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Original article

Impact of clinical pharmacist's educational intervention tools in enhancing public awareness and perception of antibiotic use: A randomized control trial

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ABSTRACT

Introduction: In most developing countries, antimicrobial resistance is a public threat, and insufficient knowledge of antibiotics among the public adds to it. This study aimed to determine the efficacy of the clinical pharmacist's pamphlets and video-based educational tools to address the public's knowledge, attitude, and practice gaps on antibiotic use.

Methods: This was a pre-and post-intervention cohort study of the adult population in South India who can read and understand Tamil or English. The study participants were designated into two groups-usual care group (pamphlet-based) and interventional group (video-based), with a pre-intervention assessment using a self-administered questionnaire, followed by an educational intervention by a clinical pharmacist, and finally, a post-intervention assessment after three months.

Result: Of the162 respondents, the majority were female (58%), in the age group of 26–35 (30%), with intermediate education (43%) from a middle-income family. The mean score calculated for each domain among the two groups: knowledge score (Pamphlet based-Pre: 2.26 ± 1.13; post: 3.23 ± 1.02), (Video based-Pre: 2.22 ± 1.45; post: 3.95 ± 0.89), Attitude score (Pamphlet based-Pre: 2.53 ± 1.96; post: 3.23 ± 0.9), (Video based-Pre: 2.39 ± 1.81; post: 4.21 ± 1.35), Practice score (Pamphlet based-Pre: 2.19 ± 1.02; post: 4.46 ± 1.81). A significant improvement was observed in all domains of the video-based counselling group compared to the pamphlet-based ($p < 0.001$).

Conclusion: Clinical pharmacists can effectively help in combating growing catastrophic AMR. Newer technologies need to be deployed in healthcare to educate the unreached. This study gives an insight into the technology-supported educational tool to provide awareness to the public effectively.

1. Introduction

Antibiotics are an essential class of medication categorized under antimicrobials with the potency to destroy or inhibit the growth and multiplication of bacteria. Antimicrobials, the boon to humankind, saving millions of lives, is now losing their potency due to antibiotic resistance. There are still misconceptions regarding the use of antibiotics and the development of antimicrobial resistance (AMR).[1–4]

The development of AMR in microorganisms is a natural phenomenon occurring due to adaptation in bacteria over time. As the evolution continues, these bacteria are acquiring more defense against antibiotics, making them ineffective, posing a threat to the public by increasing hospital stays, mortality rates, economic burden, and cost of treatment.[5,6] As per the World Health Organization (WHO) and Centre for Disease Control and Prevention (CDC), soon, the world will face a situation where there is a paucity of antibiotics, even for minor infections.[6,7] To emphasize the importance of antibiotic use and the potential for antimicrobial resistance, the WHO has introduced the Access, Watch, and Reserve (AWaRe) classification of antibiotics for evaluating and monitoring antibiotic use.[8]

The countries enrolled in WHO's Global Antimicrobial Resistance, and Use Surveillance System (GLASS) have revealed widespread antibiotic resistance among 500 000 people with suspected bacterial infections across 22 countries.[9]

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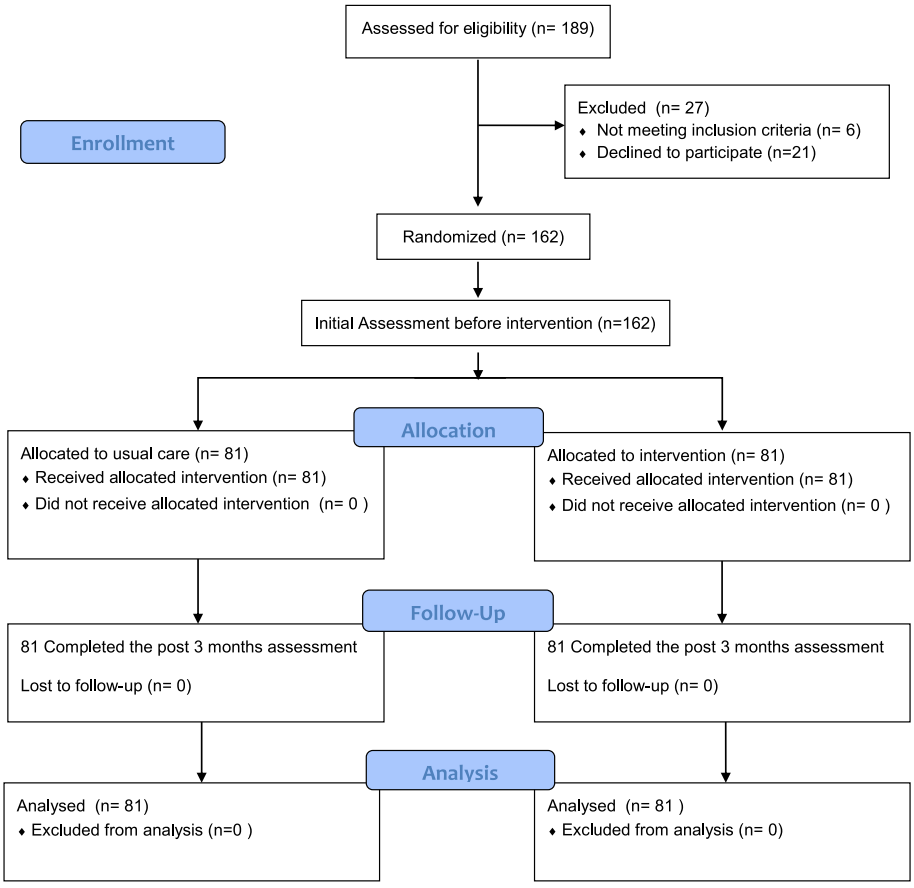

Fig. 1. Study flow chart.

The 2020 ICMR report underlines the growing AMR across India. In a developing country like India, a significant population is from rural areas, with limited access to sophisticated healthcare, relying on untrained professionals for therapy,[10–12] leading to unawareness of terms such as "antibiotic resistance".[13] According to the recent MAQART survey, 68% of healthcare is provided by untrained professionals in rural India.[14] This leads to inappropriate antibiotic use, drug sharing, overuse, not taking the whole course, self-treatment, saving some for the next time, taking unprescribed antibiotics from pharmacists, rising infectious diseases, substandard medicines, misdiagnosis, and lack of testing laboratories. Individuals, policymakers, health professionals, the healthcare industry, and the agriculture sector can significantly impact the prevention and control of antibiotic resistance.

In WHO's Global Action Plan on Antimicrobial Resistance (AMR) 2015, among the five key priorities, one is to improve the public awareness of antibiotics and AMR. In India, the Red Line Campaign on Antibiotics was launched in 2016 to raise awareness of the rational use of antibiotics. Along with this, National Centre for Disease Control (NCDC) has published National Treatment Guidelines for antimicrobial use in infectious diseases to reduce the incidence of irrational antibiotic prescribing in the country.

As the preliminary step in implementing the Action plan against the AMR, the public's knowledge, conception, and practice regarding antibiotic use and antimicrobial resistance should be improved. This initiative needs a strong group of highly qualified health professionals to educate the public through various programs. In developed countries, clinical pharmacists were exclusively used to promote rational antibiotic use and educate the public and other fellow healthcare professionals. However, in developing countries, the role of the clinical pharmacist is still underutilized and needs advancement in frontline health services. This study aimed to determine the efficacy of pamphlets and video-based educational tools by the clinical pharmacist to address the public's knowledge, attitude, and practice gaps on antibiotic use.

2. Methods

2.1. Study design

A concurrent parallel group single-blinded randomized control study was undertaken with an allocation ratio of 1:1.

2.2. Study setting

The study was conducted at the medical camp by SRM Medical College and Research Centre, Tamil Nādu, from February 2022 to May 2022 among the rural population living in the potheri village (Kattankulathur) of South India using a self-administered structured questionnaire. Based on the total population in the study location, the sample size was calculated, and a questionnaire was administered among participants who visited the camp during the study period. As per the inclusion criteria, the adult population above 18 who were not from a healthcare background and could read and understand Tamil or English were considered for the study.

2.3. Ethical consideration

Ethical approval (SRM 2908/IEC/2021) was granted by SRM Institute of Science and Technology, SRM Medical College and Research Centre on 23 November 2021.

2.3.1. Sample size

Based on the average number of participants in the pilot study

conducted in the same institution, we estimated the minimum sample size to be 162 (95% CI with 5% error), considering a potential 20% dropout. Therefore, 81 participants were randomly assigned to the intervention and usual care groups.

2.4. Randomization

A Simple randomization method was used. Based on the random sequence generated using the website (www.randomization.com) to generate the randomization schedule, the participants were randomised at a ratio of 1:1. A third independent entity who is not connected to the study generated the randomization procedure and the study envelopes. Envelopes were used to conceal the allocation and was opened by the clinical pharmacist sequentially at the time of each participant's enrolment.

2.5. Development of data collection tool

Data were collected using structured self-administered questionnaires; the questionnaire used here was adapted from the previous study conducted by Bharadwaj et al.[3]

A clinical pharmacist and microbiologist team confirmed the adapted questionnaire's readability and reliability. The senior faculty from the Department of Tamil further translated the questionnaires into the Tamil language. The participants were allowed to select either Tamil or English questionnaires.

The questionnaire comprised three main sections. The first section was regarding the socio-demographic characteristics of participants, and the second was regarding the previous history of antibiotic course duration, frequency, and sources. The third section consists of dichotomous questions to assess the respondent's knowledge, attitude, and practice on antibiotic use. Each subsection of Knowledge, Attitude, and Practice consists of 6 questions.

2.6. Development of educational interventional tool

The educational tool used in this study were pamphlets and videos which contains concise, simple demonstrations on appropriate antibiotic use and the reasons for antibiotic resistance. The information in the pamphlet and videos were collected from WHO and the Indian Council of Medical Research. The information collected from these sources was simplified and reviewed by a team of clinical pharmacists and Microbiologists. This information was further translated into the Tamil language by one of the professors in the department of Tamil.

2.7. Data collection

The aim and objective of the study were thoroughly explained, and consent was taken from the willing participants who had attended the camp. The participants were randomly assigned into two study groups, where the intervention group was provided with video-based counselling, and the usual care group was provided counselling with pamphlet Fig. 1. The study participants' baseline social demographic characteristics, such as age, gender, educational level, occupation, and income level, were collected using a pre-designed data collection form. The self-administered questionnaire was given to both the intervention and usual care groups to evaluate the knowledge, attitude, and practice of antibiotic use. Each correct answer was allocated 1 point. The scores achieved by the participants was not disclosed to avoid bias. Afterward, the participants in the interventional group received video-based counselling by a lead clinical pharmacist. Each participant was provided with information on antibiotic-related information, antibiotic use, risk factors, antimicrobial resistance, and adherence to prescription visually. In the usual care group, the clinical pharmacist provided education regarding the same using a pamphlet. The same questionnaire was reordered and disseminated to the participants in both groups after a cooling period of three months (end of May 2022) through a follow-up telephone call. Their responses were marked down, and scores were calculated.

Table 1
Socio-demographic characteristics of the participants.

Socio-demographic characters	Number	Percentage (%)
Gender		
Male	68	42
Female	94	58
Age groups		
18–25	34	21
26–35	49	30
36–45	42	26
46–60	29	18
>60 37	8	5
Education		
High-school	53	33
Intermediate	70	43
Graduate/Post-graduate	39	24
Occupation		
Students	32	20
Unemployed	56	35
Semi-skilled/skilled workers	28	17
Clerical/Shop-owner	17	10
Semi-professional/Professional	29	18
Income (Indian Rupees/Month)		
Low Income	40	25
Middle income	86	53
High income	36	22
1st-degree family member in health care related job		
Yes	8	5
No	154	95
Frequency of Antibiotic Consumption		
At least once a month	6	4
At least once every 3 months	55	34
At least once every 6 months	62	38
At least once a year	31	19
More than once a year	8	5

2.8. Outcome measure

The primary outcome of this study was a change in the knowledge, attitude, and practice of antibiotic use. The variation was calculated using the score obtained in the baseline (before counselling) and after 3 months in both the intervention and usual care groups. The impact of the interventional tool was determined using the variation in scores between both groups after three months.

2.9. Statistical analysis

The collected data were entered into Microsoft Excel and were analyzed using SPSS statistical software version 20. The participants who completed pre and post-intervention assessment were considered for the final analysis. The association between the demographic characteristics of the participants and the knowledge level was calculated using Pearson's Chi-square test.The difference between pre- and post-intervention was calculated using McNemar's test. Paired *t*-test was employed to measure changes in pre and post intervention mean scores. The p-value <0.001 is considered significant.

3. Results

There were 162 respondents who completed the study. Respondents' demographics are presented in Table 1. The majority were female (58%), belonging to the age group of 26–35 (30%), and had intermediate education (43%). A quarter of respondents (25%) belonged to a low-income family, whereas half belonged to a middle-income family (53%). Only 5% of respondents had a 1st-degree family member being a healthcare provider. All respondents claimed that they had taken

Table 2
Analysis of knowledge, attitude and Practice on antibiotic use.

Statements	Usual care Group			Intervention group		
	Educational Tool-Pamphlet (Correct responses) (n = 81)			Educational Tool-Video-Based (Correct responses) (n = 81)		
	Pre-Intervention %	Post-3-month Intervention %	p-value	Pre-Intervention %	Post-3-month Intervention %	p-value
Knowledge-Based						
K1. Antibiotics can kill bacteria	87.6	90.1	0.62	86.4	96.2	<0.001*
K2. Antibiotics can kill viruses	37.03	85.1	<0.001	37.03	92.5	<0.001*
K3. Bacteria become resistant to antibiotics	25.9	81.4	<0.001	23.4	91.3	<0.001*
K4. Humans become resistant to antibiotics	27.1	83.9	<0.001	28.3	92.5	<0.001*
K5. Antibiotics can be stopped as one starts to feel better	37.03	80.2	<0.001	35.8	91.3	<0.001*
K6. The unnecessary use of antibiotics can reduce their efficacy in the treatment	67.9	87.6	<0.001	66.6	97.5	<0.001*
Attitude Based						
A1. I think a doctor's prescription should be taken to buy antibiotics from pharmacies.	88.8	92.5	0.62	90.1	93.8	0.81
A2. I think leftover antibiotics can be used again in the future or given to someone else.	30.8	85.1	<0.001	29.6	92.5	<0.001*
A3. I think leftover antibiotics should be taken back to the pharmacy for proper disposal.	27.1	86.4	<0.001	28.3	92.5	<0.001*
A4. I think it is good that one can buy antibiotics online without consulting a doctor first.	77.7	92.5	<0.001	75.3	95.06	<0.001*
A5. I think antibiotics can be taken from friends or relatives without consulting a doctor first.	85.1	90.1	0.4	86.4	93.08	0.73
A6. I think it is good that one can buy antibiotics without a prescription in some countries.	44.4	83.9	<0.001	43.2	97.5	<0.001*
Practice-Based						
P1. If I take antibiotics, I will recover faster from the common cold	41.9	86.4	<0.001	75.9	93.8	<0.001*
P2. I always take antibiotics in case of sore throat	34.5	85.1	<0.001	35.8	92.5	<0.001*
P3. I always treat a persistent cough with antibiotics	38.2	87.6	<0.001	38.8	93.8	<0.001*
P4. In case of mild infections, I don't take antibiotics	37.03	88.8	<0.001	38.2	92.5	<0.001*
P5. In case I get an infection, I rest and wait for the infection to subside on its own.	19.7	88.8	<0.001	20.9	95.06	<0.001*
P6. If the mucus becomes colored when having a common cold, I take antibiotics.	22.2	88.8	<0.001	20.9	93.8	<0.001*

*p value < 0.001 was significant.

antibiotics at least once in their lifetime, with 38% having taken antibiotics at least once every 6 months, and 6 respondents (4%) claimed to have taken antibiotics once every month. There was no loss to follow-up during the study period, since we kept contacting the participants for their convenient time for post evaluation through phone calls.

3.1. Knowledge-based analysis on antibiotic use

The overall knowledge of respondents regarding antibiotics was fair. Most respondents knew antibiotics kill bacteria (Group 1: 87.6%, Group 2: 86.4%). Before the intervention, only 37.03% of both groups understood that antibiotics could not kill viruses. Significant improvement was observed after the intervention (Group 1: 48.07%, Group 2: 55.47%, p-value <0.001). The number of respondents who answered the statement K4 correctly increased by 56.8% in Group 1 and 64.2% in Group 2 after the educational intervention (p-value <0.001). The correct response to the statement K3 also increased significantly 3 months post-intervention assessment (Group 1: 55.5%, Group 2: 67.9%, p-value <0.001).

3.2. Attitude-based analysis on antibiotic use

Most respondents answered statement A1 correctly in pre-intervention that a doctor's prescription should be taken to buy antibiotics from pharmacies. Before the intervention, most respondents believed it was correct to use leftover antibiotics in the future. This misunderstanding was rectified in post-education, increasing the number of correctly answered respondents (p-value <0.001). Before the intervention, only 30.8% and 29.6% of Group 1 and 2 respondents answered statement A3 correctly. Post-intervention correctly answered respondents increased by 59.3% in Group 1 and 64.2% in Group 2. (p-value <0.001). The statement A6 was correctly answered by 44.4% and 43.2% during pre-intervention, showing considerable significance after post-education through pamphlets and video-based tools (p value < 0.001).

3.3. Practice-based analysis on antibiotic use

Practices based on antibiotic use strictly longed for the right education. Less than a quarter of the respondents answered that they would seek medical help after getting an infection (Group 1:19.7%, Group 2: 20.9%). Three fourth of the respondents answered incorrectly to the statements P2, P3, and P4 prior to intervention. Post-intervention assessment signified improved understanding with the proper practice (p value < 0.001). Correct responses to statement P5 significantly increased at the 3-month post-intervention assessment with 69.1% and 75.36%, respectively (p-value <0.001). The majority perceived that an antibiotic is required when the mucus becomes colored. This misconception was rectified post-intervention in both groups, with an increase in correct responses by 66.6% and 70.9% (p-value <0.001). Analysis of knowledge, attitude, and Practice on antibiotic use was depicted in Table 2.

3.4. Analysis of the change in mean score

In the pamphlet-based educational group, the mean knowledge score on antibiotic use increased from 2.26 1.13 (Pre) to 3.23 1.02 (Post), whereas it significantly increased from 2.22 1.45 to 3.95 0.89 in the

Table 3
Analysis of the Mean Score of three domains of antibiotic use.

Domain	Usual care group		Intervention group		P-value
	Educational Tool-pamphlet		Educational Tool-Video-Based		
	Pre-Intervention Mean (SD)	Post-3-month Intervention Mean (SD)	Pre-Intervention Mean (SD)	Post-3-month Intervention Mean (SD)	
Knowledge about antibiotic Score	2.26 (1.13)	3.23(1.02)	2.22 (1.45)	3.95 (0.89)	<0.001*
Attitude about antibiotic Score	2.53 (1.96)	3.23 (0.9)	2.39 (1.81)	4.21 (1.35)	<0.001*
Practice about antibiotic Score	2.08 (1.63)	3.5(0.62)	2. 19 (1.02)	4.46 (1.81)	<0.001*

Paired *t*-test was employed. *Significance between Post 3 months group of Pamphlet and Video-based. No significance was observed between the Pre-intervention of the two groups. p value < 0.001 was significant.

video-based educational group. Similarly, it was discovered that the mean attitude score increased from 2.53 1.96 (Pre) to 3.23 0.9 (Post) in the educational group using pamphlets. In contrast, it increased significantly from 2.39 1.81 (Pre) to 4.21 1.35 (Post) in the group using videos. Additionally, a higher mean score was seen in the group using videos, going from 2.19 1.02 (Pre) to 4.46 1.81 (Post), but in the groups using pamphlets, it was 2.08 1.63 (Pre) to 3.5 0.62. (Post). After educational intervention, all domains significantly improve, but video-based educational interventions show much more improvement (Table 3).

4. Discussion

Antibiotic resistance has become an international menace and has not been confined to a particular nation. The spread of resistance at this pace can lead to a perilous post-antibiotic era. This study investigated if interventional tools create a better impact among the general public regarding antibiotics in the study location. Our study participants showed a low level of knowledge of antibiotics. Most of the study participants lacked a clear basic concept regarding antibiotic activity and the consequences of unnecessary use of antibiotics. A significant proportion of the study participant believed that antibiotics could kill viruses. A similar result was seen in a study by Bhardwaj et al.[3]in Karnataka region of India. This could be attributed to the fact that a significant proportion of the population was from rural areas with primary education. Another remarkable statement was that majority of the study participants had a knowledge deficiency of antimicrobial resistance. A similar result was observed in the study conducted by Shamsudeen et al.[15] and Desai et al.[16] in India. Knowledge about antibiotic use and antimicrobial resistance improved after the educational intervention in both groups, with the video-based education showing prominence.

A moderate attitude was noted towards the perception of antibiotic use, relatable to the lack of strict regulation on over-the-counter antibiotics and limited access to sophisticated healthcare in rural areas. Most of the study participants were from low- and middle-income groups, where health care cost is a considerable burden. Likewise, a similar response was recorded in a study by S Patil et al.[17] in Maharashtra. Before the educational intervention, respondents believed that leftover antibiotics could be used in the future. Three-fourths were unaware that unused antibiotics could be returned to the pharmacy. Participants with family or friends from the health care sector had a positive attitude towards antibiotic usage. A similar result was seen in a study conducted by Bassoum et al.[18] and EI Kahn et al.[19]

All these myths were busted with the proper use of interventional tools, and positive responses were recorded. The video-based tool proves to be effective in disseminating facts about antibiotics.

Respondents demonstrated an average level of practice. More than one-quarter of the respondents believed that antibiotics work against the common cold, sore throat, and cough, and these results were similar to the study conducted by Thong et al.[20] and Mazinska B et al.[21] Participants from an educational background with a good income had a more positive approach to the practice of antibiotic use. After the educational intervention, participants showed a positive inclination toward better practice, especially among video-based educational groups.

Though both educational tools were adequate, video-based educational tools significantly impacted educating the population. Video-based education allows the participants to observe a behavior performed in the video owing to a high impact on their cognition or, more specifically, their thoughts and perception of their surroundings. However, pamphlet-based education has no demonstrated behavior.[22] Alternatively, most people lack interest and time to read the pamphlet.

Educating the public on antibiotic use and resistance is an unmanageable task. The traditional system of education through pamphlets is effective to an extent. Nevertheless, educating a broad audience about the ever-increasing AMR rates through traditional education methods would be futile. Hence, the integration of technology-based educational tools in healthcare is in need of the hour. The interventional tools in this study aided in busting myths regarding antibiotics, reducing gaps in knowledge, and achieving a positive inclination in attitude as well as practice domain.

This study has its own limitations in that its findings only reflect the smaller rural populations and not the entire country. Since the study period was very short, the long-term effect of the intervention has to be studied further.

5. Conclusion

Antibiotic resistance is emerging as a multi-faceted challenge. There is an urgent need to integrate healthcare workers from various levels into the healthcare system to address this problem. Involving Clinical pharmacists can effectively help combat antibiotic resistance, reducing healthcare costs and the growing catastrophic AMR.

Sound knowledge, attitude, and practice regarding antibiotics are the need of the hour, as with each day passing, newer technologies need to be deployed in healthcare to educate the unreached. This study gives an insight into the technology-supported educational tool to provide awareness to the public effectively.

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Declaration of competing interest

None.

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