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Effect of Health Beliefs Model-Based Educationon the Control of Urinary Tract Infection amongPregnant Women

Nora Refat Mohamed [1], Hanan Hassan Hassan Omar [2],
Inas Mohamed Abd-Allah [3], Sanaa Ali Nour[4]

[1]*Maternity, Obstetric and Gynecological Nursing, Faculty of Nursing / Suez Canal University, Egypt*
[2]*clinical pathology, Faculty of Medicine / Suez Canal University, Egypt*
[3]*Maternity, Obstetric and Gynecological Nursing, Faculty of Nursing / Suez Canal University, Egypt*
[4]*Obstetric and Gynecological Nursing, Faculty of Nursing / Zagazig University, Egypt*

Abstract:
Background: *Urinary tract infections (UTIs) are frequentlyencountered and recurrent in pregnancyposing a greattherapeutic challenge and serious complications to the mother and fetus. The aim of this study was to investigate the effect of health beliefs model-based education on the control of urinary infection among pregnant women.* ***Design:*** *Quazi-experimental design was adopted.* ***Sample:*** *purposive sampling was applied to recruit 100 pregnant women attending at primary health care (PHC) centers in Ismailia city. They were divided into an intervention group (50) and control group (50).* ***Tools:*** *Data were collected before and 3 month after intervention using a structured interviewing questionnaire, UTI Symptoms Assessment questionnaire (UTISA) and urine analysis and culture record.* ***Results:*** *After interventionthe mean scores of knowledge, practices and health beliefs of the study group displayed a significant increase compared to the control group (p= < 0.001).The recurrence rate after 3 months reduced among study group compared to controls (14%vs 32%). Symptoms severity and bothersomeness decreased significantly after intervention among study group compared to control group especially regarding incomplete bladder emptying, urination frequency (< 0.001, and 0.001) and botherness (< 0.001, and 0.004).* ***Conclusion,*** *low level of UTI risk perception was associated with poor practices and recurrence of UTI during pregnancy, and utilization of HBM in educating pregnant women with UTI proved to improve knowledge, practices, and beliefs towards the disease in addition to control UTI in pregnancy.* ***Recommendations*** *provide health education program about UTIs based on HBM during pregnancy. Periodic screening of pregnant women for early detection as well as appropriate treatment.*

Key words*: Health Belief Model, pregnancy, prevention, secondary prevention, Urinary tract infections, recurrence.*

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I. Introduction

Urinary tract diseases (UTIs) are the foremost predominant diseases in pregnancy, counting for about 20% of all pregnancies. They are considered the commonest pregnancy disease, second to anemia. Moreover, they are responsible for 10% of all hospitalizations during pregnancy. Urinary tract infection, encompasses abroad range of infections that result from microbial intrusion of the urinary tract, which is ordinarily sterile [1, 2].

Typical physiologic changes incline the pregnant woman to UTI as a result of alterations in both anatomical and hormonal effect. These changes lead to persistent stasis of urine in urinary bladder enhances the development of microorganisms, vesico-ureteric junction relaxation results in reflux of urine from bladder to ureter and afterwards to renal pelvis and then can affect the renal parenchyma influencing the work of. In addition, bacterial development is favored by the increased content of glucose, amino acids and other nutrients in pregnant women urine. Pregnancy itself is recognized as a state of compromised immunity. These changes, combined with a short urethra and destitute perineal cleanliness caused by the developing uterus hindrance, raise the chances of UTI development [3, 4, 5].

UTIs are classified anatomically into broad categories of cystitis if, confined to the lower tract (comprising asymptomatic bacteruria) and pyelonephritis, if the UTI encompasses the upper urinary tract.Asymptomatic bacteruria (ASB) is the existence of significant bacteruria without symptoms such as frequency, urgency, dysuria, hematuria, and suprapubic discomfort. It is experienced by 2% to 10% of pregnant women and non-pregnant women. Dissimilar to the general population, ASB ought to be screened for and cured in pregnant women. If left uncured, up to 40% of pregnant women with ASB may exhibit pyelonephritis [6, 7].

Acute cystitis is the most prevalent urologic disease among women. It develops in 1% to 4% of pregnancies. Acute cystitis is developed by ascending bacteria of fecal, perineal, and urethral origin through the urethra up to the bladder and renal system. Unfortunately, its diagnosis is more challenging to make during pregnancy [8, 9].

During pregnancy about 25 to 40% of these lower infections mounts to the upper tract and lead to acute pyelonephritis. Acute pyelonephritis is one of the most prevalent medical complications during pregnancy in spite of recommendations of routine screening for pregnant women and treatment of ASB, the incidence of acute pyelonephritis throughout pregnancy ranges from 1% to 2.5%. In a current large, prospective cohort at parkland hospital, the incidence of acute pyelonephritis in antepartum period was 44 per 1000 deliveries[10, 11].

Infections of the urinary tract from ASB to pyelonephritis are associated with negative consequences not only for the mother but also for the newborn. Complications resulting from asymptomatic bacteruria, cystitis and pyelonephritis are significant. Asymptomatic bacteruria has been correlated with intrauterine growth retardation (IUGR), preterm delivery, and low birth weight infants. In a large, retrospective study of nearly 200.000 births, cystitis was correlated with preterm delivery, preeclampsia, and cesarean delivery. Moreover, acute pyelonephritis carries an increased risk of complications during pregnancy such as acute respiratory distress syndrome (ARDS), anemia, renal dysfunction, premature rupture of membranes (PROM), and septic shock [12, 13].

Recurrent urinary tract infections (RUTIs) are widespread during pregnancy. Cystitis recurs in 33% of patients. Furthermore, recurrence of pyelonephritis during the same pregnancy is common, occurring in 10% to 18% of cases. Recurrent urinary tract infections causes critical adverse pregnancy sequels for the mother as well as the child as preterm birth and small for gestational age babies. The management of every repeated infection result in healthcare system expenditures[10, 11, 14, 15].

The burden of recurrent UTIs has both personal and societal aspects. The societal burden comprises the clinical and economic burden of the disease while the personal burden comprises social and psychological effects which have negative influence on the quality of life (QoL).The abrupt, rapid, as well as painful commencement of the UTI episode is often an origin of anxiety in patients. Also, depression can emerge because of guilt Feelings concerning patient's disability to execute their habitual activities. Given the plateau of UTI prevalence and recurrence, the evaluation of UTI burden at both individual and societal levels and the recognition of prophylactic processes to eliminate this burden are substantial for the efficacious management of RUTI [16, 17].

For women susceptible to recurrent urinary tract infection, prevention and treatment start with non-pharmacologic therapy: dietary, hygienic, and activities /exercise modifications. This choice is preferred as antibiotics prescription in pregnancy must be influenced by the potential for the agent to harm the mother and /or her fetus. Besides the exposure to numerous courses of antibiotics or long courses of antibiotic prophylaxis may rapidly cause infections with multi-resistant organisms that turn antibiotic choice problematic [18.19].

Nurses can aid patients through the diagnostic process, treatment and prevention of UTIs, promotion of their wellbeing and empowerment. Teaching self-care practices and prevention strategies are vital nursing activities for UTI prevention and management during pregnancy. This urges the requisite for more organized educational activities during pregnancy to assure high quality and clients' satisfaction [3, 20, 21].

The Health Belief Model (HBM) is considered one of the first theories generated particularly for health related behaviors. It is most considerably applied cognitive model in studies of health behavior and compliance. In the 1950s a team of social psychologists constructed the HBM to investigate reasons of low participation of people in programs for disease prevention and detection.The Health Belief Model is a vital and exact pattern that is employed to determine the relation between health beliefs and behavior. Thus, HBM can play a significant role in establishing appropriate intervention programs. In nursing, HBM is a commonly applied model, particularly in issues concentrating on patient compliance and preventive health care practices [22, 23].

SIGNIFICANCE OF THE STUDY

Urinary tract infection during pregnancy is complicated because of the probable risks to the infant and of critical diseases in the mother even if the infection was asymptomatic. Therefore, studies recommended health education programs with the purpose of ensuring optimal pregnancy outcomes and maternal health. Furthermore, RUTIs are widespread during pregnancy causing burdens to families and communities so preventive strategies are essential nursing activities for its combating[24, 25].

HBM is the most significant model that is applied in the development and design of prevention programs. Besides,educational interventions based upon health belief model were proved to be effective in behavior modification of women during pregnancy in the field of urinary infections [26, 27]. So, this study aimed to

investigate the effect of health belief model-based education on urinary tract infection control among pregnant women.

II. Materials And Methods

Research design:
Descriptive and Quazi experimental design were applied to achieve the stated objectives.

Study Settings:
The study was carried out at antenatal clinics of governmental primary health care centers in Ismailia city that cover urban districts. Health centers include Hay Elsalam, Elshik zaid, Elsabaa Banat and Elshohada health centers .The chosen health care centers are distributed all over Ismailia city that represents the high flow rate centers.

Antenatal clinics of the chosen health care centers consist of 2 rooms, booking room for registration ,initial assessment that include history taking ,height ,weight , and B.p measuring ; and clinical examination room . Other main services delivered to pregnant women include routine ultrasound, investigations especially urine analysis and hemoglobin level, dental care, mineral and vitamins supplementation, and tetanus vaccination. All these services are delivered In exchange for trivialamount of money.

Target population:
The target population of the present study was pregnant women that have urinary tract infection.

Sampling

- **Sample size:**

The sample size was calculated utilizing the following formula:

$$n = 2\left[\frac{\left(Z_{\alpha/2} + Z_{\beta}\right) * \sigma}{\mu_1 - \mu_2}\right]^2$$ [28]

Where:
n = sample size
Zα/2 = 1.96 (The critical value that divides the central 95% of the Z distribution from the 5% in the tail)
Zβ = 0.84 (The critical value that separates the lower 20% of the Z distribution from the upper 80%)
σ = the estimate of the standard deviation = 2.41 [26]
μ1 = mean in the study group = 8.63 [26]
μ2 = mean in the control group = 10.85 [26]
So, by calculation, the sample size will be equal to 45 cases per group, giving a total of 90 cases. Adding a drop-out rate of 10% of cases raises the sample size to a total of 100 cases.

- **Sampling technique:**

Purposive sampling was used to collect the study subjects according to the inclusion and exclusion criteria till reach the determined sample size.

Inclusion criteria:

1- Pregnant women in first and second trimester.
2- Pregnant women diagnosed with urinary tract infection by physician based on urine culture of (at least 10^5 CFU/mL).
3- Primigravidas and multigravidas were enrolled in the study irrespective to age.

Exclusion criteria:

1- Patient need to be hospitalized.
2-Women have known underlying renal pathology, chronic renal disease, and renal transplant.
3-Women have diabetes mellitus.
4- Women under immunosuppressant therapy

Sampling method:

Pregnant women, enrolled in this study, wererandomly assigned to two groups, each with 50 subjects. Pieces of paper numbered 1 and 2 were drawn blindly, oneat a time, to determine the order of group assignment ofsubjects. Subjects were then assigned to the groups in orderindicated by the drawing. Theorder was repeated

until 100 subjects were obtained. Group 1 were the controls who received routine care. While group 2 received training program about the control of UTI during pregnancy based on the health belief model.

Data collection tools

Three main tools were employed to collect data:

Tool (1): structured interviewing questionnaire: this tool was developed by the investigator based on the review of related literatures to assess the effectiveness of education based on health belief model on the control of urinary tract infection among pregnant women. It consisted of seven parts:-

Part 1: socio- demographic data, it consisted of 7 items as (patient's age, education level, residence, occupation, and economic status, etc.).

Part 2: obstetrical and gynecologic history, it consisted of 9 items as parity, gravidity, abortion, gestational age, living children number, child spacing, and previous family planning methods.

Part 3: history of urinary tract infection and its recurrence, it consisted of 6 items.

Part 4: included questions to assess pregnant women's knowledge regarding urinary tract infections (pre and post-test), it consisted of 15 main items as (concept, risk factors, signs and symptoms, and complications…etc.) covered by 26 questions.

Scoring system:

Regarding knowledge items, the correct answers scored "two", incomplete answers scored "one" and the incorrect or unknown answers scored "zero". These scores were transformed into percent score.

Part 5: included questions about health behaviors regarding UTI it consisted of 5 main items as (clothing, nutritional habits, urinary habits, hygiene habits, and habits related to sexual behavior) covered by 30 questions. (pre and post-test)

Scoring system:

For the behavior items, the correct responses scored 2 and the incorrect 1. The scores of the items were summed-up then divided by the total number of the items, giving a mean score for the part.

Part 6: includes questions related to health belief model (HBM) that concerned with pregnant women health beliefs regarding UTI as; women's perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues of action, and self-efficacy. (Pre and post-test)

It included 38 items with a 3point Likert scale anchored at 1= disagree, 2= not sure and 3=agree. The scale consisted of 41 questions and 6sub-scales including perceived susceptibility (5 items), perceived severity (5 items), perceived barriers (7items), and perceived benefits (5 items), self-efficacy (7items), cues to action (2items).

Part 7: included questions about compliance to treatment and reason for noncompliance. (Post-test)

Tool (2): The UTI Symptoms Assessment questionnaire UTISA

The UTISA is a self-administered instrument developed by**Clayson et al., 2005** [29].It comprises 14-items inquiring about the severity and bothersomeness of seven basic UTI symptoms. The Likert scales concerning each item were 4-point scales.The clinical assessments occur at the first visit,at any early stage (day 1–3),and at the visit of cure test.

For all of the seven most considerably reported symptoms and signs of UTI (frequency, urgency , pain/burning on urination, incomplete voiding, pain in pelvic area, low back pain, blood in urine), degrees of 'severity' and bothersomeness'. every item has a Likert scale of responses, the 'severity' item responses options include 'did not have', 'mild', 'moderate,'severe', scored 0–3; also the bothersomeness item responses options include 'not at all', 'a little', 'moderately', 'a lot', scored 0–3.

Tool (3): physiologic measures record*:*

It consisted of 3 items and was used to record the results of physiological measures as urine analysis test and culture.

Content validity:

Data collection tools were reviewed by five expertise in the maternity, obstetric, gynecologic nursing, and urology specialists to ensure applicability, comprehensiveness, understanding, and ease of implementation of the tools.

Reliability was done by cronbach's alpha coefficient test which revealed that each item of the utilized tools consisted relatively homogenous items. The internal consistency of knowledge was 0.89; the total HBM construct was 0.92, and health behavior regarding UTIs was 0.75.

2-Operational Design:

This design combines the preparatory phase, content validity and reliability, pilot study, in addition to field work**.**

Preparatory phase:

Reviewing of all available local and international related literatures about the various aspects of the research problem was done by the investigator. Tools of data collection were prepared based on related literatures and tested for content validity.

Pilot study:

The pilot study was executed on 10% of sample. It was conducted to test tools applicability and the study feasibility. According to the results of the pilot study, items were corrected, modified, omitted or added. It also helped in determining the time needed for interviewing and evaluating the suitability of settings to perform the interview and lab investigations. Pregnant women recruited in the pilot study were not enrolled in the study.

Field work:

After assessing and analyzing the collected pilot data, health education program based on health belief model was designed. A total of 100 pregnant women were recruited from the study settings. Data were collected using the pre constructed tools through face to face interviewfrom study and control group.Data were collected from the selected governmental centers on along the days of the week especially on Saturdays, Sundays, Mondays, and Wednesdays from November 2018 to June 2018. The intervention, education program based on health belief model, was applied to the study group only.

Interviewing phase:

In the selected study settings the investigator introduced herself to pregnant women, and based on pre-mentioned inclusion and exclusion criteria suitable subjects were excused to participate in the study. Oral consent was taken after explaining the purpose and procedures of the study. The investigator interviewed each woman individually on-site in a private room. The approximate time spent with each woman during the interview was 15-20 minutes.

Intervention phase:

After assessing and analyzing the collected pilot data, health education program based on health belief model was designed. The HBM hypothesizes that persons will not seek healthcare unless they possess minimal levels of relevant general healthmotivation and knowledge, view themselves as potentially vulnerable (Susceptible) and perceive the condition as threatening (severe), assured of the intervention efficacy (benefits), and view fewobstacles (barriers) in carrying out the recommended measures. Socio-demographic, experiential and patient-provider interaction variables are categorized as modifying factors that have anindirect influence on compliance behaviors. Cues to action such assymptoms, advice from others and reminders are also consideredindirect influences on compliance behavior

Health education program:

A health education program designed mainly for improve pregnant women knowledge, beliefs, and practices related to UTI during pregnancy and its management based on HBM theoretical frame work. Educational contentincluded general information regarding UTI as: prevalence; risk factors; signs and symptoms complications, health education regarding treatment and UTI prevention. Intervention was performed by the researcher for the experimental group via lecture, question and answer followed by discussion in 5 sessions each 60-45 minutes over a period of two weeks. Individual face-to-face education was started utilizing varied teaching methods and materials as booklet, power point presentation, video presentation, and role playing and demonstration with model.

The content of the teaching sessions

Content and aim of the program were explained to each enrolled pregnant woman. Session (1), included information about content and aim of the program, introduction, condition of the disease in Egypt and the world with emphasis on the constructs of ***susceptibility and perceived severity***. To ameliorate this group member's perceived susceptibility regarding UTI, the elevated prevalence of UTI in women particularly pregnant ones was conveyed. In addition to explaining the complications of recurrent UTI as sepsis, renal failure, adhesions, and so forth to raise their perceived severity concerning UTI.

Session (2) included, information about the symptoms of the disease and the ways of treatment with emphasis on the constructs of ***perceived benefits and barriers***. The role of health behaviors to prevent recurrence of UTI was described to increase the perceived benefits of UTI preventive behaviors and the participants were encouraged to be active in group discussions about barriers of UTI preventive behaviors to compare the benefits and barriers and overcome the barriers.

Sessions (3 and 4) included, information about ***Benefits and barriers*** of prevention of disease, recommendations, ***self-efficacy*** in preventing and controlling the disease. WhileSession (5) included, reviewing the issues from previous sessions and answering possible questions. Discussion was used to direct subjects towards proper beliefs on the seriousness of UTI, their susceptibility to the disease, the benefits and barriers of adopting preventive behaviors, and the reasons for trust in adopting such behaviors. At the end of the educational intervention, an educational booklet was given to these participants. The educational booklet about UTI and preventive behaviors was as a cue to action for the samples.

Evaluation and follow-up phase:

Two follow-up were held for the enrolled pregnant women. The first follow up was done1 week after completing antibiotics. A questionnaire was utilized to assess symptoms severity and bothersomeness, treatment compliance and infection outcome and test of cure culture will be obtained from both the study and control groups. Clean catch mid-stream urine specimen was collected and tested for presence of UTI after instructing women about the proper technique.

The second evaluation occurred three months after intervention, the pregnant women of both study and control groups completed the post-test to assess their knowledge and behaviors and also they were assessed for presence of UTI using urine culture to assess effectiveness of the educational program. Considerably, the participants were telephoned before each meeting.

Urine Sample collection

Clean catch mid-stream urine specimen were collected by the women after explaining the technique of urine sample collection, which was through the following process:

1-Wash hands thoroughly using soap and water then dry.

2- Separate the labia with one hand.

3-Area surrounding the urethral meatus is cleaned from front backwards with water then dried thoroughly.

4-Still with labia separated, void the first 20 to 30 ml into the toilet, after that collect a portion of the remaining the urine passed into a sterile container

5- Screw on cap of urine bottle immediately touching only the outside of the bottle and the cap [30].

Specimen transportation:

Urine specimens were put in ice box immediately after pregnant women handled them and were labeled with client's name, number and date. Urine examinations were performed at laboratories that follow the universal procedures for urine analysis and culture (Al-Ismailia laboratory).Urine specimens were cultured within 2-4 hours of collection.

Urine specimens' culture*:*

Urine specimens were cultured when they were first opened then the specimens were sent for microscopic and dip stick urine analysis. The specimens of urine were inoculated on blood agar, MacConkey agar. The plates were turned upside down to be incubation for 24 hours at 37°C under aerobic conditions. After incubation, the cultured plates were assessed macroscopically for the size, appearance, color, in addition to morphology of the colonies. The bacterial isolates were examined applying standard bacteriological procedures, including biochemical tests Gram stain, and microscopic examination. Antimicrobial susceptibility test of isolates was performed to assure that proper and adequate antibiotic administered [31].

Diagnosis of UTI

A diagnosis of UTI was made when there were more than 100.000 colony forming unit (CFU)/ml of urine. Contaminated and specimen with mixed growth specimens, were excluded from the study.

3- Administrative Design:

An official approval letters directed from the dean of the faculty of nursing at to the medical and nursing directors of health centers and laboratory of Al-Ismailia laboratory to obtain their permission and cooperation.

Ethical consideration

Oral consents were obtained from the women after a brief explanation of the study with her right to withdraw at any time. Confidentiality of the subjects was maintained. The group was not exposed to any increased risk as a result of the study. The result from the study helped the patient in receiving appropriate treatment and investigating recurrence, hence beneficial. At the end of the program the control group were given educational booklet and were asked to follow for any question.

4- Statistical design:

Collected data were arranged, and analyzed by employing Statistical Package for the Social Sciences (SPSS) program. Pregnant women who are uninfected with urinary tract infection were considered as control group. Descriptive statistics was expressed using mean, median and frequency. Chi–square test (X2) and were used were used to find the significant difference for qualitative variables of different groups. The differences are considered significant when P value is equal to or less than (0.05). Independent and paired t test were used to assess change pre and post intervention.

III. Results

Table (1): knowledge about urinary tract infection during pregnancy among the study and control groups throughout the intervention phases (n = 100).

Knowledge areas	Control group (Mean ± SD)		Study group (Mean ± SD)		P_1-value	P_2-value
	pre	post	pre	post		
Anatomy and urinary defenses	0.82±0.89	0.92±0.85	0.74±0.85	2.44±0.88	0.200	**< 0.001***
Urinary tract normal Pregnancy changes	0.42±0.73	0.44±0.76	0.30±0.58	2.46±0.87	0.743	**< 0.001***
Urinary tract infection concepts	0.66±0.65	0.68±0.68	0.56±0.57	1.68±0.47	0.322	**< 0.001***
Urinary tract infection epidemiology	1.36±0.94	1.38±0.87	1.18±0.47	2.70±0.46	0.837	**< 0.001***
Risk factors of urinary tract infection	0.70±0.81	0.74±0.82	0.60±075	2.08±0.69	0.322	**< 0.001***
Types of UTIS	0.84±1.18	0.88±1.10	0.42±0.90	1.84±1.3	0.485	**< 0.001***
Lower UTI signs and symptoms	1.58±0.90	1.68±0.86	1.48±0.86	2.8±0.78	0.133	**< 0.001***
Upper UTI signs and symptoms	0.40±0.63	0.42±0.67	0.22±0.46	1.80±0.72	0.785	**< 0.001***
UTI maternal complications	0.52±0.70	0.56±0.73	0.34±0.65	2.0±0.70	0.622	**< 0.001***
UTI fetal complications	0.38±0.56	0.40±0.60	0.20±0.40	1.56±0.54	0.569	**< 0.001***
Management of UTI	1.58±0.99	1.68±0.89	1.68±0.91	2.82±0.38	0.358	**< 0.001***
Measures to control UTI	6.32±3.82	6.38±3.64	5.60±3.41	9.76±1.4	0.595	**< 0.001***

*statistically significant at $p < 0.05$.

Table (1) shows the mean level of studied pregnant women knowledge of urinary tract infection among the study and control groups during the intervention phases. Improvements were observed in all areas of knowledge among the study group (p=<0.001), whereas there was no significant difference changes among the control group.

Table (2): Practices about urinary tract infection during pregnancy among the study and control groups throughout the intervention phases (n = 100).

practice areas	Control group (Mean ± SD)		Study group (Mean ± SD)		P_1-value	P_2-value
	Pre	Post	Pre	Post		
Dietary Habits	6.40±2.43	6.58±2.58	5.64±2.75	11.50±2.14	0.381	< **0.001***
Personal Hygiene	12.12±3.37	12.22±2.40	12.08±3.98	17.42±3.09	0.692	< **0.001***
Clothing	5.62±1.88	5.78±1.83	5.22±2.62	7.86±1.27	0.132	< **0.001***
Urinary Habits	5.20±1.53	5.44±1.56	4.14±2.39	8.10±1.11	0.153	< **0.001***
Sexual hygiene and habits	11.42±4.27	11.52±3.75	12.82±4.25	18.62±3.14	0.748	< **0.001***

*statistically significant at $p < 0.05$.

Table (2) shows the mean level of studied pregnant women practices of urinary tract infection among the study and control groups during the intervention phases. Improvements were observed in all areas of practice among the study group (p=<0.001), whereas there was no significant difference changes among the control group.

Table (3): Comparison of the mean scores of health belief model(HBM) categories urinary tract infection during pregnancy among the study and control groups throughout the intervention phases (n = 100).

HBM categories	Study (n = 50) Mean ± SD		Control(n = 50) Mean ± SD	
	Pre	Post	Pre	Post
Perceived susceptibility to UTI during pregnancy	8.76 ± 3.17	13.10±1.95	8.60 ± 3.16	8.96 ±3.34
P	< **0.001***		0.170	
Perceived severity of UTI during pregnancy	9.32 ± 3.01	14.12±2.06	9.4 ± 4.5	9.6 ±3.24
P	< **0.001***		0.125	
Perceived barriers to control of UTI during pregnancy	11.22± 3.1	14.44±1.83	11.54 ±3.10	11.78 ±3.11
P	< **0.001***		0.098	
Perceived benefits to control of UTI during pregnancy	12.76±4.36	17.06±1.77	12.98 ±4.5	13.42 ±4.8
P	< **0.001***		0.224	
Self-efficacy regarding control of UTI during pregnancy	10.52±4.01	17.86±2.02	10.80 ±4.05	11.04 ±3.88
P	< **0.001***		0.103	
Cues to action regarding UTI during pregnancy	2.72±1.94	6.14±1.19	2.88 ± 1.6	3.06 ±1.73
P	< **0.001***		0.151	

*statistically significant at $p < 0.05$.

Table (3) shows the mean level of studied pregnant women perception of urinary tract infection among the study and control groups during the intervention phases. Positive changes in perception were observed in all health belief model constructs among the study group, whereas there was no significant difference changes among the control group. The most common improvement was noticed in the variable of Perceived susceptibility, Perceived severity, Perceived benefits, and Self-efficacy compared to those in the control group (13.10±1.95, 14.12±2.06, 17.06±1.77, and 17.86±2.02 vs. 8.96 ±3.34, 9.6 ±3.24, 13.42 ±4.8, 11.04 ±3.88)

Table (4): UTI symptoms severity among the study and control groups throughout the intervention phases (n = 100).

Symptoms	Pre –intervention (Mean ± SD)		P_1-value	Post-intervention (Mean ± SD)		P_2-value
	Study	Control		Study	Control	
Frequency of Urination	1.66±1.15	1.70±1.01	0.854	0.22±0.46	0.78±1.05	**0.001***
Urgency of Urination	1.24±1.18	1.34±1.15	0.670	0.06±0.24	0.46±0.90	**0.004***
Pain or Burning When Passing Urine	1.42±0.81	1.48±1.24	0.776	0.16±0.42	0.54±0.93	**0.010***
Not Being Able to Empty Your Bladder Completely	1.08±1.12	1.22±1.28	0.563	0.02±0.14	0.64±0.98	**< 0.001***
Uncomfortable Pressure in The Lower Abdomen	1.66±1.15	1.30±1.16	0.124	0.28±0.49	0.66±0.49	**0.015***
Low Back Pain	1.28±1.16	0.90±1.14	0.103	0.14±0.35	0.46±0.86	**0.018***
Blood in Urine	0.76±1.13	0.48±0.99	0.193	0.02±0.14	0.14±0.53	0.131
Total severity	9.10±5.08	8.42±4.72	0.490	0.90±1.38	3.68±5.26	**0.001***

*statistically significant at $p < 0.05$.

Table (4) shows that there was no statistical significant difference between the study and control group regarding symptoms severity pre-intervention. Whereas post intervention there was statistical significant improvement in symptoms severity among study group compared to control group. Especially regarding incomplete emptying of bladder, frequency of urination and total severity of symptoms **< 0.001, 0.001, and 0.001**, respectively). Perceived severity of symptoms is decreased among the studied pregnant women than in the control group.

Table (5): UTI symptoms botherness among the study and control groups throughout the intervention phases (n = 100).

Symptoms	Pre -intervention (Mean ± SD)		P_1-value	Post-intervention (Mean ± SD)		P_2-value
	control	study		control	study	
Frequency of Urination	1.72±1.05	1.52±1.21	0.381	0.58±0.99	0.20±0.45	**0.016***
Urgency of Urination	1.18±1.37	1.08±1.14	0.662	0.46±0.88	0.06±0.31	**0.004***
Pain or Burning When Passing Urine	1.22±1.14	1.52±1.21	0.208	0.62±0.96	0.18±0.38	**0.004***
Not Being Able to Empty Your Bladder Completely	1.22±1.20	0.98±1.15	0.310	0.64±0.96	0.04±0.19	**< 0.001***
Uncomfortable Pressure in The Lower Abdomen	1.30±1.16	1.40±1.21	0.675	0.58±0.90	0.20±0.45	**0.010***
Low Back Pain	0.92±120	1.22±1.20	0.216	0.44±0.86	0.08±0.27	**0.007***
Blood in Urine	0.48±0.99	0.50±0.95	0.918	0.16±0.58	0.04±0.19	0.174
Total bothersomeness	8.04±4.89	8.22±5.70	0.866	3.48±5.26	0.80±1.79	**0.001***

*statistically significant at $p < 0.05$.

Table 5 reveals that, there was no statistical significant difference between the study and control group regarding symptoms bothersomeness pre-intervention. Whereas post intervention the study group reported statistical significant decrease in bothersomeness of experienced symptoms compared to control. Especially regarding incomplete emptying of, burning urination, urgency and total bothersomeness< **0.001, 0.004, 0.004 and 0.001**, respectively).Perceived bothersomeness of symptoms is decreased among the studied pregnant women than in the control group.

Table (6): Comparison between the study and control groups regarding the causative organisms after intervention (n = 100).

Items	*1st follow up*				*2nd follow up*			
	Study (n = 50)		**Control (n =50)**		**Study (n = 50)**		**Control (n =50)**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Negative	**100**	**100**	**44**	**88**	**41**	**82**	**34**	**68**
Positive cultures	**0**	**0**	**6**	**12**	**7**	**14**	**16**	**32**
Causative organism	**(n = 0)**		**(n = 6)**		**(n = 7)**		**(n = 16)**	
E-Coli	**0**	**0**	**4**	**8**	**3**	**6**	**6**	**12**
Staph-aureus	**0**	**0**	**0**	**0**	**1**	**2**	**3**	**6**
Klebsiella	**0**	**0**	**1**	**2**	**1**	**2**	**2**	**4**
Proteus	**0**	**0**	**1**	**2**	**1**	**2**	**3**	**6**
Acenitobacter	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**
Enterococci	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**2**

Table (6) shows that, study group pregnant women had a higher recovery rate in the first follow up and reduced recurrence of infection than pregnant women in the control group. There was similar trend of bacterial growth, one week after antibiotic and three months after intervention where E-coli is the commonest organism in both study and control groups.

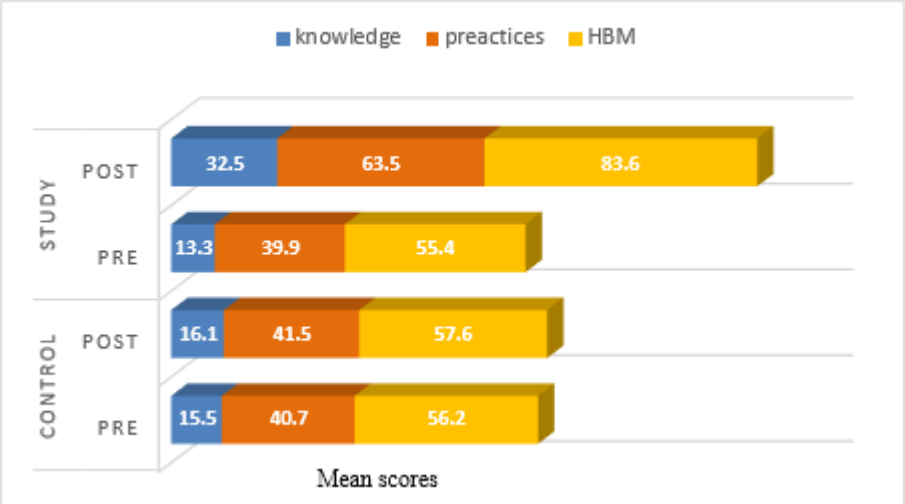

Figure 1: Effectiveness of health belief model based education on control of UTI among pregnant women.

Figure 1: Shows that the mean post-intervention scores of knowledge, practices and HBM construct were higher than the mean pre-intervention score in study group. The mean difference was statistically significant between pretest and posttest in study group Moreover the previously mentioned scores were greater than theses of the control group. Hence research hypothesis H1 was accepted. This indicates that the HBM was effective to control UTI infection among pregnant women diagnosed with the disease.

IV. Discussion

Urinary tract infection (UTI) is defined as an inflammatory response of the urothelium to bacterial invasion that is typically associated with bacteruria and pyuria. Urinary tract infection (UTI) is one of the most widespread health problems during pregnancy with an incidence between 17% and 20% of pregnancies. Recurrence of UTI is common in pregnancy especially late in pregnancy, when urinary stasis tends to be even greater [32, 33].

Pregnant women undergo changes in their elimination pattern because of the enlarging uterus and hormonal influences. These changes cause normal, minor discomforts. UTI has been correlated with premature rupture of the membranes, preterm labor, chorioamnionitis, postpartum fever, and neonatal infections. UTI can progress into critical maternal complications such as aseptic shock, respiratory insufficiency, fluid imbalance, chronic renal insufficiency, and even death. Anticipatory guidance by the nurse helps the pregnant woman cope with these changes and prevent complications of pregnancy [34, 35].

Nurses play a significant role in the prevention and control of UTIs through teaching the pregnant woman appropriate measures may prevent the disease. In educational planning, selection of theoretical model, recognition of the problem and the effectiveness is most important. The health belief model is one of the models involved in preventive behaviors. Studies of the HBM to increase awareness and acceptance of attitudes and practice in the field of UTIs [36, 37].

Thus, this study aimed to investigate the effect of health beliefs model-based education on the control of urinary infection among pregnant women. A Quazi-experimental design was utilized to accomplish the study aim. Purposive sampling was applied to enroll 100 pregnant women attending the antenatal care clinics at selected primary health care (PHC) centers in Ismailia city.They were randomly allocated into an intervention group (n=50) and control group (n=50). UTI was diagnosed by growth of > 10^5CFU/ml of a urinary tract pathogen in a culture of a midstream urine sample.

Effective health promotion programs are based on the individual's knowledge of the behavior, his or her personality and beliefs, the environmental factors that affect the person and the confidence and skills that he or she possessesthe health belief model has developed over time and has been effective in identifying factors that affect a person's health behavior. Consequently, the health belief model is by far the most frequently applied theory in health education and health promotion [23].

Concerning participant's knowledge, the current study revealed that improvements were observed in all areas of knowledge amongst the studied group (p=<0.001), whereas there was no significant difference changes among the control group. These results are in agreement with **Sadeghi et al., 2012** [38] who studied the influence of education structured upon the health belief model on urinary infection prevention among pregnant women in Iran.

Similarly another Egyptian study reported that, there was a highly significant improvement amongst the intervention group knowledge two months after program implementation in comparison with the control group. Also there was a highly significant improvement within the intervention group before and after program implementation [39].

Regarding pregnant women behaviors, the present results showed that the mean level of studied pregnant women practices of urinary tract infection among the study and control groups during the intervention phases. Improvements were observed in all areas of practice among the study group (p=<0.001), whereas there was no significant difference changes among the control group.

Similarly, **(Taghdisi and NejadSadeghi, 2012**) [40], reported significant differences were observed between the mean scores of all aforesaid variables (pvalue<0.05) after intervention. Whereas the mean scores of control group changed trivially and no significant differences were observed.

Equivalently, **Abd El Aziz et al., 2016** [39] who studied the influence of health belief model implementation on pregnant women's health beliefs and knowledge concerning urogenital infections clarified that there was a highly significant improvement in the health behavior to prevent urogenital infections in the intervention group in comparison with the control group two months after program implementation. Also, significant improvement was observed within the intervention group health behavior before and two months after program implementation.

This result is also in agreement with the previously mentioned studies **Tehrani et al., 2014, Taghdisi&Sadeghi, 2012 and Jahanbin et al., 2015**[40,41,42] they stated that education constructed upon HBM can foster preventive behaviors of UTI and decrease the risk of the disease amongst pregnant women. Another study done by **Rahimi et al., 2016**[43] based on the HBM to predict the preventive behaviors of urinary tract infections among pregnant women, showed that education constructed upon HBM which involves attitudes and beliefs of the participants can be useful and effective in order to promote preventive behaviors of the UTI.

The present study result is also in the same line with some other studies as **Khoramabadi et al., 2016** [44] who investigated the influence of education structured upon HBM on diverse health behaviors. They emphasized that changing the health belief is prerequisite for behavior change.

This study revealed, positive changes in perception were observed in all health belief model constructs among the study group, however there was no significant difference changes amongst the control group. The most common improvement was noticed in the variable of perceived susceptibility, perceived severity, perceived benefits, and self-efficacy compared to those enrolled in the control group.

Regarding The four main HBM constructs, these results goes in line with **Abd El Aziz et al., 2016** [39] who reported a significant escalation in the mean scores of main HBM constructs on the intervention group in comparison with the women in control group two months after program implementation.

Similarly a study in Iran reported that, after the intervention the experiment group showed a significant increase in the average score of the perceived susceptibility, perceived severity, perceived benefits, cues to action and health behaviors, compared with the control group (P=<0.001) [41]**.**

In the study of **Taghdisi and Sadeghi, 2012** and **(Tehrani et al., 2014)** about the effect of health belief model based education on improving preventive behaviors regarding UTI amongst women, structures of perceived barriers and perceived benefits formed the greatest predictors of behavior, respectively [40, 41]. While the study of **Griffin (2011)** in the United States concerning the field of colorectal cancer screening, the results showed that perceived severity was the most dominant behavior predictive and perceived susceptibility [45].

Self-efficacy expectancies are assumed to have a direct impact upon behavior and an indirect effect via their influence upon intentions. Self-efficacy was found to be an important moderator of the relationship between knowledge and behavior [46, 47].

Rahimi et al., 2016 reported that Self-efficacy was powerful predictor. The reasons for higher impact of self-efficacy are self-confidence and awareness of the women about the effectiveness of simple behaviors and actions to control urinary tract infection as they acknowledged in their group discussions on the issue.Similarly the score of the self-efficacy in the comparison group had significantly increased after the education in an interventional study by **(Taghdisi and sadeghi, 2012)** [40, 43].

Whereas, in a study about self-efficacy and health behaviors of women with urinary tract infection, the educational program was effective for promoting the self-efficacy of the intervention group, although the score of the self-efficacy in the comparison group had not significantly increased after the education[41].

On the other hand **Aqdam et al., 2012** investigated the effect of HBM based education on screening behavior regarding breast cancer amongst women. The results revealed no significant difference between intervention and control group in the perceived susceptibility after the education. The difference between the present study result and **Aqdam et al., 2012 study** may be attributed to the natural difference between the urinary tract infections UTIs and breast cancer risk factors. Where, the physiological changes during pregnancy precipitate the women to UTIs. Also, UTIs are more common than breast cancer among pregnant women [48].

In addition,**Tehrani et al., 2014** reported that the average score of the perceived barriers of the experiment group was not significantly different compared with the control group (P=0.235).Also, **Griffein, 2011** found contradicted results with the present study that, perceived benefits and efficacy had a poor predictability [41,45].

Concerning urinary tract infection symptoms, the present study reported statistical significant improvement in urinary tract infection symptoms severity and bothersomeness after application of educational program based upon health belief model. This result agrees with **Ahmed, 2015 who proved that** application of the intervention and the following guidelines for pregnant women regarding performance of healthy self-care practices, had a significant positive influence on their relief of urinary tract infection symptoms. These findings can be attributed tothe application of HBM which, has been applied with considerable success to a range of health behaviors and populations, particularly preventive behaviors, such as adherence to recommended medical treatments [49,50].

Moreover, Health Beliefs have been deliberated as a construct fundamental to effective adjustment to persistent pain disorders. Various investigations have discussed the role of control beliefs with the Multidimensional Health Locus of Control Scale. Self-efficacy is one of the techniques through which coping approaches improve pain-related outcomes. Increased levels of self-efficacy may escalate coping efforts of individuals', thus increasing the possibility of positive outcome, and in turn, provide for maintaining or enhancing self-efficacy. Also, another study provided evidences of a correlation between self-efficacy and

endogenous opiates. Lower levels of functional self-efficacy are thought to impact on disability by limiting the range of activities the patient will undertake, or by reducing the effort invested in activity[51].

Findings of the current study confirmed the effectiveness of educational intervention according to Health Belief Model in improving recovery rate and reducing recurrence of urinary tract infection among the study group pregnant women in comparison to the control group pregnant women.

This study result is consistent with**Nejadsadeghi, and Taghdisi , 2014** Who reportedthat designing and implementing educational program according to health belief model can be effective in preventive behaviors from UI in the pregnant women. In addition Abd **El Aziz, et al., 2016** proved that HBM was effective in improving pregnant women' knowledge, health beliefs and health behaviors to prevent urogenital infections. **This result goes in line with Changizi et al., 2014** result who concluded that implementing educational programs to increase the susceptibility of getting urinary tract infection amongst female students was beneficial in preventing urinary tract infection [26, 39, 52].

Also, **Sadeghi, et al., 2015** study concluded that the effects of HBM based educational program as a tertiary preventive measure on adopting self-care behaviors in patients can help them achieve self-efficacy in controlling their disease and enhancing their treatment process. Which can be justified as that The Health Belief Model (HBM) is a framework for understanding patient compliance to healthy behaviors. Utilization of HBM enables health care providers to implement effective strategies that increases perceived risks and knowledge regarding the disease. Furthermore, self-efficacy component had great influence on initiating and maintaining behavioural changes and act as a vital moderator of the association between knowledge and behaviors[41, 53, 54].

In conclusion, suboptimal risk perception of disease, knowledge and health practices plays a vital role in recurrence of UTI especially during pregnancy. Positive health beliefs, and adequate knowledge are vital moderators towards healthy practices. Thus, education based on health beliefs model was proved to be effective in secondary and tertiary prevention of UTI during pregnancy. And this model is recommended to be used in other community based interventions regarding maternal health.

V. Conclusion

Based on the findings of the study, this study concluded that**:** pregnant women with UTI in this study have deficient knowledge, practices, and beliefs related to UTI. Likewise low level of perceiving risks, and low estimation of susceptibility to the disease and its complications affected their compliance to the treatment regimen. Implementation of educational program using HBM was effective to control UTI among the studied pregnant women. As results proved its success in improving knowledge, practices, and changing the perceptions of UTI in pregnancy, particularly theperceived susceptibility, perceived severity, perceived benefits, and self-efficacy. Thus, the intervention improve the compliance to treatment and showed higher recovery rate in addition to reduced recurrence of infection among the studied pregnant women compared to the control group.

VI. recommendations

Based upon these study findings, the following could be recommended:

- The protocol of management of UTI in pregnancy based on HBM should be integrated in antenatal care program.
- Periodical screening of pregnant women with urine culture through the three trimesters for early detection and proper treatment.
- Simple illustrative booklets and pamphlets in Arabic language about UTI and its prevention should be prepared and made available to pregnant women

Further researches conducted:

- To design health education program based on HBM about preventive measures for UTI during pregnancy in a wider range of samples.
- To implement experiential researches to compare effectiveness of HBM based education with the traditional educational programs and other theory based programs in the field of UTI in pregnancy.

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