case and Control groups before and after intervention

Variables		**Daily**		**Weekly**		**Twice a Week**		**Monthly**	
		Case N (%)	Control N (%)	Case N (%)	Control N (%)	Case N (%)	Control N (%)	Case N (%)	Control N (%)
Cereals (bread or rice)	Before	80 (100)	80 (100)	-	-	-	-	-	-
	After	80 (100)	80 (100)	-	-	-	-	-	-
Leafy vegetables	Before	20(25)	22(27.5)	25(31.25)	29(36.25)	15(18.75)	19(23.75)	20(25)	10(12.5)
	After	30(37.5)*	20(25)	41(51.25)*	28(35)	17(21.25)	20(25)	2(2.5)	12(15)
Fruits	Before	31(38.75)	30(37.5)	28(35)	30(37.5)	25(31.25)	11(13.75)	16(20)	9(11.25)
	After	39(48.75)*	28(35)	28(35)	31(38.75)	11(13.75)	11(13.75)	2(2.5)	10(12.5)
Dairy products	Before	31(38.8)	22(27.5)	24(30)*	27(33.7)	2(2.5)	7(8.8)	23(28.8)*	24(30)
	After	42(5.5)*	24(30)	18(22.5)	25(31.3)	1(1.3)	7(8.8)	19(23.8)	24(30)
Flesh food	Before	25(31.3)	21(26.3)	49(61.3)*	53(66.3)	6(7.5)	5(6.3)	-	1(0.3)
	After	41(51.3)*	23(28.8)	34(42.5)	51(63.8)	5(6.3)	5(6.3)	-	1(0.3)

* significant at 5% level (**Based on the results of independent T-test**

DISCUSSION AND CONCLUSION

The results of this study indicated that the majority of the subjects were more or equal than 65 years old. This finding is consistent with the results of Kayani [18], Sarani [17], Bidarpour [19] and Shojaei [20].

However, in the study of Taheri Aziz [21], the disease was found to be more prevalent in the individuals younger than 25 years of age who were in their active life stages. This might be due to the difference in the study populations or the differences between the two study samples as Taheri Aziz studied 35 subjects in Tehran Pasteur Institute. In the present study, the majority of the population were female (53.8%). Similarly, the subjects were mainly women in the studies of Phuong Hoa [22], Shojaei [20], Sarani [17], Zareban [23] and Kiani [18] whereas in the study of Taheri Aziz [21], the majority of cases were men. With regard to

occupational status, housekeeping was most frequent in both groups, followed by agriculture. Similarly, housekeeping was the most frequent job in the study of Kiani (18). In the study of Hakary [24], 62.2% of men and 50% of women were employed in the agriculture and animal husbandry.

One of the prominent findings of the current study was the high prevalence of illiteracy (76.9%) in the population. Higher levels of education are associated with a lower incidence of diseases, especially infectious ones [18]. Therefore, education is an essential component in controlling TB. In the studies of Sarani [17], Kiani [18], Dadipour [25], Zareban [23] and Hakary [24] as well as the current study, most of the subjects were illiterate whereas in the study of Taheri Aziz [21], illiterate and educated individuals accounted for the same proportion (35.5%).

In the present study, 83.8% of the cases had already received training on TB while in the study of Rahbar [26], only 35.4% had been previously trained in the area. In terms of expert training sources, health agents including technicians and health workers accounted for the most common trainers (59.4%). In the study of Kar [27], television was the main source of information on TB with a 34% incidence and in the study of Mangesho [28], friends and relatives were mainly involved in the training. In the studies of Sarani [17], Dolatabadi [29], Taghizadeh Asl [30] and Zareban [23], the majority of subjects had developed skills being trained by health care workers and physicians while in the study of Mahboubi [31], 60% of the subjects had got their information from their friends. According to the Kruskal-Wallis and Mann-Whitney tests, a significant association was found between the main variables of the research and age, education, place of residence and the source of training. The comparison of the results of Mangesho [28] revealed that in rural communities, there is little knowledge about the cause and transmission of TB which leads to a delay in the treatment of the disease. In the study of Zaeimi [21], a significant correlation was found between age, residence, education, resources information about TB and the knowledge, attitude and behavior of the participants regarding self-care patterns ($P<0.05$). In the study of Dadipour [25], a statistically significant correlation was observed between the rate of the patients' knowledge and their place of residence ($P<0.0001$). In the study of Karimi [32], a significant relationship was found between the subjects' age, education level, marital status and place of residence while no such correlation was observed between the variables of job, income, family size, and the patients' knowledge, attitude and compliance of the recommended therapeutic regimen. In the study of Mahboubi [31], gender and literacy were found to be associated with the patients' knowledge and attitude toward TB ($P<0.05$). In the study of Pishkar monfared [33], knowledge and education, occupation, place of residence, training by health personnel and the patients' compliance with the therapeutic regimen were found to be significantly associated with education, occupation and place of residence ($P<0.05$). In the study of Aghakhani [34], no significant correlation was detected between the patients' compliance with the therapeutic regimen and their knowledge of the effects of medications with the age and gender while they were significantly correlated with the patients' education level, occupation, self-confidence, urban residence and previously received training.

In the study of Taheri Aziz [21], there was a significant relationship between the patients' education and their knowledge and practice. There was also a significant correlation between the knowledge and attitude by gender while no such correlation was found between marital status and occupation with knowledge, attitude and practice of the TB patients before and after the intervention.

The role of demographic factors in the effectiveness of interventions has been established and it could be concluded that with proper planning for each of these groups, which should be separated by age, education, location and the other demographic factors, educational programs proportional to the patients' conditions could be provided through offering various training resources. On the other hand, the study of the main variables lead us to the understanding that before the intervention, there were no significant differences in the mean scores of the experimental and the control group regarding all the structures, knowledge

and self-care behaviors (P>0.05). However, the difference was proven to be significant in all the structures and self-care behaviors with the exception of perceived severity and efficacy after the intervention (P<0.05). It is also noteworthy that the mean scores of these two variables increased in the experimental group after the intervention. The pre-training results of Sarani's study [17] are similar to the current results. However, the post-results of the study (after intervention) indicated that the mean scores of all variables, except for perceived barriers, significantly increased in the experimental group (P<0.05) while the mean scores of the control group did not demonstrate any significant differences (P>0.05). In comparison with the level of variables in the present study, 46.9% of the participants in the study of Zaeimi [21] had poor knowledge of self-care and 57.8% demonstrated poor self-care behavior. Similarly, 58% of the patients in the study of Shams [35] had poor knowledge of how to take care of themselves. In the study of Haj Amiri [36], 43% had poor and 18% had good knowledge of lung TB while 62% of the cases applied the therapeutic regimen properly, 47% moderately and 11% complied poorly. In the study of Phuong Hoa [22], many of the patients who had a cough lasting for more than 3 weeks were found to have insufficient knowledge of the cause, mode of transmission, symptoms and possible treatments of TB. Increased knowledge was significantly associated with the patients' following the instructions of health care workers or medical agents. In the study of Abebe [37], 50.4% of the TB patients were aware of the cause of the disease. The literate subjects had a better knowledge of the disease compared to uneducated ones being aware that the major cause of TB was the micro-organisms. Moreover, men were more aware of the causes of TB compared to women. Overall conclusion drawn from the comparison of the changes in the mean levels of the framework, knowledge and self-care behaviors in the case group after the intervention indicated that all these variables saw a significant increase as a result of education affecting the promotion of self-care behaviors in TB in region of Sistan. In the studies of Olayemi [38], Sarani [17] and Taheri Aziz [21], the results were indicative of the effects of an educational intervention on the patients' knowledge, attitude and behavior as well as their adherence to the preventive treatment and pattern structures.

According to the results of the correlation analysis, pattern structures and knowledge could be considered as predictors of promoting self-care model constructs. Furthermore, the results of the regression analysis indicated that knowledge and structural barriers constitute the major part of the program. In the study of Mathuria [39], a distinct difference was observed between the awareness of the signs, the awareness of the disease and the patient's behavior. In the study of Sarani [17], the structure of perceived susceptibility and knowledge were the only practical predictors according to the regression analysis.

As depicted in the Table 5 bread and rice were common cereals that used daily by case and control groups. Although our finding showed an increase in daily consumption of all food items such as leafy vegetables, fruits, dairy products and flesh food after intervention in the case group. But it's notably that at least 500 - 750 ml of milk or yogurt should be consumed daily to ensure adequate intakes of vitamin D and calcium. Also 5-6 portions of fruit and vegetables should be eaten per day. Pure fruit juice can be used to decrease the bulk of the diet. The best dietary sources of vitamin B6 (pyridoxine) are yeast, wheat germ, liver, whole grain cereals, legumes, potatoes, bananas, and oatmeal. As a person with TB often have a poor appetite, however, supplements should be given, after consulting an expert health professional. It is mentionable that a good multivitamin and mineral supplement, providing 50-150% of recommended daily intake.

Throughout the world, poor nutritional status is more common in people with active tuberculosis than in people without tuberculosis (van Lettow 2003), and weight loss, including loss of lean body mass, is a well-recognized symptom of the disease.

The following recommendations are proposed as a result of the findings of the current research:

1. Given the high rate of illiteracy, educational films need to be prepared and used based on the HBM regarding therapeutic orders on diet, personal hygiene, health behavior and other factors
2. Development of the DOTs strategies by combination of HBM in order to prevent, control and increase the patients' ability in DOTs process
3. Expert health care teams are required to train in accordance with HBM and apply it in the teachings of TB;
4. Training programs for prevention, control and treatment of TB need to be designated and implemented based on HBM in all levels of the health system
5. Regarding the importance of this disease and the need to inform and educate the public on this issue, it is also recommended that further research be done on a broader spectrum.
6. There is no documented evidence that any specific food on its own can alter the course of the disease or can for that matter be effective in the treatment of malnutrition. It is advisable in TB patients that encouraged eating a healthy varied diet.

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