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Reducing the incidence of pregnancy-related urinary tract infection by improving the knowledge and preventive practices of pregnant women

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ABSTRACT

Objective: Pregnancy-related urinary tract infections (UTI) is the leading cause of obstetrical ward admissions and is responsible for poor maternal and perinatal outcomes. This study aimed to reduce the incidence of UTI by improving the knowledge and preventive practices of pregnant women through the implementation of a health education package.

Study Design: A health education package consisting of a seminar, sending of weekly text messages, and distribution of educational leaflets on UTI awareness and prevention was implemented in various rural health units in Pampanga, Philippines. A structured questionnaire was used to assess the pre- and post-intervention knowledge and preventive practices of pregnant women. Whereas, urinalysis results from the various rural health units were used to assess the incidence of UTI among the respondents.

Results: Significant improvement ($p < 0.001$) was observed regarding the participant's knowledge and water intake after the intervention. Although there was no significant change ($p = 0.16$) in their hygiene statistically, all participants had improvements in hygiene practices after the intervention. The number of pregnant women who were positive for UTI also decreased significantly ($p < 0.001$) following the intervention.

Conclusion: The implemented health education package was able to reduce the incidence of pregnancy-related UTI by improving the knowledge and preventive practices of pregnant women.

Introduction

Urinary tract infection (UTI) refers to the unwanted proliferation of microbial pathogens within the urinary tract and is said to be the primary cause of health expenditure and morbidity among persons of all ages, causing over 1 million hospitalizations all over the world [1,2]. In the Philippines, UTI is the 4th leading cause of morbidity among females, as stated in the Field Health Service Information System report of the Department of Health [3]. UTI can occur to anyone but is usually common among women [4]. Approximately one-third of adult women are diagnosed with UTI before the age of 24 [5].

UTI is reported to affect 20% of pregnant women and is the leading cause of obstetrical ward admission [6]. In a conducted study at the obstetrical ward of Khartoum North Hospital in Sudan, Africa, 20% of the pregnant women admitted were reported to be positive for UTI [7]. In a study done in California, the USA from 2007 to 2012, 2,892,756 women were included, of whom 140,910 (4.9%) had a diagnosis of a UTI related to an emergency visit or hospitalization during pregnancy [8]. UTIs are classified to be symptomatic or asymptomatic; reported among 17.9% and 13% of pregnant women, respectively [9]. Asymptomatic UTI among pregnant women can lead to complications, not only on women but as well as to the fetus. Several adverse perinatal outcomes like premature birth, low birth weight, and perinatal death have been implicated in pregnancy with UTI [9,10].

The occurrence of UTI is common during pregnancy due to the numerous physiologic and anatomic changes in a woman's body [11–13]. Being a female itself is a risk factor due to reasons such as: having a short urethra, proximity of the vagina to the anus, and the inability to empty the bladder [14,15]. The proximity of the vagina to the anus could cause the transfer of fecal coliforms, which could result in UTI. Whereas, the urine of females have a more suitable

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pH for the growth of *Escherichia coli* compared to males [15,16]. Furthermore, glycosuria that develops during pregnancy also predisposes a woman to UTI since the environment is favorable for bacterial proliferation [11,17].

As the uterus expands in a pregnant woman, the increasing weight blocks the passage of urine from the bladder, therefore causing urine stasis, which in turn would cause the infection in the urinary tract. UTI among pregnant women, if left untreated, can lead to severe obstetrical complications, and poor maternal and perinatal outcomes [15]. Possible consequences of UTI in pregnancy include: undersized birth, abortion, hypertension, maternal anemia, preterm labor, thrombosis, chronic pyelonephritis, and phlebitis are related to UTI during pregnancy [18,19]. It can also lead to irreversible kidney damage, which results in renal failure and renal hypertension [15,18]. With the impending complications of pregnancy-related UTI, strategies should be done to reduce its incidence.

Proper health education, especially on different preventive practices, are some of the ways to reduce cases of pregnancy-related UTI. In line with this, a health education package that covers various techniques against UTI was implemented to determine the effects of the change in knowledge and preventive practices on the incidence of pregnancy-related UTI.

Methods

Research design

The study used a longitudinal, quasi-experimental design. This design was used to determine the effect of a health intervention in improving the knowledge and preventive practices of pregnant women in order to reduce the incidence of UTI. The researchers collected pre- and post-intervention data from pregnant women coming from various rural health units (RHUs) in the province of Pampanga, Philippines.

Sampling and setting

The sample size was calculated using the free sample size calculator from Raosoft (Rasosoft, Inc., USA). A population size index of 113 (PSI), 95% confidence interval, and a 5% margin of error was used for the calculation. The PSI calculated was based on the number of pregnant women (n = 70,582) that sought medical check-up in the 52 RHUs in Pampanga for the year 2015. Based on the result of the sample size calculation, a baseline sample population composing of 88 pregnant women were initially recruited for the study. Fig. 1 shows how the sampling of participants was determined, whereas, Fig. 2 summarizes the number of pregnant women who were able to complete the health education package and those who were identified as "lost to follow-up" or LTFU.

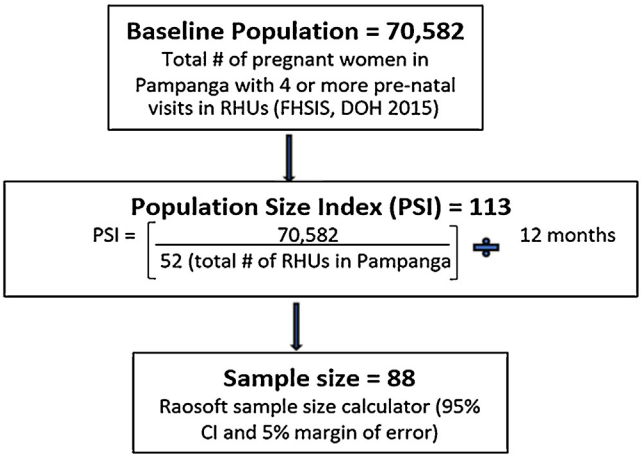

Fig. 1. Sample size calculation and participant sampling.

Inclusion and exclusion criteria

Participants included in the study were pregnant women who seek monthly consultation in different RHUs in Pampanga regardless of their age, educational background, family monthly income, and age of gestation. Participants who have diabetes mellitus, urolithiasis, renal failure, received a renal transplant, taking immunosuppressant drugs, and other medical conditions that may increase their risk of having UTI were excluded from the study. Whereas, participants who failed to complete the whole health education program and were not able to attend the post data collection were considered as LTFU. Participants were then grouped into two, namely: pregnant women with UTI and pregnant women without UTI based on the diagnosis of the attending physician in the RHUs using the patient's urinalysis result ($\geq$10 pus cells per high power field is considered positive for UTI) and physical assessment.

Ethical consideration

The study was approved by the Angeles University Foundation Center for Research and Development - Ethics Review Committee. Informed consent was given, and verbally explained to each participant. Confidentiality of information and anonymity was at all times ensured during data collection. Participation in the study was purely voluntary, and participants can freely withdraw from the study at any time without any question and loss of benefits.

Data collection protocol and interpretation of responses

The data collection protocol consists of the following: [1] collection of urinalysis results of the pregnant women from the RHUs to assess the incidence of UTI, and [2] collection of a pre-intervention (Week 0) and post-intervention (Week 8) data using a structured questionnaire to assess the knowledge and preventive practices of pregnant women. The self-structured questionnaire is composed of 2 parts: knowledge and preventive practices, wherein the latter are categorized further into two aspects, namely: participants' hygiene and fruit and water intake.

For participants to be classified as having a satisfactory knowledge, they must get a score of $\geq$60% of the correct points regarding the basic information about UTI. Moreover, for them to be classified as having good preventive practices, they must accumulate $\geq$75% of the weighted value of UTI preventive practices, and for fluid intake, participants must have >8 glasses of water per day [20].

Health education package

The implemented health education package consists of the following intervention: a health education seminar, sending of text messages every week, and the distribution of educational leaflet. The topics in the three-intervention scheme are mainly about the symptoms, causes, possible complications to both the mother and developing fetus, ways of prevention, and treatment of UTI. All participants included in the study received all the treatment schemes regardless if they have UTI or not. Summary of the health intervention process is shown in Fig. 3. The purpose of the three-intervention scheme is to share basic knowledge about UTI and to increase the awareness of pregnant women on UTI prevention. The delivery of the health education as to the seminar, SMS and written

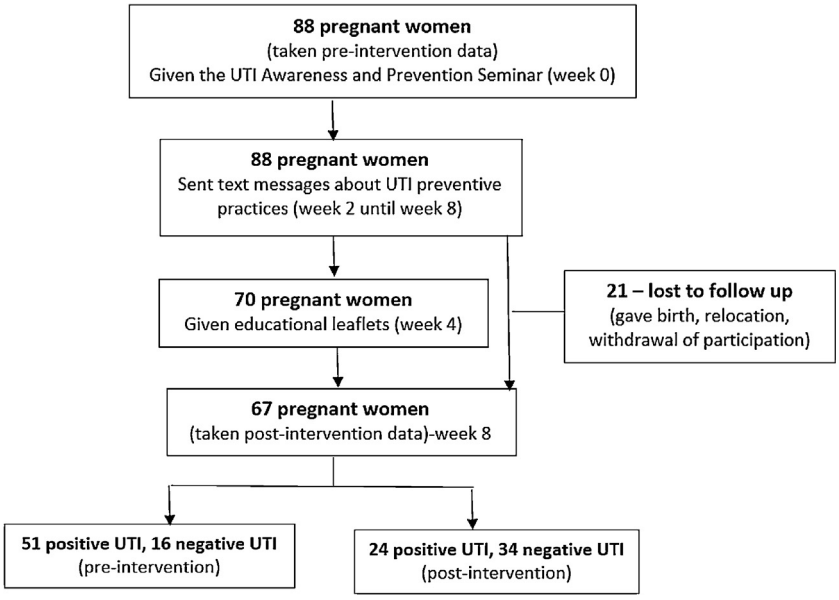

Fig. 2. Summary of pregnant women who were able to complete the health education package.

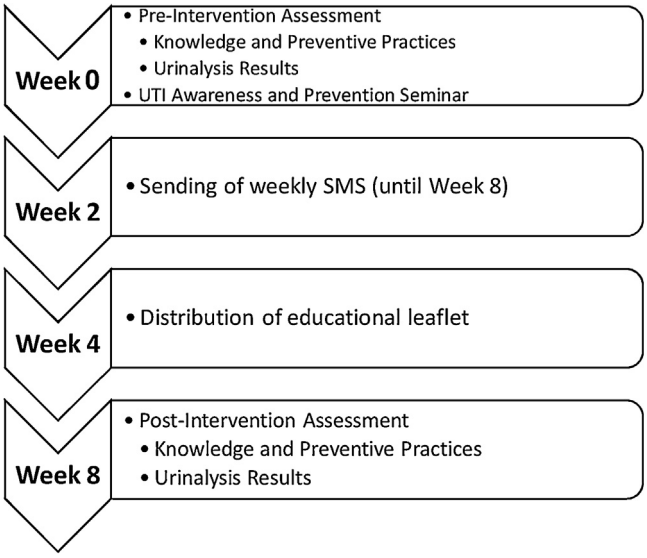

Fig. 3. Summary of the health intervention process.

information were on a monthly interval, which coincided with the "buntis-day' of the RHU, which is being held once a month. During the "buntis-day," the pregnant women had their usual pre-natal check-up after the delivery of the mother's class, into which the researchers incorporated the health education about UTI prevention during pregnancy.

UTI awareness and prevention seminar

After collection of the pre-intervention data (Week 0), a seminar was carried out and facilitated by a competent professional with expertise in public health education and promotion. Topics discussed in the seminar included: (a) prevalence of UTI, (b) reasons why women are more susceptible to UTI, (b) complications and economic cost of UTI, and (d) preventive health behaviors.

Sending of weekly short message service (SMS)

Two weeks after the health education seminar, text messages were sent to each participant twice every week until the end of the program. Text messages were constructed based on the socio-demographic profile of the study participant receiving the SMS. All text messages sent were about health preventive practices against UTI.

Educational leaflet distribution

A month (Week 4) after the pre-intervention assessment, leaflets containing the basic facts and ways to prevent UTI were distributed. Topics discussed in the educational leaflet include (a) knowledge, signs, and symptoms of UTI, (b) preventive health practices, and (c) treatment compliance. Frequently asked questions such as (a) What are the possible complications of UTI among pregnant women? (b) What are the possible complications of UTI among the developing fetus? (c) How will you know if you have UTI? were also discussed.

Statistical analysis

STATA (IC Ver 13.0) was used for the analysis of the data acquired in the study. McNemar's test or McNemar's Chi-square was used to determine if there are any significant differences between the knowledge, preventive practices, and the incidence of pregnancy-related UTI in the pre- and post-intervention assessment.

Results

Eighty-eight (88) participants were initially included in the pre-intervention assessment (Week 0). Table 1 shows the overall socio-demographic profile of the participants included in the baseline assessment. From the 88 participants that attended the health education seminar, 61 were positive for UTI, and 17 were negative. Majority of pregnant women with UTI were aged 19–27 years old, on their third trimester of pregnancy, those who have live-in partners, high school graduates, and were unemployed.

Out of the 88 participants included in the baseline assessment, only 70 were able to receive the educational leaflets (Week 4). However, by the end of the health intervention package (Week 8), only 67 participants were able to comply fully. Overall, 21 were regarded as LTFU. Some of the reasons of the LTFU participants include: giving birth, relocation, and withdrawal of participation.

Table 1
Baseline socio-demographic profile of the study participants.

VARIABLE	NO. (%)
AGE	
18 years old below	17 (19.3%)
19–27 years old	41 (46.6%)
25–30 years old	18 (20.5%)
30 years old above	12 (13.6%)
AGE OF GESTATION	
First trimester	10 (11.4%)
Second trimester	38 (43.2%)
Third trimester	40 (45.5%)
CIVIL STATUS	
Single	3 (3.4%)
Married	34 (38.6%)
Separated	3 (3.4%)
Live-in	48 (54.5%)
EDUCATION	
Elementary	6 (6.8%)
High School	64 (73.7%)
College	18 (20.5%)
EMPLOYMENT	
Employed	11 (12.5%)
Housewife	77 (87.5%)

Table 2, on the other hand, shows the effect of the implemented health education package against the incidence of pregnancy-related UTI. Out of the 67 participants who completed the program, 51 (76.1%) were positive for UTI in the pre-intervention assessment. Whereas, in the post-intervention assessment, the total number of participants with UTI significantly declined ($p < 0.001$) to 24 (35.8%).

Table 3 summarizes the result of the McNemar's test for the pre-intervention and post-intervention data regarding the knowledge and preventive practices of pregnant women against UTI. The level of knowledge and preventive practices of the participants in the pre- and post-intervention is summarized in Fig. 4. Before the health intervention, only a few of the participants had satisfactory knowledge (9/67). Moreover, most of them have good hygiene practices (65/67) and take adequate amounts of water (31/67). After the health intervention, the results reflect that there was a significant improvement ($p < 0.001$) in the knowledge of the participants (29/67) as well as their water intake (47/67). No significant change ($p = 0.16$) was observed for hygienic practices. Although, all participants (67/67) had good hygienic practices after the health intervention.

As for the participants' pre- and post-intervention fruit and fluid intake, the results are also summarized in Table 3. Majority of the pregnant women during the pre-intervention had poor fluid intake practices since more than half are drinking coffee and carbonated drinks, whereas, only a few are taking probiotics. On the other hand, after the intervention, a significant change ($p < 0.001$) in fluid intake practice was noted since the majority of the participants choose not to drink other fluids and the number of participants drinking probiotics increased. For the pre-intervention fruit intake, the majority of pregnant women have a good practice of eating ascorbic-acid rich fruits such as papaya, grapes, pineapple, and orange. The number of participants who eat ascorbic acid-rich foods even increased after the intervention.

Discussion

UTI is associated with significant morbidity and mortality and may affect females of all age group, especially those who are pregnant [11]. Age of gestation is found to be associated with the incidence of UTI, because of urine stasis due to the increasing weight of the fetus in the uterus [21,22]. In the present study, a health education package was given to pregnant women in the selected RHUs in Pampanga to help reduce the impeding incidence of UTI. In a study conducted by Javaheri Tehrani et al. [23], developing an education program is practical and useful in improving the preventive behaviors of patients from having UTI. However, in the Philippine setting, no health education programs about UTI among pregnant women are being conducted in the various RHUs, since it is not included in the topics discussed in the usual "Mother's class" of the maternal health program. Hence, the lack of health education programs contributes to the high prevalence of UTI among pregnant women.

Based on the pre-intervention assessment, the majority of pregnant women have an unsatisfactory knowledge regarding UTI. Hence, after implementing the health education package, a significant improvement in knowledge was observed. The results are consistent with the study conducted by Al-Kotb et al. [24], in which knowledge, together with the regular hygienic practices, was noted to improve after health intervention. However, in the present study, health education was not statistically effective in improving respondents' hygienic practices. This is due to the good hygiene practices of most of the respondents at baseline. Studies suggest that improving hygienic practices such as frequent replacement of underwear and washing the genitals from front to back were associated with a reduced frequency of UTI among women [25,26]. Moreover, women are encouraged to clean and wash their genital areas before and after intercourse and to wipe from front to back to reduce the spread of organisms from the perineum to the urethra [19,25].

Before the health intervention, many of the participants had inadequate water intake and were fond of drinking coffee and carbonated drinks. However, after implementing the health education package, fewer participants choose to drink coffee and carbonated drinks, and the number of those who drink probiotics increased. It is crucial to promote the increased intake of water among pregnant women since studies have shown that the consumption of carbonated drinks, coffee, and tea appears to have an association with the risk of having UTI [27,28]. According to the American Pregnancy Association, eliminating caffeine, alcohol, refined foods, and sugar can reduce the occurrence of UTI among pregnant women [26]. It is highly recommended that pregnant women drink adequate amounts of fluids (2 to 3 liters each day) and to urinate regularly to help rinse bacteria from the bladder. Retaining urine for long periods allows for bacterial multiplication within the urinary bladder, resulting in infection [19,24,25]. On the other hand, the intake of fermented milk products that contain probiotic bacteria like *Lactobacillus GG* or *Lactobacillus acidophilus* is associated with a lower risk of having UTI [1].

Fruit intake also has an impact on UTI prevention. Based on the results of the study, after the health intervention, most of the pregnant women started to eat fruits rich in ascorbic acid.

Table 2
Effect of health education on the incidence of pregnancy-related UTI.

PARAMETER	PRE-INTERVENTION	POST-INTERVENTION	*p*-value	McNemar's Test
With UTI	51 (76.1%)	24 (35.8%)	<0.001*	Pre > Post
Without UTI	16 (23.9%)	43 (64.2%)		

* significant at $p < 0.05$.

Table 3
Effect of health education on the knowledge and preventive practices of pregnant women regarding UTI.

PARAMETER	PRE-INTERVENTION	POST-INTERVENTION	*p*-value	McNemar's Test
Knowledge	13.4%	43.3%	<0.001*	Pre < Post
Personal Hygiene	97.0%	100%	0.16	NA
Fluid Intake			<0.001*	Pre < Post
• Water (>8 glasses/day)	42.6%	70.1%		
• Hot Tea	19.4%	11.9%		
• Iced Tea	47.3%	29.9%		
• Coffee	50.8%	44.8%		
• Chocolate Drinks	64.2%	55.2%		
• Carbonated Drinks	52.2%	23.9%		
• Alcohol	4.5%	1.5%		
• Probiotics	9.0%	17.9%		
Fruit Intake			NA	NA
• Papaya	57.6%	77.6%		
• Grapes	65.2%	80.6%		
• Pineapple	78.8%	85.1%		
• Orange	84.9%	89.6%		

NA: not-applicable.
* significant at $p < 0.05$.

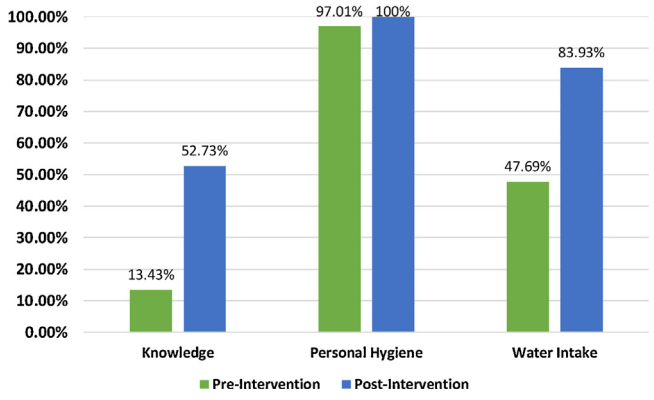

Fig. 4. Level of knowledge and preventive practices of the study participants pre- and post-intervention.

Vitamin C or ascorbic acid is often taken to fight UTI symptoms since it helps inhibit the growth of bacteria. Although its efficacy is quite limited, it still is beneficial in the treatment of relapsing UTI [29]. It also makes the urine less acidic and may reduce the chances of having recurrent UTI. Examples of fruits rich in vitamin C are grapes, papaya, pineapple, and orange [30]. Generally, there was an improvement in the fruit and water intake of the participants after the health intervention. The result agrees with the study conducted by [30] regarding the benefits and progress of nutrition education intervention in food intake. According to them, participants who are knowledgeable about proper nutrition and its prospective benefits were 25 times more likely to meet the current recommendations for food intake than those who are not.

Conclusion

In general, improved knowledge and preventive practices are ways of hindering UTI development during pregnancy. However, the problem in most healthcare facilities is the lack of appropriate interventional programs. The implemented health education package among pregnant women in the selected RHUs in Pampanga was shown to be effective in reducing the incidence of UTI by improving the knowledge and water intake of the participants based on the pre- and post-data analysis. Even if statistically non-significant, hygienic practices of pregnant women also improved.

To the best of our knowledge, this is one of the first studies dealing with the implementation of a health education package among pregnant women in the Philippines that aims in improving pregnant women's knowledge and preventive practices to reduce the incidence of UTI.

The author(s) declared no potential conflicts of interest concerning the research, authorship, and publication of this article.

Declaration of Competing Interest

The author(s) declared no potential conflicts of interest concerning the research, authorship, and publication of this article.

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