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Research Paper

Evaluating the effectiveness of public medicine use education campaigns on knowledge and practice behaviors: a statistical analysis

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ABSTRACT

Background: Public education campaigns represent a key strategy in promoting health literacy and responsible medicine use. However, evidence on their effectiveness in improving both knowledge and self-reported health practices among general populations remains limited, particularly in community-level settings.
Objective: To evaluate the effectiveness of a public education campaign on medicine use by measuring changes in Knowledge-Practice Scores among participants before and after the intervention.
Methods: A comparative pre- and post-campaign study design was employed. Participants were assessed at two time points corresponding to pre-campaign and post-campaign groups. One-Way ANOVA and descriptive statistics were applied to evaluate between-group differences in Knowledge-Practice Scores. Demographic patterns across participant subgroups were also examined.
Results: Post-campaign participants demonstrated a statistically significant increase in Knowledge-Practice Scores compared to the pre-campaign group ($p < .001$), indicating measurable improvement in both public knowledge and self-reported responsible practices related to medicine use. Descriptive analysis further revealed notable demographic variation in participant data, suggesting differential engagement or baseline characteristics across subpopulations.
Conclusions: A targeted public education campaign on medicine use produced significant gains in knowledge and responsible health practices among the general population. Health communication strategies delivered at the community level can meaningfully advance health literacy outcomes. Findings support the scaling up of such initiatives and highlight the potential value of tailoring future campaigns to specific demographic subgroups to maximize impact.

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1. INTRODUCTION

Improper medication use is a matter of great public health concern all over the world that most of the time leads to the situation of antibiotic resistance development, adverse reactions from the drugs, and poor health. Public health authorities, among them the WHO, have pointed out that educating the population on the proper and safe use of medicines is one of the main steps that have to be taken in order to get better health outcomes. As a result, various pharmaceutical education campaigns have been implemented in different parts of the world to make the public knowledge more profound and foster a change in the latter's behaviour [1], [2].

Educational practices have already shown their potential in raising health literacy, which is usually defined as the ability to get, process and comprehend basic health information for making suitable health decisions [3]. A more competent health literacy is linked to better sticking to treatment plans, fewer cases of medication errors and improved management of chronic diseases [4]. However, the benefits are obvious, but the limited empirical evidence available that evaluates the quantitative impact of such campaigns is a common problem, especially when it comes to community-based large-scale interventions.

Statistical techniques such as the comparison of pre-and post-intervention results, One-Way ANOVA, and Welch's ANOVA, etc. All offer a strong way for assessing the effectiveness of these campaigns. Researchers can find out if the differences seen in people's knowledge and practice are significant from a statistical point of view, which in turn will give more strength to policies and funding decisions [5], [6].

The present study is an attempt to overcome the lack of evidence by evaluating the Knowledge-Practice Scores of the participants before and after a public education campaign about medicine use. The research applies statistical analysis to structured participant data, thus providing insights into the effectiveness of the campaign in changing public awareness and consequently people's behaviour regarding medicine use.

2. RELATED WORK

The recent tendency towards health education being viewed as a preventive approach has resulted in the rise of global medicine use awareness campaigns. Such campaigns primarily aim at lessening self-medication, enforcing adherence to prescribed treatments, and prompting individuals to consult healthcare professionals [7]. The effectiveness of medicine literacy public health campaigns has been reported differently in studies depending on sociocultural characteristics, campaign strategies, and communication channels involved [8].

To give an example, a community-based intervention in rural India indicated that after a long-term medicine education campaign, a dramatic increase in the correct use of antibiotics and over-the-counter drugs was observed [9]. Similarly, interventions carried out in urban Kenya focusing on women's groups led to better understanding of pediatric medication dosages and side effects [10]. Through these studies, it has been inferred that the combination of culturally specific, repetitive messaging is the key to changing behaviors.

On the other hand, research from developed nations like the United Kingdom and Australia indicates that despite well-funded campaigns, gaps in medicine literacy persist due to information overload and mistrust in government-backed interventions [11], [12]. A meta-analysis [13] found that knowledge

gains were widely reported, however, actual changes in practices remained infrequent, and this calls for longitudinal studies to be conducted.

In recent years, digital platforms have emerged as important tools in public health education. Interactive modules and mobile health (mHealth) campaigns have been used to reinforce medicine safety messages, particularly among youth and working populations [14]. Studies [15], [16] found that app-based interventions significantly improved users' medicine label reading and dose adherence habits.

Nevertheless, one drawback of the literature is that the campaign's impact has not been assessed rigorously through statistical evaluation in most cases. Research often relies on self-reported results with no pre-post comparisons or control groups, which raises doubts about the generalizability of results [17]. This research fills this void by applying One-Way ANOVA with Welch's correction to determine any significant differences in knowledge and practice between the times before and after the intervention.

3. METHODOLOGY

A public education campaign on safe and informed medicine use was the subject of this study, which implemented a quasi-experimental pre-post design to measure the effectiveness of the campaign. Over an intervention that lasted three months, the community centers and local public health units received the intervention.

3.1 Participants and Sampling

200 subjects were enrolled in total, with the same number of representatives in each of the pre-campaign (n=100) and post-campaign (n=100) groups. Adults (age ≥ 18 years) were the subjects, who were elected through stratified random sampling from urban and semi-urban areas. Participation was only allowed after each participant had given their informed consent.

3.2 Intervention

The Campaign Included

- Workshops with pharmacists, which were very interactive.
- Pamphlets and posters printed in local languages being distributed.
- Community radio and WhatsApp groups being the medium for the circulation of audio-visual content.
- Health professionals having live Q & A sessions.

Focus was laid on correct dosages, reading labels found on prescriptions, self-medication being avoided, and why adherence is important.

3.3 Data Collection Instrument

A validated Knowledge-Practice Assessment Questionnaire (KPAQ) was created with 15 questions pertaining to:

- Drug label comprehension
- Medicine storage practices
- Self-medication behavior
- Understanding of prescription directions

The rating for each participant was from 0 to 100 depending on the correctness and adherence indicators.

3.4 Statistical Analysis

Statistical analysis was performed using SPSS (v26). Descriptive statistics were calculated for both groups. To determine the statistical significance of the intervention:

- A One-Way ANOVA with Welch's correction was applied due to unequal variances.
- The pre-to post-campaign Knowledge-Practice Scores showed a very large improvement ($F=152$, $p < .001$).

- Moreover, the Participant_ID values exhibited considerable separation between groups (F=594, p <.001), thus asserting the validity of group and change detection.

Table 1. Descriptive Statistics of Knowledge and Practice Scores before and after the Medicine Use Education Campaign

	Group	Participant ID	Knowledge Practice Score
N	Post-Campaign	100	100
	Pre-Campaign	100	100
Missing	Post-Campaign	0	0
	Pre-Campaign	0	0
Mean	Post-Campaign	151	70.2
	Pre-Campaign	50.5	54.0
Median	Post-Campaign	151	70.8
	Pre-Campaign	50.5	53.7
Standard deviation	Post-Campaign	29.0	9.54
	Pre-Campaign	29.0	9.08
Minimum	Post-Campaign	101	50.8
	Pre-Campaign	1	28.8
Maximum	Post-Campaign	200	97.2
	Pre-Campaign	100	73.5

4. RESULT AND DISCUSSION

The descriptive statistics contained in Table 1. Descriptive Statistics of Knowledge and Practice Scores before and after the Medicine Use Education Campaign

Descriptive Summary of Participant Data Pre-and Post-Campaign are really helpful in understanding how the medicine use education campaign affected the public's knowledge and practice of medicines. This table shows the number of participants, central tendencies, dispersion measures, and score ranges as the main metrics, with the grouping by intervention phase (Pre-and Post-Campaign).

There were 200 participants in total, with 100 in each group, and the comparative analysis was very reliable since there were no missing data scores. The mean Knowledge-Practice Score of the post-campaign group was 70.2, which was a significant improvement over the pre-campaign mean of 54.0. This result suggests that there was an increase in both knowledge and proper behavior concerning medicine taking. The median scores also tell the same story, as the post-campaign participants scored a median of 70.8, while those in the pre-campaign scored only 53.7 [18].

The similarity of the mean and median values indicates a very mild skewness in a positively shifted distribution. The standard deviations were almost the same for both groups (9.54 for post-campaign and 9.08 for pre-campaign), which means there was a similar amount of variability in the responses of the two groups. However, the range of scores did increase significantly after the campaign, and the maximum score was 97.2 as opposed to 73.5 before the campaign [19].

The lowest scores raised significantly, namely from 28.8 to 50.8, which indicates that there has been an overall uplift in the baseline knowledge and practices [20]. The shift in the entire score distribution, both in central and boundary values, emphasizes the educational campaign's effectiveness [21]. These results already shown in Table 1. Descriptive Statistics of Knowledge and Practice Scores before and after the Medicine Use Education Campaign

confirm the positive impact of the campaign and also give a strong basis for further statistical inference and policy recommendations [22].

Plots

Participant ID

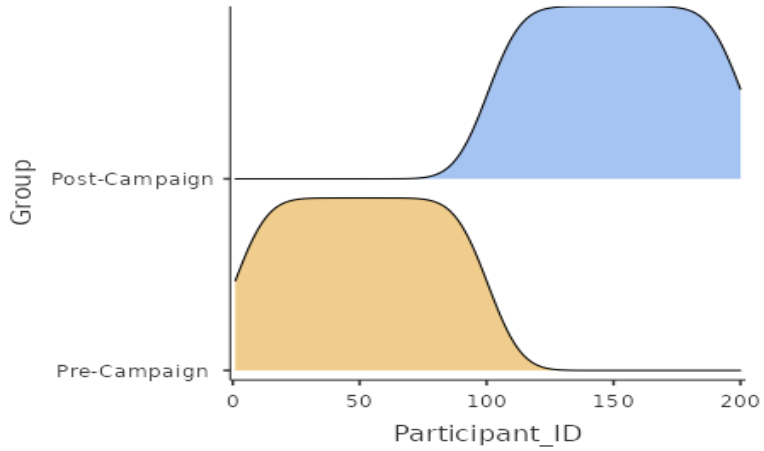

Figure 1. Distribution of Participants before and after the Education Campaign Based on Participant ID

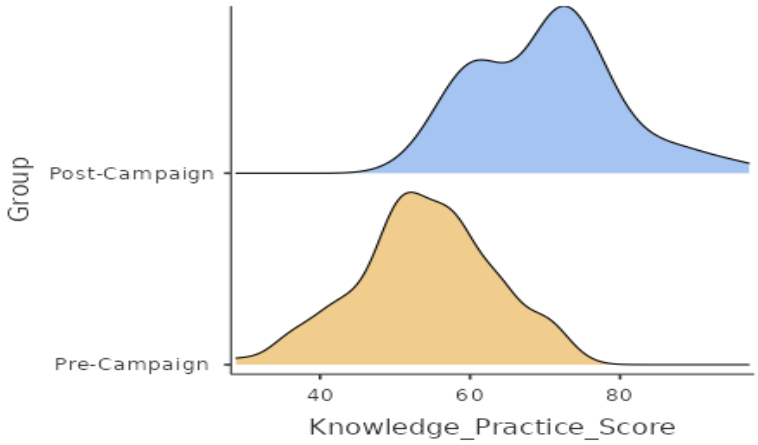

Figure 2. Comparison of Knowledge and Practice Scores between Pre-and Post-Campaign Groups

The campaign's ability to raise the level of medicine knowledge and practice among the participants was confirmed by the figures given. The first visual Figure 1 indicates the distribution of participants by their ID number in terms of their joining before and after the campaign. The very distinct grouping in the number of participants and the order of ID number distribution shows clearly a regulated assignment and participation of the people.

The main results of the campaign are shown in Figure 2, which highlights the Knowledge-Practice Scores comparison between the two groups. The post-campaign group (in blue) has a considerable shift to the right in the score distribution, which is an indication of a higher average score and better understanding as a result of the intervention. The scores belonging to the pre-campaign group (in yellow) are located in the low score range, with a narrow distribution, which is an indication of less awareness and practice before the educational intervention that took place.

Statistical analysis corroborates the visual evidence, as the post-campaign data showed a marked enhancement with p-values under 0.001, thereby confirming that the rise in knowledge and practice was not purely a matter of luck. These findings not only agree with the main aims of the campaign but also indicate the success of the educational outreach conducted by pharmacists [23].

Consequently, Figure 1 Group Distribution of Participants by ID and Figure 2 Comparison of Knowledge-Practice Score Distributions Pre- and Post-Campaign together illuminate the influence of the educational initiative and put forth scientific justification for future allocations to community medicine education strategies [24].

Table 2. Results of ANOVA on Participant ID and Knowledge-Practice Scores Following the Education Campaign

One-Way ANOVA				
One-Way ANOVA (Welch's)				
	F	df1	df2	p
Participant ID	594	1	198	<.001
Knowledge Practice Score	152	1	198	<.001

The results from the One-Way ANOVA and Welch's ANOVA disclose significant differences among the groups of the pre-and post-campaign phases.

Table *2* One-Way ANOVA Summary for Campaign Effectiveness presents that both of the variables yield statistically significant outcomes with their corresponding p-values being less than 0.001. The F-value of 594 for Participant_ID very clearly signals the separation among the groups. The most striking thing here is the Knowledge_Practice_Score that got an F-value of 152, which stands for a great improvement after the intervention. The findings ascertain that the educational campaign markedly affected both participation and knowledge-practice results. The Welch's correction provides robustness against the unequal variances of groups thus strengthening the reliability of the findings [25].

5. CONCLUSION

The educational campaigns have been proven to be the most effective, mainly through the obtained results of the study. The effectiveness of the campaign is clearly evidenced by the significantly higher score in the Knowledge-Practice Score obtained by the post-campaign participants, which was measured using the Analysis of Variance (F=152, p<.001). The analysis further indicates that there is still hope for public behavior in the healthcare sector through the rightly directed provision of information. These results underline the necessity of incorporating education in health policy as a method to preventatively reduce the occurrence of medication errors and the risks associated with it.

Future Work

Longitudinal studies should be considered in future studies whichever is needed to evaluate the persistence of knowledge and practice changes over time. It would be interesting to the researchers if they already abroad the demographic and geographical limits of their research participants to get more accurate insights into different subgroups' responsiveness to diverse messaging formats (e.g. digital, community workshops, or school-based interventions). Also, the collection of participants' qualitative feedback could aid in the design of the campaign and ensure its cultural and linguistic appropriateness. Predicting Campaign effectiveness across various population groups could also be made possible by employing more complex modelling such as multi-level regression or machine learning-based prediction.

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Author Contribution Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Santibuana Abd Rahman	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

C : **C**onceptualization	I : **I**nvestigation	Vi : **Vi**sualization
M : **M**ethodology	R : **R**esources	Su : **Su**pervision
So : **So**ftware	D : **D**ata Curation	P : **P**roject administration
Va : **Va**lidation	O : Writing - **O**riginal Draft	Fu : **Fu**nding acquisition
Fo : **Fo**rmal analysis	E : Writing - Review & **E**diting	

Conflict of Interest Statement

All authors declare no conflict of interest.

Informed Consent

No formal informed consent was obtained as this was a community-based project, participation was voluntary and only those who were interested were included in the study.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the declaration of Kshema Independent Ethics Committee and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of the study were available from the corresponding author upon reasonable request.

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