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The Effectiveness of Educational Intervention Based on Health Belief Model on The Mothers regarding Antibiotics Self-Medication

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Abstract
Background: Antibiotic resistance is one of the most significant threats to world health. Countries like Egypt may make a significant contribution to maintaining efficacy of antibiotics for future generations by tackling self-medication. **Aim:** Evaluate the effectiveness of educational intervention based on health belief model on the mothers regarding antibiotics self-medication. **Setting:** Two Maternal and Child Health Centers: Benha Health Center 1 and Benha Health Center 4, located in Qalyubia Governorate, Egypt. **Sampling: First:** Random sample technique was used to choose MCH in which the study had been conducted. **Second:** A convenience sampling technique was used for the selection of mothers who participated in the study. The total sample size comprised 267 mothers. **Tools of data collection:** Two tools were used. **I:** an interviewing questionnaire consisting of four parts representing demographic characteristics of studied mothers, mothers' healthcare facilities, mothers' knowledge and mothers' reported practices regarding antibiotics self-medication. **II:** Health Belief Model Scale to assess mothers' beliefs regarding antibiotics self-medication. **Results:** 72.7% of the studied mothers had good knowledge regarding antibiotics use, 71.2% of them had high satisfactory total reported practices and 61.8% of them had high total health beliefs regarding antibiotic self-medication post-educational intervention implementation. There was a highly statistically significant improvement in all items of knowledge and reported practices level of the studied mothers regarding antibiotics self-medication also, there was highly statistically significant improvement in all items of the health belief model regarding antibiotics self-medication pre and post-educational intervention implementation. **Conclusion**: Educational intervention based on health belief model was effective in increasing knowledge, beliefs and improving reported practices of mothers regarding antibiotics self- mediation. **Recommendations**: Establishment of more educational intervention that aimed at enhancing public awareness regarding risks associated with self-medication with antibiotics recommended.

Keywords: Antibiotics self- medication, Educational Intervention, Health belief model & Mothers

Introduction
Antibiotics constitute a class of medicines that either eradicate or inhibit the proliferation of bacteria, thereby facilitating the treatment of bacterial infections. By successfully treating infections that were previously deadly, they represent one of the most significant developments in contemporary medicine, having preserved millions of lives. Antibiotics are utilized in the management of a diverse array of medical conditions, including dermatological infections, urinary tract infections, respiratory infections (such as pneumonia), among various persons **(Centers for Disease Control and Prevention, 2024).**

Antibiotic resistance currently represents one of the most critical challenges related to the utilization of antibiotics. This phenomenon transpires when microorganisms develop mechanisms that confer resistance to pharmacological agents that were formerly effective in eradicating them or suppressing the proliferation. Resistance is exacerbated by the overuse and abuse of antibiotics, such as when they are used for viral diseases (such as the flu or colds) or when a prescribed course of antibiotics is not completed. Superbugs, commonly known as antibiotic-resistant bacteria, present significant challenges in treatment, leading to prolonged hospitalizations, increased mortality rates, and elevated expenses for healthcare **(Saha & Sarkar, 2021).**

Antibiotic self-medication is the use of antimicrobial medications without appropriate medical supervision, frequently to treat common illnesses or symptoms. This activity is particularly alarming, as it may result in numerous health risks, including antibiotic resistance. Self-medicating can also lead to possible adverse effects, improper dosing, and a delayed identification of more serious illnesses. To ensure the appropriate and effective utilization of antibiotics, it is imperative to consult with a healthcare professional prior to the administration **(Baracaldo-Santamaria et al., 2022).** Antimicrobial resistance constitutes an

escalating global challenge, resulting in over 700,000 fatalities annually. Projections indicate that this issue may lead to the deaths of 10 million individuals by the year 2050 **(Helmy et al, 2023).**

An important psychological framework for understanding and predicting health-related behaviors, especially in the context of disease prevention and health promotion, is the Health Belief Model (HBM). Originally proposed in the 1950s by social psychologists Godfrey Hochbaum, Irwin Rosenstock, and colleagues, the model states that a person's propensity to engage in health-related behaviors depends on various important factors relating to the views of the dangers to the health and the advantages of taking precautions **(Ritchie et al., 2021).**

Constructs that make up the HBM include things like self-efficacy, perceived advantages and obstacles, perceived severity and vulnerability, and cues to take action. An individual's belief in the benefits and significance of preventive measures (perceived benefits), the understanding of the implications related to clinical, medical, and social consequences (perceived severity), the barriers to the behavior (perceived barriers), and the confidence in the ability to engage in preventive behaviors (perceived self-efficacy) are the factors that influence the decision to engage in a particular behavior, according to this framework **(Hosseinalipour et al., 2021).**

The HBM is often applied in health education and behavior change interventions to encourage preventive actions such as vaccination, healthy eating, and appropriate medication use, like avoiding self-medication with antibiotics. By addressing these perceptions and barriers, the model aims to promote healthier behaviors and improve public health outcomes **(Alyafei & Easton-Carr, 2024)**

In Egypt, where many people turn to using antibiotics without a doctor's supervision to treat common illnesses like colds, the flu, or other viral diseases, antibiotic self-medication is a pervasive and expanding problem. The emergence of antimicrobial resistance, this practice poses a considerable public health risk, **(Helmy et al, 2023).** Antibiotic self-medication is a significant public health issue in Egypt, driven by a combination of factors, including easy access to antibiotics, cultural beliefs, lack of awareness, and gaps in the healthcare system. Addressing this issue necessitates a comprehensive strategy that encompasses public education initiatives, enhanced regulation of antibiotic distribution, improved access to healthcare services, and augmented training for healthcare practitioners. By tackling the root causes of self-medication and promoting responsible antibiotic use, Egypt can take essential steps toward reducing the threat of antibiotic resistance and safeguarding public health for future generations **(Abd El-Rahman et al., 2020).**

Higher rates of morbidity and mortality have been associated with antibiotic resistance in Egypt, especially in patients with weakened immune systems, chronic diseases, and hospital-acquired infections. More powerful and expensive antibiotics are frequently needed to treat multidrug-resistant diseases, but these are not always accessible or inexpensive in environments with limited resources. This leads to longer hospital stays and worse health outcomes, especially for vulnerable groups including the elderly and those with impaired immune systems **(Basahel et al., 2020)**.

Community Health Nurses (CHNs) play a pivotal role in promoting public health initiatives and addressing the misuse of antibiotics, particularly the issue of self-medication, which has emerged as a substantial global concern. CHNs positioned to use advocacy, education, and direct intervention to change people's lives. CHNs play a crucial role in stopping antibiotic self-medication. CHNs may lessen antibiotic abuse and encourage responsible usage by educating people, advocating them, encourage screening, and enhancing access to healthcare. CHNs play a pivotal role in mitigating antibiotic resistance by providing individuals with the necessary information to make informed decisions regarding their health and medications, thereby enhancing overall community health. Their contribution to this endeavor is crucial to preserving antibiotics' efficacy for upcoming generations **(Hayat et al., 2020).**

Significance of the study:

Antibiotic resistance in Egypt is particularly concerning, as studies indicate elevated rates of resistance to frequently prescribed antibiotics. Research indicates that various bacterial infections, including Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa, exhibit resistance to multiple classes of antibiotics **(Hassan et al., 2022).** E. coli isolates from Egyptian hospitals, for instance, have demonstrated resistance rates of more than 50% to widely used antibiotics such as fluoroquinolones and cephalosporins **(Abd El-Rahman et al., 2020).**

The high prevalence of hospital-acquired infection resistance, which makes treatment more challenging and expensive, is a significant issue in Egypt. In Egyptian hospitals, nosocomial infections caused by resistant microorganisms have become a significant contributor to morbidity and mortality. Antibiotic abuse and overuse are prevalent in Egypt. Ineffective antibiotics are commonly administered for viral illnesses, and patients routinely use their remaining medications to self-medicate. 60% of antibiotics

supplied in medical settings are either unneeded or inappropriate, while over 70% of Egyptians utilize antibiotics without a prescription **(Hassan, et al., 2020).**

In Egypt, there remains a significant deficiency in public awareness concerning the dangers associated with antibiotic resistance and misuse. The dangers of self-medication or not taking prescribed antibiotics as directed are often unknown to people although the Egyptian government and healthcare system are making progress in addressing this issue so, additional efforts are necessary to enhance public awareness, particularly among mothers, who frequently assume a crucial role in family care. They are often responsible for overseeing the treatment of family members and promoting antibiotic stewardship to mitigate the escalating threat of antibiotic resistance **(Maarouf et al., 2023)**. As a result, the objective of this research is to evaluate the effectiveness of an educational intervention based on HBM on mothers' knowledge, beliefs and self-reported practices concerning the self-medication of antibiotics.

Aim of study:

The aim of this study was to evaluate the effectiveness of educational intervention based on health belief model on the mothers regarding antibiotics self-medication through:

- Assessing mothers' knowledge regarding antibiotics self- medication.
- Assessing mothers' reported practices regarding antibiotics self- medication.
- Assessing mothers' beliefs regarding antibiotics self- medication.
- Designing, implementing and evaluating the effect of an educational intervention utilizing Health Belief Model on improving mothers' knowledge, beliefs and reported practices regarding antibiotics self- medication.

Research hypothesis:

The following research hypothesis was established to achieve the aim of this study:

- Educational intervention based on health belief model was effective in improving knowledge, beliefs and reported practices of mothers regarding antibiotics self- mediation

Subject and Methods

Research design

The current study employed a quasi-experimental design that included pre- and post-intervention assessments to evaluate the efficacy of the interventions. This methodology does not incorporate randomization and aims to ascertain a causal relationship between the intervention and the resultant outcomes.

Setting:

The study was conducted at 40% of the total Maternal and Child Health Centers (5) located in Benha City, Qalyubia Governorate, Egypt. These centers characterized by high flow rates of the mothers and providing many of services for the mothers. Specifically, two centers were selected: Health Center 1 and Health Center 4. These centers were selected randomly.

Sampling:

First: Random sample technique was used to choose MCH in which the study had been conducted.

Second: Convenience sampling technique was used for the selection of mothers who participated in the study after obtaining their consent from the previous settings for about 3 months under the following criteria:

Inclusion criteria included the mothers visiting the specified health centers for sampling in the city of Benha who want to participate in the study and characterized by recurrent infection, while the **exclusion criteria:** this encompassed the mothers' hesitance to persist in their participation in the study, as well as their absence from multiple sessions.

Tools of data collection:

Two tools were used to collect data:

Tool I: A structured interviewing questionnaire was designed by researchers in straightforward Arabic language following a review of the existing recent literature and it consisted of four parts:

The First part: Was concerned with demographic characteristics of the studied mothers and consisted of seven items such as (age, educational level, marital status, residence, number of family members, family monthly income and occupation).

The Second part: It was performed to assess the studied mothers' health care facilities through asking questions and included 5 questions such as (Is there a hospital or health center close to where you live?, is there a pharmacy near your residence?, is one of the family members a doctor or works in health sector?, is there a home pharmacy at home (place where medications are kept inside the house)? and do you or a family member have health insurance?).

The Third part: Was concerned with the studied mothers' knowledge about antibiotic use which included ten closed ended questions as (Antibiotics are used to treat infections caused by bacteria, antibiotics are not used to treat infections caused by virus, antibiotics are indicated to reduce inflammation, antibiotics can not be stopped when person start feeling better, antibiotics can cause allergic reactions, antibiotics can kill “good bacteria” of the human ecosystem, misuse of antibiotics can lead to antibiotic resistance, antibiotic resistance results when the body becomes resistant to an

antibiotic and the antibiotic cannot work with it, antibiotic resistance is only a problem for people who take antibiotics regularly and antibiotic resistance is an issue in our country).

Regarding the scoring system of knowledge: The knowledge questionnaire consisted of a total of 10 questions, with each correct answer earning 1 point, and incorrect or "do not know" responses receiving 0 points. The resulting scores ranged from 0 to 10, which were then converted into percentages. Categories of knowledge are as follows:

Poor (< 50%, < 5 point), fair (50 - < 75%, 5-< 8 point), and good (≥ 75%, ≥ 8 point).

The Fourth part: Was concerned with the studied mothers' self-reported practices regarding antibiotics self-medication which included eight questions as (Consult a doctor before starting antibiotic, avoid buying antibiotics from medicine shops/pharmacies directly, avoid using antibiotics after the suggestions from friends/neighbors, read the advertisement (leaflets/internet etc.) while purchasing antibiotics, if one of the family members is sick, avoid sharing antibiotics together, take antibiotic until completing full course, make an allergy test before taking antibiotics and avoid leaving the rest of antibiotic for future use for any infection).

Scoring system of reported practices: Done reported practice was scored one, while not done was scored zero. The total practices included 8 points which were classified as the following:

Unsatisfactory if the score (< 50%, < 4 point), satisfactory if the score (50 - < 75%, 4-< 6 point), and high satisfactory if the score (≥ 75%, ≥ 6 point).

Tool II: Health Belief Model Scale (HBMS): It was adopted from **(Kouhpayeh et al., 2017)**. The pre/post educational intervention was used to assess mothers' beliefs regarding antibiotics self- medication. The components of the health belief model were evaluated using the Health Belief Model Scale. It is a self-reported questionnaire designed to assess perceived sensitivity, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. 20 questions were included, and they were divided into the following six categories: Assess perceived sensitivity included (3 questions with a score range of 3 to 15), perceived severity (3 questions with a score range of 3 to 15), perceived benefits (3 questions with a score range of 3 to 15), perceived barriers (4 questions with a score range of 4 to 20), cues to action (4 questions with a score range of 4 to 20), and self-efficacy (3 questions with a score range of 3 to 15). For example, one of the "perceived sensitivity" items is "attention to antibiotics resistance warning signs reduces the chance of developing resistance in the future." Examples of other model constructs include the "perceived severity" construct: "many people with antibiotics self- medication neglected antibiotics resistance warning signs;" "perceived benefit" construct: "paying attention to antibiotics warning signs reduces treatment costs;" "perceived barriers" construct: "conducting diagnostic tests and diagnosis are costly;" "cue to action" construct: "physicians and other staff at the health-care center can help me identify and diagnose the problem " and "self-efficacy" construct: "I can overcome my fear and the barriers for avoiding the use of antibiotics without prescription.

Scoring System for total health belief = 100

A five-point Likert scale was used to measure the scale, and the results are summarized as: Strongly disagree (1); disagree (2); no idea (3); agree (4) and fully agree (5). The total scores were 100, divided into three categories. The total scores were constituted high belief if the score ≥ 75 % (≥75points) while constituted moderate belief if it is equals 50-<75 % (50-<75points) and constituted low if it is less than 50% (<50 points). **(Boulos & Hassan, 2023)**

Administrative approval:

In order to obtain consent for the study, the Dean of Faculty of Nursing, Benha University, provided formal written approval, which was subsequently submitted to the Directors of the previously mentioned settings after the research's purpose was clarified.

Tools validity:

Five academic nursing faculty members within the Community Health Nursing department conducted a review of the current study to evaluate the content validity of the tools employed. The suggested modifications, including corrections, omissions, and/or additions of certain items, were implemented in response to the assessment conducted by academic nursing specialists regarding the suitability of the content and the clarity of the language used.

Tools reliability:

The reliability was checked using the Cronbach's Alpha coefficient test to make sure that the items in the two tools for collecting data were largely homogeneous (reliability for knowledge was (0.75), reported practices were (0.82), sensitivity was (0.85), severity was (0.75), benefits were (0.79), barriers were (0.74), cues to action were (0.81), and self-efficacy was (0.83).

Ethical consideration:

Benha Faculty of Nursing Research Ethical Committee provided acceptance for conducting the study with code. RFC.CHNP65, then the mothers' consent to participate in the study was taken after being informed that any information gathered about them would be kept private, used just for research purposes. The safety, protection, privacy, and anonymity of the studied mothers were ensured.

Mothers have the right to leave the study at any time. Ethical approval was taken on October 2024, and another follow-up approval was taken due to some modification in researchers' affiliation on January 2025.

Pilot study:

Pilot study was conducted with a sample size of 27 participants, or 10% of the total. This study set out to assess the research instruments' readability, objectivity, practicability, and usefulness. Additionally, it aimed to identify any potential obstacles or issues that could face the researcher and identify any specific problems related to the sequence of questions and clarity. It also helped to assist in estimating the necessary time for data collection. Subsequent modifications were made based on the findings of the pilot study. In order to avert any potential contamination of the sample, the pilot sample was omitted from the final study.

Educational Intervention Construction:

An educational intervention based on the health belief model was implemented in four distinct phases:

Phase I: Assessment phase: This phase encompassed interviewing pretest group. At the commencement of the interview, the researchers extended their greetings to the mothers, introduced themselves to each participant involved in the study, and furnished the mothers with comprehensive information regarding the research, including its objectives, duration, and the educational intervention being implemented. Subsequently, they acquired verbal consent for participation in the investigation. The researchers initially gathered data through the administration of the instruments: A systematically designed interview questionnaire instrument encompassing demographic information and maternal awareness pertaining to antibiotic utilization. Secondly: The Modified Health Belief Model questionnaire instrument was utilized, with the average duration for the completion of each maternal interview being approximately 25 to 30 minutes. The typical quantity collected was between five and six mothers per day.

Phase II: Planning phase: Informed by the findings derived from the pretest group during the assessment phase, an educational intervention was subsequently formulated. The quantity of sessions, along with their corresponding content, diverse pedagogical methodologies, and instructional media, was determined based on the pretest outcomes and the specific needs identified among the mothers participating in the study.

Phase III. Implementation phase: Data was collected from the beginning November 2024 of till the end of January 2025, covering 3 months. The researchers visit the previous settings 2 days per week for each setting (Saturday and Tuesday for health center 1) and (Monday and Thursday for health center 4) Between 9:00 A.M. and 12:00 P.M., approximately 5 to 6 mothers who met the inclusion criteria were interviewed following the acquisition of their consent. The objectives of the study and ethical considerations were thoroughly elucidated. The educational interventions were administered over multiple sessions, each with duration of approximately 30 to 45 minutes.

At the commencement of the initial session, mothers were provided with an orientation concerning the educational intervention related to the self-medication of antibiotics. Which is consisting of five theoretical sessions. Various teaching methods were used, such as interactive lectures, audiovisual presentations, case studies, questions and answers discussions, and printed educational materials to enhance comprehension and engagement. At the conclusion of each session, all mothers were duly apprised of the schedule for the subsequent session. In subsequent sessions, the researchers elucidated the gravity of self-medication with antibiotics (perceived severity), the health risks associated with the consumption of antibiotics without a physician's prescription (perceived sensitivity), and underscored the advantages of discontinuing self-medication with antibiotics (perceived benefits). The researchers encouraged group talks to get past any obstacles (perceived obstacles) in the way of self-efficacy and healthy behaviors. Various pedagogical approaches were employed, including discussion and ideation techniques. The instructional media utilized comprised a video that encompassed all the content from the sessions. Following each session, evaluations of the prior session were completed, and the objectives of the next ones were stated.

Phase IV: Evaluation phase: By tracking how much mothers learned and how often they used antibiotics, researchers were able to determine whether an educational intervention grounded in the health belief model was successful in reducing antibiotic self-medication. This assessment utilized identical tools employed during the initial evaluation phase for the pretest group, focusing on the health belief model and the intention to discontinue self-medication with antibiotics. This was achieved through a comparative analysis of the pre-test and post-test administered immediately after the implementation of the intervention.

Statistical analysis:

The result is related to the application of SPSS version 25, an abbreviation for the Statistical Package for the Social Sciences. Illustrations of descriptive statistics encompass frequency distributions, percentages, means, and standard deviations. For this

study, researchers resorted to inferential statistics like Chi-square to test the research hypotheses. We calculated the correlation coefficient to analyze the relationships among the total scores of the research variables. A p-value of 0.001 or lower indicates an exceptionally significant difference across all statistical tests. Conversely, a p-value exceeding 0.05 indicates a lack of statistically significant difference, whereas a p-value of 0.05 or lower signifies the existence of a statistically significant difference.

Results:

Table (1): Distribution of the studied mothers related to demographic characteristics (n=267)

Variable	Item	No	%
Age in years	20-30	65	24.3
	31-40	128	47.9
	>40	74	27.7
	Mean ±SD	**38.67±6.25**	
Educational level	Read & write	166	62.2
	Secondary	50	18.7
	University	51	19.1
Marital Status	Married	189	70.9
	Divorced	22	8.2
	Widow	56	20.9
Residence	Rural	168	62.9
	Urban	99	37.1
Number of family members	2-3	86	32.3
	4-6	120	44.9
	>6	61	22.8
Family monthly income	Enough	67	25.1
	Not enough	200	74.9
Occupation	Housewives	150	56.2
	Working	117	43.8

Table (2): Distribution of the studied mothers according to healthcare facilities' characteristics (n=267)

Items	Yes		No	
	No	%	No	%
Is there a hospital or health center close to where you live?	101	37.8	166	62.2
Is there a pharmacy near your residence?	82	30.7	185	69.3
Is one of the family members a doctor or works in health sector?	69	25.8	198	74.2
Is there a home pharmacy at home (place where medications are kept inside the house)?	101	37.8	166	62.2
Do you or a family member have health insurance?	97	36.3	170	63.7

Table (3): Distribution of the studied mothers regarding their knowledge about antibiotics use pre and post educational intervention (n=267).

Knowledge items	Pre- educational intervention				Post educational intervention				Chi-square	P value
	Correct		Incorrect		Correct		Incorrect			
	No	%	No	%	No	%	No	%		
Antibiotics are used to treat infections caused by bacteria	122	45.7%	145	54.3%	210	78.7%	57	21.3%	61.66	0.000**
Antibiotics are not used to treat infections caused by virus	104	39.0%	163	61.0%	224	83.9%	43	16.1%	113.80	0.000**
Antibiotics are indicated to reduce inflammation	85	31.8%	182	68.2%	214	80.1%	53	19.9%	126.46	0.000**
Antibiotic cannot be stopped when person start feeling better	97	36.3%	170	63.7%	211	79.0%	56	21.0%	99.69	0.000**
Antibiotics can cause allergic reactions	90	33.7%	177	66.3%	228	85.4%	39	14.6%	148.05	0.000**
Antibiotics can kill 'good bacteria' of the human ecosystem	100	37.5%	167	62.5%	212	79.4%	55	20.6%	96.71	0.000**

Knowledge items	Pre- educational intervention				Post educational intervention				Chi-square	P value
	Correct		Incorrect		Correct		Incorrect			
	No	%	No	%	No	%	No	%		
Misuse of antibiotics can lead to antibiotic resistance"	97	36.3%	170	63.7%	211	79.0%	56	21.0%	99.69	0.000**
Antibiotic resistance results when the body becomes resistant to an antibiotic and the antibiotic cannot work with it	89	33.3%	178	66.7%	222	83.1%	45	16.9%	136.20	0.000**
Antibiotic resistance is only a problem for people who take antibiotics regularly	88	33.0%	179	67.0%	211	79.0%	56	21.0%	114.97	0.000**
Antibiotic resistance is an issue in our country	96	36.0%	171	64.0%	213	79.8%	54	20.2%	105.14	0.000**

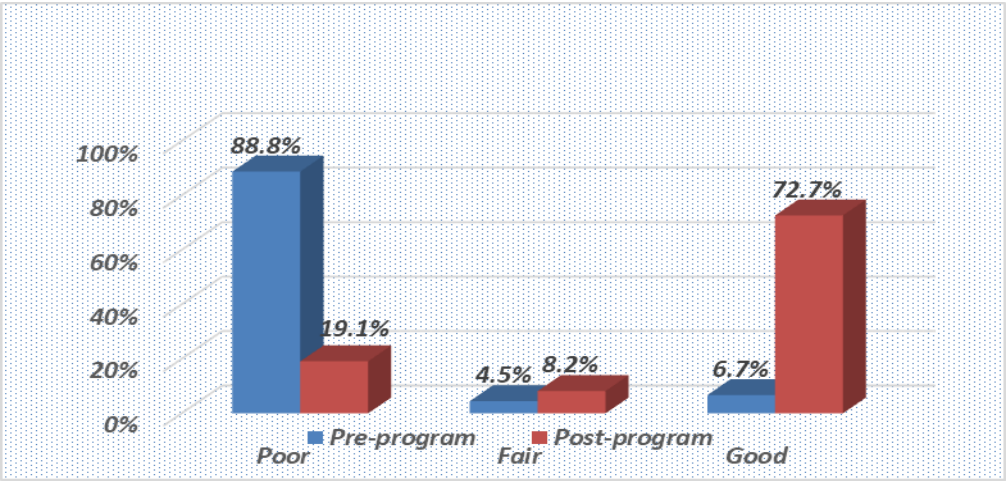

Figure (1): Percentage distribution of total knowledge level among studied mothers pre and post educational intervention (n=267)

Table (4): Distribution of the studied mothers about the reported practices pre and post program (n=267)

Items	Pre- educational intervention				Post- educational intervention				Chi-square	P value
	Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%		
Consult a doctor before starting antibiotic	88	33.0%	179	67.0%	235	88.0%	32	12.0%	33.70	0.000**
Avoid buying antibiotic from medicine shops/pharmacies directly	128	47.9%	139	52.1%	209	78.3%	58	21.7%	52.77	0.000**
Avoid using antibiotics after the suggestions from friends/neighbor	147	55.1%	120	44.9%	224	83.9%	43	16.1%	52.35	0.000**
Read the advertisement (leaflets/internet etc.) while purchasing antibiotics	127	47.6%	140	52.4%	216	80.9%	51	19.1%	64.56	0.000**
If one of the family members is sick, avoid sharing antibiotics together	98	36.7%	169	63.3%	232	86.9%	35	13.1%	39.74	0.000**
Take antibiotic until completing full course	136	50.9%	131	49.1%	218	81.6%	49	18.4%	56.35	0.000**
Make an allergy test before taking antibiotics	124	46.4%	143	53.6%	218	81.6%	49	18.4%	71.85	0.000**
Avoid Leaving the rest of antibiotic for future use for any infection	165	61.8%	102	38.2%	229	85.8%	38	14.2%	39.65	0.000**

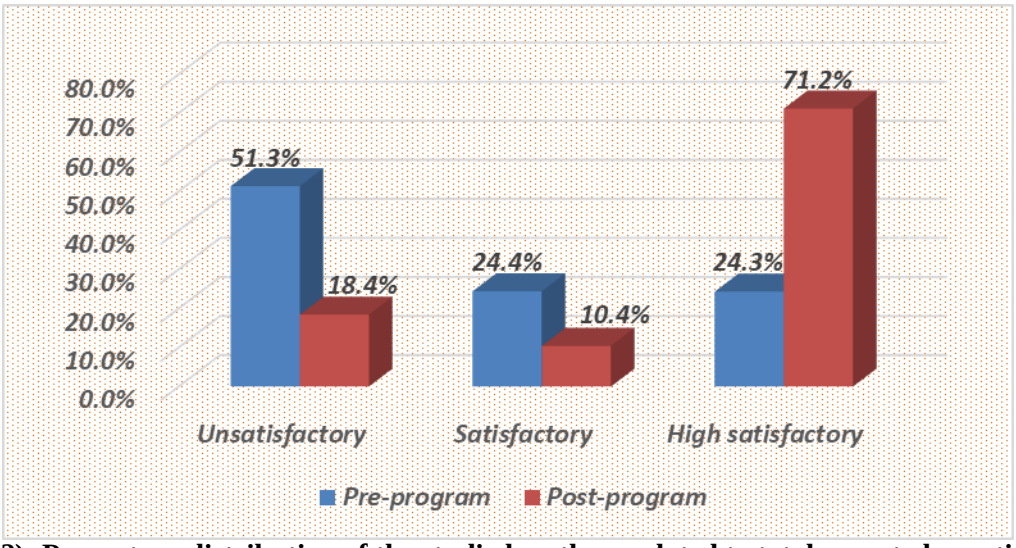

Figure (2): Percentage distribution of the studied mothers related to total reported practices level pre and post program (n=267)

Table (5): Mean and standard deviation of studied mothers regarding their total health belief model pre- post educational intervention (n=267).

Health belief model items	Pre- educational intervention	Post- educational intervention	Paired t test	P value
	Mean ±SD	Mean ±SD		
Perceived sensitivity	14.3221±1.46936	18.4532±2.37639	-23.126	0.000**
Perceived severity	9.3333±1.81611	18.8652±1.77190	-60.959	0.000**
Perceived benefits	15.4607±3.04499	29.4419±2.43707	-58.951	0.000**
Perceived barriers	10.4419±2.06824	18.6929±.3059	-57.386	0.000**
Cues to action	9.3521±1.57149	17.5581±.93360	-72.349	0.000**
self- efficacy	58.9101±5.39209	103.0112±4.35414	-106.861	0.000**

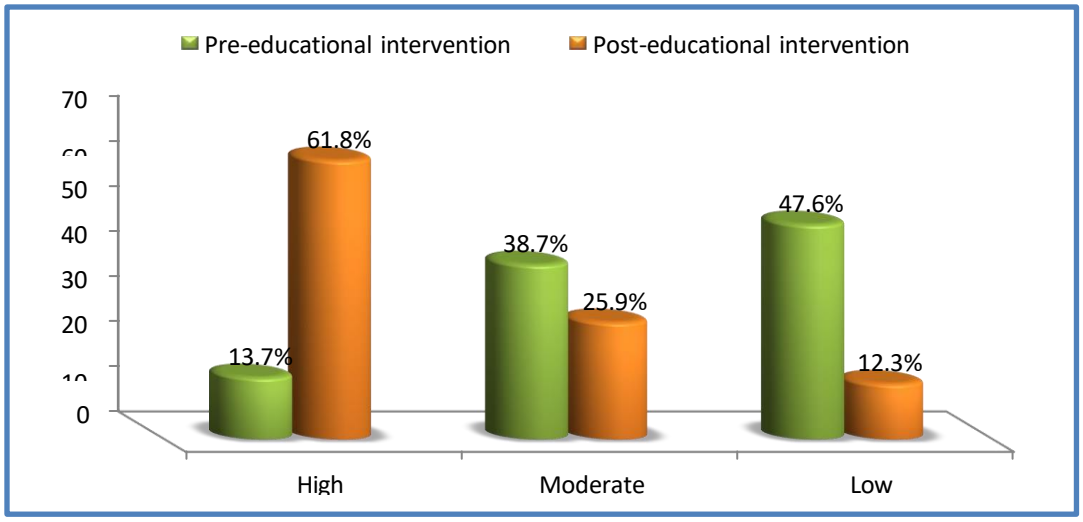

Figure (3): Percentage distribution of the studied mothers regarding their total health beliefs level pre and post educational intervention (n=267)

Table (6): Correlation among studied mothers' knowledge, reported practice, and health belief model regarding self-medication with antibiotics pre and post educational intervention (n= 267)

	Variables		Total knowledge score	Total reported practice score	Total Health belief model score
Pre-educational intervention	**Total knowledge score**	R	1	.235	.153
		P- value	-	0.05*	>0.05
	Total reported practice score	R	.235	1	.124
		P- value	0.05*	-	>0.05
	Total Health belief model score	R	.153	.124	1
		P- value	>0.05	>0.05	-
Post-educational intervention	**Total knowledge score**	R	1	.348	.253
		P- value	-	0.000**	0.000**
	Total practice score	R	.348	1	0.432
		P- value	0.000**	-	0.000**
	Total Health belief model score	R	.253	0.432	1
		P- value	0.000**	0.000**	-

Table (1): Demonstrates that; 47.9% of the studied mothers were between the ages of 31 and 40, with a mean age of 38.67± 6.25 years and 62.2% of them could read and write. Additionally, 70.9% of them were married. In relation to residence, 62.9% of the studied mothers lived in rural areas. Additionally, 44.9% of them had 4 to 6 family members in addition, 74.9% had not enough family monthly income. As well as, 56.2% of them were housewives.

Table (2): Shows that; 62.2% of the studied mothers had not hospital or health center close to where they live, 69.3% of them did not have a pharmacy near their residence and 74.2% of them did not have a doctor in their family members or works in the health sector. Additionally, 63.7% of them did not have health insurance or any of their family members.

Table (3): Reveals that; there was a marked change in knowledge of the studied mothers regarding antibiotics use after implementation of the educational intervention with a highly statistical significant difference ($p<0.001$) between pre and post- intervention phases.

Figure (1): Displays that; 6.7% of the studied mothers had good knowledge pre– educational intervention, which improved to 72.7% at post educational intervention regarding antibiotics use. While 88.8% of them had poor total knowledge at pre- educational intervention, and then this percentage decreased to 19.1% post educational intervention. Only 4.5% of them had fair total knowledge at pre-educational intervention, and then this percentage increased to 8.2% post educational intervention.

Table (4): Clears that; highly statistically significant improvement was found pre and post educational intervention application in all items of reported practices score of the studied mothers regarding antibiotics self-medication ($p<0.001$).

Figure (2): Illustrates that; 51.3% of the studied mothers had unsatisfactory total reported practices pre- educational intervention, and then this percentage decreased to 18.4% post educational intervention. While, 24.3% of them had high satisfactory total reported practices pre- educational intervention, and then this percentage increased to 71.2% post educational intervention.

Table (5): Shows that; highly statistically significant improvement was found pre and post educational intervention application in all items of the health belief model regarding antibiotics self-medication ($p<0.001$).

Figure (3): Shows that; only 13.7% of the studied mothers had high total health beliefs regarding antibiotic self-medication pre- educational intervention, which improved to 61.8%, post educational intervention.

Table (6): indicates that there was a positive statistically significant correlation between total knowledge and total reported practices pre- program, and a highly significant correlation between total knowledge and total reported practices and between total health belief and total reported practices post-program ($p<0.001$).

Discussion:

Self-medication with antibiotics has been identified as inappropriate and irrational use of antibiotics. It is a serious public health issue affecting both developed and developing countries. It constitutes a form of malpractice that may result in an elevated incidence of antibiotic resistance, attributable to the improper utilization of antibiotics and a variety of adverse effects. To facilitate the attainment of a longer,

healthier, and more active existence, individuals must recognize the various factors that influence their behavior. HBM is a fundamental and precise framework utilized to elucidate the relationship between health beliefs and behaviors. It functions as the principal framework utilized in the formulation and design of prevention and educational initiatives **(Kouhpayeh et al., 2017).** When doing studies on health behavior, HBM is among the most used conceptual frameworks. Healthcare educators use it to learn about people's beliefs and perceptions so they can better predict, describe, and explain healthcare-related behaviors. HBM includes various basic ideas that people use to assess themselves and make changes to the behavior **(Abd- Elhakam et al., 2020).**

Regarding demographic characteristics of the studied mothers, the current study revealed that; less than half of the studied mothers lied in the age group of 31 to 40 years with the mean age was 38.67±6.25 years. In relation to educational level, less than two thirds of the mothers could read and write and lived in rural areas respectively. More than two thirds of them were married. As well, the same table reveals that less than half of them had 4-6 members in the family, approximately three quarters of the studied mothers had not enough income and more than half of them were housewives (table.1). These study findings disagreed with **Ghareb et al., (2024)**, who conducted a study in Egypt about " Antibiotic Resistance: Efficacy of Guidelines Intervention on Mothers' Awareness", who reported that over two thirds of the mothers fell within the age range of 21 to 40 years and the majority of the mothers were homemakers.

While the findings of this research are inconsistent with **Yunita et al., (2022),** a study entitled "Knowledge and Practices Related to Antibiotic Use Among Women in Malang, Indonesia" was conducted with a sample size of 677 participants. The results showed that reported that more than two-thirds of the participants were from urban areas. Quite a few people, more than half were between the ages of 18 and 29, and more than two fifths had completed high education. In addition, this study was in the opposite line with **Yin et al., (2021),** who conducted a study " In titled "Prevalence of Self-Medication with Antibiotics and Associated Factors Among Chinese Residents: A Cross-Sectional Study," it was reported that approximately more than three quarter of the participants resided in urban areas, while nearly half possessed college degrees. In addition, approximately three quarters of them rated their economic status as average.

Regarding to distribution of healthcare facilities' characteristics of the studied mothers, the present study indicated that less than two thirds of the studied mothers didn't have a hospital or health center close to where they live, more than two-thirds of them reported the absence of a pharmacy nearby, and approximately three-quarters indicated that there was no physician among their family members. Additionally, less than two thirds of them did not have health insurance or any of their family members (table.2). These study findings was congruent with **Barakat & Mohasseb, (2023),** who conducted a study about " Self-medication with antibiotics: an examination guided by the theory of planned behavior among a rural population in Egypt during the covid-19 pandemic", who reported that less than three quarters of the mothers had a long distance to the nearest facility or hospital, only about one third of them had a simple access to the nearest pharmacy and half of them did not have health or medical insurance.

Concerning knowledge of the studied mothers regarding antibiotic use pre, and post educational intervention implementation, The current study demonstrated a significant enhancement in the knowledge of the participating mothers concerning the use of antibiotics following the implementation of the program, with a highly statistically significant difference ($p<0.001$) observed between the pre-intervention and post-intervention phases. The percentage of mothers who had good knowledge about (antibiotics use, antibiotics' allergic reactions, and antibiotic resistance) increased from less than half, about one third and one third at pre-intervention to more than quarter, and most of them at post intervention respectively. This could potentially reflect a return to the straightforward and uncomplicated approach employed in the elucidation of the educational material utilized in the investigation. The educational program grounded in HBM proved to be effective in fulfilling their needs for knowledge enhancement and in modifying their behavior regarding the self-administration of antibiotics.

The findings of this research were in concordance with **Ghareb et al., (2024)**, who reported that mothers knowledge regarding identification, side effects of antibiotics, and antibiotic resistance increased from less than one third at pre-intervention to more than two thirds post intervention. Furthermore, this analysis was consistent with **Yunita et al., (2022),** who reported that approximately more than four fifth of their respondents correctly identified antibiotics as medications employed for the purpose of eradicating microorganisms. More than two thirds of the respondents correctly indicated that antibiotics must be taken in their entirety, even in the event that symptoms subside. Furthermore, over fifty-five percent of the respondents correctly recognized that

bacteria possess the capacity to develop resistance to antibiotics.

Regarding to total knowledge level of the studied mothers, the implementation of the educational intervention led to a significant improvement in the knowledge of the studied sample, as evidenced by the present research. A statistically significant difference was identified between the pre-intervention and post-intervention phases ($p < 0.001$). less than three quarters of the studied mothers had good total knowledge level post educational intervention while pre- educational intervention implementation minority of them had good total knowledge level (figure. 1). The observed outcome could be attributed to employing straightforward language in the educational sessions, the mothers' readiness to learn about antibiotic and their side effect as mothers often play a vital role in the care of their families and they were responsible for managing the treatment of family members.

The findings of this study align with **Parveen et al., (2022),** who conducted a study on " Public Health Interventions to Improve Antimicrobial Resistance Awareness and Behavioral Change Associated with Antimicrobial Use: A Systematic Review Exploring the Use of Social Media" indicated that following a community-based educational intervention aimed at enhancing awareness of antibiotic use and resistance in Ras Al Khaimah, United Arab Emirates, there was a notable enhancement in participants' understanding of Antimicrobial Resistance (AMR), which achieved statistical significance with a P-value of less than 0.001.

Concerning **the reported practices of the studied mothers regarding antibiotics self-medication pre, and post educational intervention implementation,** the current study revealed that; there were highly statistically significance improvement regarding all items related to studied mother's reported practices about antibiotics self-medication pre and post intervention implementation (P= 0.000) (table.4). From the researcher's perspective, this phenomenon may be attributed to the provision of guidance and essential information concerning antibiotic misuse and its associated adverse effects, such as resistance. This, in turn, contributes to the enhancement of the practices of the mothers under study.

These findings was incongruent with **Limwado et al., (2024),** More than half of the participants who self-medicated with antibiotics did not take their medication exactly as prescribed and stopped taking it once their symptoms improved, according to the researchers who studied " Prevalence of antibiotic self-medication and knowledge of antimicrobial resistance among community members in Neno District rural Malawi: A cross-sectional study " (n=531), who reported that Over half of participants who self-medicated antibiotics did not complete the dosage of antibiotics during the treatment when their signs and symptoms improved, also over half of them reported that they initially were prescribed medication from pharmacy and, often from left over from a previous course of treatment for future use.

Regarding to total reported practices of the studied mothers, the current study demonstrated that more than half of the studied mothers had unsatisfactory practices pre implementation of the educational intervention, and then this percentage improved to less than three quarters of them had high satisfactory reported practices post implementation of the educational intervention (figure. 2). **From researchers' standpoint,** various factors contributed to unsatisfactory practices among mothers pre educational intervention as lack of knowledge and misconceptions, and financial limitations can lead families to avoid repeated visits to healthcare providers, that encouraging reuse of leftover antibiotics or sharing of medication among family members who assuming similar symptoms but after the educational intervention, this finding may be ascribed to the impact of an educational intervention aimed at improving mothers' practices regarding self-medication with antibiotics. This program aids mothers in comprehending the underlying rationale for each practice. Consequently, the mothers have acquired substantial knowledge, which has subsequently improved their practices. This study results supported by **Yunita et al., (2022),** who found that 69% of their participants exhibited adequate practices, attributable to their elevated level of knowledge regarding antibiotics.

The results of this study indicated that **all components of Health Belief Model had positive meaningful changes and highly statistically significant improvement** was found pre and post educational intervention implementation in the health beliefs of the mothers regarding antibiotics self-medication (P=0.000) (table. 5). **From the perspective of the researcher**, the statistically significant improvement across all HBM constructs reflects a well-structured, context-sensitive educational intervention that not only informed participants but also addressed their beliefs, concerns, and motivations holistically. By effectively combining knowledge delivery with behavior change strategies, the program successfully influenced mothers' perceptions and practices regarding antibiotic use. This study aligns with **Movahed et al., (2022),** who conducted a study about " Effectiveness of the Application of an Educational Program Based on the Health Belief Model (HBM)

in Adopting", Iran, (n= 200), who found that there was a statistically significant improvement in the mean scores for perceived sensitivity, perceived severity, perceived self-efficacy, perceived benefits, perceived barriers, cues to action, and actual behavior (P <0.05).

The findings of the current study revealed that more than one tenth of the studied mothers demonstrated heightened total health beliefs prior to the implementation of the educational intervention; however, this proportion increased to three-fifths following the implementation of the educational intervention (figure. 3). From the perspective of the researcher, this result might be attributed to the implementation of structured instruction grounded in a model of health beliefs, which proved to be an effective strategy for enhancing mothers' health beliefs concerning self-medication with antibiotics. This improvement was achieved through the utilization of appropriate educational methodologies and diverse media to effectively communicate the advantages of antibiotic use in a suitable manner. Also the intervention was likely designed based on a needs assessment, addressing the specific beliefs, misconceptions, and gaps in knowledge among the target group. By customizing content to the audience's context, the program effectively increased their perceived susceptibility (understanding they could be at risk) and perceived severity (recognizing the serious consequences of antibiotic misuse).

Concerning the **correlation among studied mothers' knowledge, reported practice, and total health belief model about antibiotics self-medication**, the current study showed that; a positive statistically significant correlation was found between total knowledge and total reported practices pre educational intervention. While, post educational intervention there are a positive a highly statistically significant correlation was found between total knowledge and total reported practices and between total health belief and total reported practices (p<0.001) (table. 6). From the researchers' point of view, pre-intervention correlation likely reflects a weaker and more inconsistent relationship, where knowledge alone without a structured understanding of health risks or behavioral motivation was not sufficient for widespread behavior change. A stronger post-intervention correlation suggests that knowledge became a more reliable predictor of behavior, indicating that the intervention succeeded in enabling mothers to apply what they learned in real-life scenarios. It shows that the intervention shaped beliefs, which are critical for sustaining long-term behavior change. It also validates the importance of incorporating behavioral models like the HBM in designing educational interventions. These Findings highlight the comprehensive effectiveness of the program. It reflects not only increased knowledge but also a deeper internalization of health concepts and motivation for behavior change.

These study findings were congruent with **Barakat & Mohasseb, (2023),** who reported that a statistically significant correlation exists between possessing adequate knowledge of self-medication with antibiotics and the practices reported by mothers (P = 0.04). In addition, this study findings agreed with **Mallah et al., (2020),** Who conducted a study regarding " Association of Knowledge and Beliefs with the Misuse of Antibiotics in Parents: A study in Beirut (Lebanon)", who reported that a correlation exists between individuals' knowledge and their health beliefs. It was found that a low level of knowledge, coupled with the presence of misconceptions regarding antibiotics, is associated with an elevated likelihood of antibiotic misuse and inappropriate practices. Furthermore, this study aligns with the same trajectory with **Movahed et al., (2022),** who reported that education grounded in HBM was effective in enhancing the performance and practices of mothers.

Conclusion:

This research concluded that the educational intervention based on health belief model is effective in improving the knowledge, beliefs and reported practices of mothers regarding the antibiotics self-medication, it illustrates the pressing necessity for health education programs and strict regulations to reduce the misuse of antibiotics and help combat antibiotic resistance on a global scale.

Recommendations:

- Establishment of more educational intervention that aimed at enhancing public awareness regarding risks associated with self-medication with antibiotics recommended.
- Implement stringent regulations that prohibit the over-the-counter sale of antibiotics without a valid prescription.
- Collaborative counselling programs should be done by the nurses for consumer seeking antibiotics without prescriptions on the risks and refer them to appropriate healthcare providers
- Utilize mass media as TV, radio, social media, to disseminate educational messages in simple and relatable language.

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