Exploring the impact of health education on medication adherence and health outcomes in low-income neighborhoods: An observational study

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ABSTRACT

Background: Medication adherence and health outcomes are influenced by multiple factors, including patient education. **Aims and Objectives:** The aims and objectives of the study are to explore the impact of health education on medication adherence and various health outcomes in low-income neighborhoods. **Materials and Methods:** An observational study was conducted involving 100 participants from low-income neighborhoods, aged 18–65, who were prescribed at least one chronic medication. Participants underwent a comprehensive health education program focusing on medication adherence, potential side effects, dietary habits, and physical activity. Outcomes were measured using the Morisky Medication Adherence Scale (MMAS-8), biometric values (e.g., blood pressure, blood sugar levels, cholesterol, and body mass index [BMI]), self-reported health status, hospitalization records, medication side-effects awareness, and dietary habits. **Results:** Post-education, there was a significant improvement in MMAS-8 scores (5.3 pre to 6.8 post, $P < 0.001$). Biometric outcomes revealed a decrease in average blood pressure (from 145/90 mmHg to 130/85 mmHg), fasting blood sugar (from 150 mg/dL to 130 mg/dL), cholesterol levels (from 210 mg/dL to 180 mg/dL), and BMI (from 28.5 to 27.3), all with a statistical significance of $P < 0.01$. Participants reporting "Good" or "Very Good" health increased from 45% to 65%, and those reporting regular physical activity increased from 25% to 45% ($P < 0.05$). Hospitalizations/medical visits decreased from an average of 2.1–1.3 over 6 months ($P < 0.01$). The proportion of participants with awareness of their medication's side effects significantly increased from 30% before the health education program to 70% afterwards ($P < 0.001$). In addition, participants reporting adherence to dietary guidelines rose from 20% to 50% ($P < 0.01$). **Conclusion:** Health education appears to have a substantial positive impact on medication adherence, biometric health outcomes, and overall well-being in low-income neighborhoods. Structured health education interventions may play a pivotal role in improving community health.

Key words: Health education; Medication adherence; Biometric measures; Self-reported health status; Low-income neighborhoods

INTRODUCTION

Health-care disparities persist as one of the most challenging issues facing the medical community today. While medical advancements continue to evolve at an unprecedented rate, ensuring equitable access and understanding of these developments remain a hurdle, especially in low-income neighborhoods.[1,2] These disparities not only manifest in the

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form of limited access to health-care services but also in the understanding and management of individual health, which can lead to poor outcomes.[3]

Medication adherence, the extent to which a patient takes their medications as prescribed, serves as a pivotal aspect of managing chronic conditions.[4] Non-adherence can result from a myriad of reasons, including but not limited to, financial constraints, misunderstanding of the medication regimen, lack of perceived need, or concerns about potential side effects.[5] According to the World Health Organization, improving medication adherence may have a far greater impact on the health of a population than any improvement in specific medical treatments. Yet, in many low-income neighborhoods, adherence rates remain suboptimal, potentially exacerbating existing health disparities.

Concurrently, biometric measures, such as blood pressure, blood sugar levels, cholesterol, and body mass index (BMI), play a crucial role in determining an individual's overall health status and risk for various diseases. In underserved populations, these measures often tend to deviate from recommended levels due to factors such as poor diet, inadequate physical activity, limited health-care access, and insufficient health education.[6] The interconnectedness of these factors makes it imperative to address them holistically, especially in settings where socioeconomic constraints can magnify their impact.

Moreover, the importance of self-reported health status and its correlation with actual health outcomes cannot be understated. Often, how an individual perceives their health can guide their health behaviors, influencing decisions ranging from seeking medical advice to engaging in preventive health practices.[7] In low-income settings, where external barriers already hinder optimal health, a poor self-perception of health can further deter individuals from taking proactive steps to manage their well-being.

Acknowledging these challenges, health education emerges as a powerful tool to bridge the knowledge gap and empower individuals to take charge of their health. Comprehensive health education can demystify medical jargon, address misconceptions, and provide actionable steps for individuals to improve their health outcomes. By focusing on aspects such as medication adherence, understanding biometric outcomes, and improving self-perception of health, education can potentially act as a lever to uplift the overall health profile of an entire community.

Aim and objectives

The primary aim of this study is to investigate the impact of health education on individuals from low-income neighborhoods, specifically focusing on medication adherence and various health outcomes. The specific objectives encompass assessing changes in medication adherence using the Morisky Medication Adherence Scale (MMAS-8), evaluating shifts in biometric measures (blood pressure, fasting blood sugar, cholesterol levels, and BMI) before and after the intervention, understanding variations in self-reported health status and physical activity levels, examining differences in hospitalizations or medical visits over a 6-month period post-education, and assessing improvements in awareness of potential medication side effects and dietary habits.

MATERIALS AND METHODS

Study design

An observational study was carried out in economically disadvantaged communities with the objective of investigating the influence of health education on medication adherence and overall health outcomes. The study was conducted at the Government Medical College in Srikakulam, Andhra Pradesh, India, during the period from March 2021 to February 2022.

Participants

The study included 100 individuals aged 18–65 years, residing in low-income neighborhoods, and prescribed at least one chronic medication (e.g., for hypertension, diabetes). Participants were recruited through community health centers and outreach programs.

Sample size calculation

The sample size of 100 was derived from anticipated effect size, statistical power, and logistical factors.

We utilized the paired t-test sample size formula for our power analysis.

$$ n = \frac{\left(\left(Z\alpha / 2 + Z\beta \right)^2 \times 2 \times \sigma^2 \right)}{\delta 2} $$

This suggested that 100 participants would discern significant shifts in medication adherence and health outcomes, accounting for potential dropouts in this observational context.

Inclusion criteria

- Individuals aged between 18 and 65 years
- Residents of specified low-income neighborhoods in Srikakulam, Andhra Pradesh
- Currently prescribed at least one chronic medication for conditions such as hypertension or diabetes
- Ability to provide informed consent

- Availability to attend all sessions of the health education program
- Willingness to participate in follow-up assessments, including biometric measurements and interviews.

Exclusion criteria
- Individuals below 18 years or above 65 years of age
- Non-residents of the specified low-income neighborhoods
- Not prescribed any chronic medications
- Cognitive impairments or any condition that hinders comprehension of the educational content
- Severe medical or psychiatric conditions that could interfere with participation, such as terminal illnesses or severe uncontrolled mental disorders
- Currently participating in another clinical trial or interventional study that could influence medication adherence or health outcomes
- Previous attendance in a similar health education program within the past year.

Intervention
A comprehensive health education program was designed and delivered to the participants by trained health-care professionals. The education program consisted of interactive sessions focusing on the importance of medication adherence, potential side effects, dietary habits, physical activity, and self-care. The sessions were conducted in group settings and tailored to the participants' needs and comprehension levels.

Data collection
Medication adherence
Medication adherence was assessed using the MMAS-8 before and after the intervention. The MMAS-8 is an 8-item self-report questionnaire that measures medication adherence. Higher scores indicate better adherence.

Biometric health outcomes
Baseline biometric measurements were taken, including blood pressure (systolic and diastolic), fasting blood sugar levels, cholesterol levels, and BMI. These measurements were repeated after the completion of the education program to assess changes in health outcomes.

Self-reported health status
Participants' self-reported health status and physical activity levels were collected through structured interviews before and after the education program. Participants were asked to rate their health status on a categorical scale ("Poor," "Fair," "Good," "Very Good," or "Excellent") and report their frequency of physical activity.

Hospitalizations/medical visits
Medical records were reviewed to determine the number of hospitalizations and medical visits each participant had over a 6-month period following the education program.

Medication side effects awareness
Participants' awareness of potential medication side effects was assessed through structured interviews before and after the education program.

Dietary habits
Dietary habits were evaluated through self-reported dietary surveys before and after the education program to determine adherence to dietary guidelines.

Data analysis
Statistical analysis was performed using appropriate tests, including paired t-tests for continuous variables (e.g., MMAS-8 scores, biometric measurements), Chi-square tests for categorical variables (e.g., self-reported health status, physical activity), and Poisson regression for hospitalization and medical visit data. Statistical significance was set at $P<0.05$.

Ethical considerations
This study was approved by the Institutional Ethics Committee, Government Medical College, Srikakulam, Andhra Pradesh, India.

RESULTS

Medication adherence
The impact of the health education program on medication adherence was assessed using the MMAS-8. Pre-education, participants had a mean MMAS-8 score of 5.3, indicating suboptimal adherence. Following the education program, there was a significant improvement, with the mean MMAS-8 score increasing to 6.8 ($P<0.001$). This statistically significant improvement underscores the program's effectiveness in promoting better adherence to prescribed medications among participants (Table 1).

Biometric health outcomes
Biometric health outcomes, including blood pressure, fasting blood sugar levels, cholesterol levels, and BMI, exhibited positive changes following the intervention. Average blood pressure decreased from 145/90 mmHg to 130/85 mmHg ($P<0.01$), indicating improved

Table 1: Medication adherence

Parameter	Pre-education	Post-education	P-value
MMAS-8 mean score	5.3	6.8	<0.001

MMAS-8: Morisky medication adherence scale

cardiovascular health. Fasting blood sugar levels decreased from 150 mg/dL to 130 mg/dL (P<0.01), indicating better glycemic control. Cholesterol levels also improved significantly, declining from 210 mg/dL to 180 mg/dL (P<0.01). Furthermore, participants' BMI decreased from an average of 28.5–27.3 (P<0.01). These findings collectively suggest that the health education program had a substantial positive impact on various biometric health parameters, reducing the risk of chronic diseases (Table 2).

Self-reported health status and physical activity

Self-reported health status showed notable improvements. Before the intervention, 45% of participants reported "Good" or "Very Good" health. Post-education, this percentage increased to 65% (P<0.05). In addition, physical activity levels improved, with the percentage of participants engaging in regular physical activity increasing from 25% to 45% (P<0.05). These findings indicate enhanced self-perceived health and increased physical activity among participants, indicative of improved well-being and lifestyle (Table 3).

Hospitalizations and medical visits

A significant reduction in the average number of medical visits or hospitalizations over a 6-month period was observed post-education. Participants experienced an average of 2.1 medical visits or hospitalizations before the intervention, which decreased to 1.3 post-education (P<0.01). This reduction in health-care utilization suggests improved health outcomes and better management of chronic conditions among participants (Table 4).

Medication side effects awareness

Awareness of potential medication side effects significantly increased following the educational program. Before the intervention, 30% of participants were aware of potential

side effects. Post-education, this percentage more than doubled to 70% (P<0.001). This finding highlights the program's effectiveness in enhancing participants' understanding of medication-related risks and benefits (Table 5).

Dietary habits

Dietary habits also showed marked improvement. The percentage of participants reporting the consumption of a balanced diet as per dietary guidelines increased from 20% to 50% post-education (P<0.01). This underscores the positive influence of the education program on participants' dietary choices, potentially leading to better overall health (Table 6).

DISCUSSION

The findings of this study, which reveal significant improvements in medication adherence, biometric health outcomes, self-reported health status, health-care utilization, awareness of medication side effects, and dietary habits following a comprehensive health education program in low-income neighborhoods, are in line with previous research in the field. The effectiveness of such tailored health education interventions can be further understood and contextualized by referencing relevant studies:

Medication adherence

Our study demonstrated a substantial enhancement in medication adherence, corroborating the findings of earlier research (Kalantzi et al.,[8] Jankowska-Polańska et al.[9]). The increase in MMAS-8 scores from 5.3 to 6.8 post-education

Table 2: Biometric health outcomes

Parameter	Pre-education	Post-education	P-value
Blood pressure (mmHg)	145/90	130/85	<0.01
Fasting blood sugar (mg/dL)	150	130	<0.01
Cholesterol level (mg/dL)	210	180	<0.01
Body mass index	28.5	27.3	<0.01

Table 3: Self-reported health status

Parameter	Pre-education (%)	Post-education (%)	P-value
"Good" or "Very Good" health	45	65	<0.05
Regular physical activity	25	45	<0.05

Table 4: Hospitalizations/medical visits

Parameter	Pre-education	Post-education	P-value
Average medical visits/ hospitalizations over 6 months	2.1	1.3	<0.01

Table 5: Medication side effects awareness

Parameter	Pre-education (%)	Post-education (%)	P-value
Aware of potential medication side effects	30	70	<0.001

Table 6: Dietary habits

Parameter	Pre-education (%)	Post-education (%)	P-value
Consuming a balanced diet	20	50	<0.01

aligns with the outcomes of interventions emphasizing health education's role in improving adherence (Kalantzi et al.[8]). This consistency underscores the robustness of health education programs in promoting better adherence across diverse patient populations.

Biometric health outcomes

The positive changes in biometric health outcomes, including reductions in blood pressure, fasting blood sugar, cholesterol levels, and BMI, are consistent with prior research (Kalantzi et al.;[8] Gagnon et al.[10]) The observed improvements in blood pressure, glycemic control, and cholesterol levels align with findings from studies emphasizing the impact of health education in reducing cardiovascular risk factors (Kalantzi et al.[8]) The parallel reduction in BMI mirrors the outcomes of interventions focused on lifestyle modifications.

Self-reported health status and physical activity

The augmented self-reported health status and increased engagement in regular physical activity post-education are in harmony with previous investigations (Kalantzi et al.;[8] Fernandez-Lazaro et al.[11]). The rise in self-perceived health status and physical activity levels corresponds with studies[12] demonstrating health education's ability to motivate individuals to adopt healthier behaviors (Kalantzi et al.[8]). The congruence in findings highlights the multifaceted benefits of health education in enhancing overall well-being and lifestyle.

Hospitalizations and medical visits

The reduction in hospitalizations and medical visits post-education aligns with prior studies (Kalantzi et al.;[8] Fernandez-Lazaro et al.[11]). This decline in health-care utilization supports the notion of improved chronic disease management and reduced health-care costs, as seen in similar interventions (Kalantzi et al.[8]). The parallelism in outcomes underscores the potential of health education to optimize health-care resource allocation.

Medication side effects awareness

The significant increase in awareness of potential medication side effects, as observed in our study, is in line with the findings of previous research (Zhang et al.;[13] Ran et al.[14]). The enhanced understanding of medication-related risks and benefits aligns with the outcomes of interventions aimed at improving patient knowledge (Zhang et al.[13]). Improved medication awareness is vital as it empowers individuals to make informed decisions about their treatment, ultimately leading to enhanced treatment adherence (Kalantzi et al.;[8] Zhang et al.;[13] Ran et al.[14]).

Dietary habits

The improvements in dietary habits, particularly the increased consumption of a balanced diet, are consistent with prior investigations (Bazrafkan et al.;[15] Kalantzi et al.[8]). The observed changes in dietary choices are in harmony with studies emphasizing health education's potential to promote healthier eating behaviors (Kalantzi et al.,[8] 2023; Bazrafkan et al.[15]). These findings underscore the pivotal role of health education in facilitating dietary modifications and enhancing overall health.

In addition, it is noteworthy that health literacy has been recognized as a critical factor influencing medication adherence and health-related knowledge (Ran et al.;[14] Lor et al.[16]). Further research in this area has highlighted the importance of addressing health literacy as a part of comprehensive health education interventions, as it can play a substantial role in improving patient understanding of their medications and overall health management.

Limitations of the study

A small sample size and lack of control group, which may limit generalizability. Self-reported measures could introduce bias. Short-term follow-up may not reflect long-term adherence or outcomes. The study's observational design cannot establish causality between education and health improvements.

CONCLUSION

Our study demonstrates the significant positive impact of a tailored health education program on medication adherence, biometric health outcomes, self-reported health status, health-care utilization, medication side effects awareness, and dietary habits among individuals in low-income neighborhoods. These findings underscore the potential of comprehensive health education to improve the health and well-being of underserved communities.

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