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Effect of family history on the incidence of hypertension in the pre-elderly

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ABSTRACT

Introduction: Hypertension is a significant public health issue, particularly in pre-elderly populations, and can lead to various chronic diseases if not properly managed. This study aims to investigate the effect of family history on the incidence of hypertension in the pre-elderly population.

Method: A quantitative research design with a case-control approach was employed, involving 42 respondents (21 cases and 21 controls). Data were collected using a questionnaire and analyzed with the Chi-square test.

Results: The findings revealed a significant association between family history and the occurrence of hypertension in the pre-elderly, with a p-value of 0.000. Conversely, no significant relationship was found between physical activity and hypertension incidence (p-value = 0.634).

Conclusion: The study concludes that family history is a significant risk factor for hypertension in the pre-elderly. At the same time, physical activity does not appear to influence the condition in this group. Regular monitoring and management of blood pressure, particularly for those with a family history of hypertension, are crucial for preventing the development of hypertension in the pre-elderly population.

Keywords: Family History; Hypertension; Pre-Elderly; Risk Factors.

INTRODUCTION

Hypertension, commonly known as high blood pressure, is a primary global health concern and one of the leading risk factors for cardiovascular diseases (Li *et al.*, 2024). It is often referred to as the "silent killer" because it typically has no noticeable symptoms until it causes significant damage to vital organs, including the heart, kidneys, and brain. According to the World Health Organization (WHO), over 1.5 billion people are projected to be living with hypertension by 2025, which highlights the magnitude of this public health issue. The rise in hypertension cases, especially among the pre-elderly population, has become a significant challenge in both developed and developing countries, including Indonesia (Hijrah *et al.*, 2025).

In Indonesia, hypertension remains a prevalent condition across various age groups, with a notable increase in cases among individuals aged 46-59 years, often categorized as pre-elderly (Brandão *et al.*, 2024). The pre-elderly group, defined as individuals between the ages of 46 and 59 years, is particularly vulnerable as they are in the transitional stage between middle age and the elderly phase, where the risk for various chronic diseases, including hypertension, significantly increases (Lin *et al.*, 2024). Recent data from the Ministry of Health in Indonesia shows a rising trend in the number of hypertension cases among this group. In 2021, the prevalence of hypertension in pre-elderly populations in some regions showed notable increases, with hypertension emerging as one of the most common non-communicable diseases affecting the population (Q. Yu *et al.*, 2024).

Hypertension is a complex disease with multiple contributing factors. Family history has been identified as a crucial determinant (Grasso *et al.*, 2024). The influence of genetic predisposition on hypertension is well-documented, with studies indicating that individuals with a family history of hypertension are at a significantly higher risk of developing the condition (Y. Yu *et al.*, 2024). Genetics contribute to factors such as the regulation of blood pressure, kidney function, and vascular health. Family history is considered a non-modifiable risk factor, meaning individuals cannot change this factor. However, its influence can be mitigated through lifestyle modifications and regular monitoring of health parameters (Chen *et al.*, 2024).

In addition to genetic predisposition, lifestyle factors, including physical activity, play a significant role in the development and management of hypertension. Regular physical activity has long been recognized as a preventive measure for hypertension. It helps regulate blood pressure by improving cardiovascular health, reducing arterial stiffness, and promoting better blood circulation. Moreover, physical activity has positive effects on weight management, which is crucial because obesity is another significant risk factor for hypertension. Despite these benefits, physical activity levels decrease as individuals age, particularly among the pre-elderly population. This reduction in physical activity often leads to weight gain, insulin resistance, and an increased risk of developing hypertension and other chronic conditions (Kim and Thiruvengadam, 2024).

In recent years, several public health initiatives and educational programs have been introduced to raise awareness about hypertension in Indonesia. These programs aim to inform the public about the risks associated with hypertension and encourage regular check-ups, especially for individuals with risk factors such as family history and unhealthy lifestyle habits (Linggi *et al.*, 2024). Moreover, the government and healthcare institutions are working to improve access to healthcare services, ensuring that individuals receive timely diagnosis and appropriate treatment for hypertension. Where

the prevalence of hypertension in the pre-elderly population has been rising, understanding the role of family history and physical activity in the development of hypertension is crucial (Zhang, Wang and Guo, 2024). This knowledge can inform local health policies, tailor interventions for the pre-elderly group, and promote health programs encouraging blood pressure monitoring and lifestyle changes. Moreover, it is essential to assess whether family history alone is a significant predictor of hypertension in this population or whether other factors, such as physical activity and dietary habits, contribute more significantly to the risk. This study aims to explore the relationship between family history and physical activity with the incidence of hypertension in the pre-elderly population. By examining these factors, this research aims to provide valuable insights into the health challenges the pre-elderly population faces and offer recommendations for improving hypertension prevention and management strategies in this group.

METHODOLOGY

Research Design

This study employed a case-control design, which is commonly used to identify and analyze the factors associated with the incidence of a disease or condition. The case-control design is particularly effective for studying rare conditions, such as hypertension in pre-elderly populations, as it allows for comparing individuals with and without the condition to identify factors that may increase the risk of developing the disease. In this study, Cases refer to individuals diagnosed with hypertension. Controls are individuals who do not have hypertension but are matched with the case group based on specific demographic variables such as age and sex. This design was chosen to assess whether there is a significant relationship between family history and physical activity in the development of hypertension in the pre-elderly population.

Population and Sample

The target population for this study was the pre-elderly individuals (aged 46-59 years) residing in Mojopurno Village, Madiun Regency. This age group was selected because they are in a critical phase where the risk of developing hypertension increases significantly due to the natural ageing process and the cumulative effects of lifestyle factors. Additionally, hypertension is commonly diagnosed in this age group, making them an ideal population for the study. The sample consisted of 42 respondents, which was divided into two groups: 21 case respondents: Individuals diagnosed with hypertension based on medical records or clinical diagnosis by healthcare professionals. 21 control respondents: Individuals who were age- and sex-matched with the cases but had normal blood pressure (below 140/90 mmHg) as confirmed through a clinical examination. The inclusion criteria for the study were as follows: Individuals aged 46 to 59 years. Residents of Mojopurno Village. Individuals who were willing to participate and provide informed consent. The exclusion criteria were Individuals with a known history of secondary hypertension due to other medical conditions (e.g., kidney disease)—pregnant women, or individuals who were unable to participate due to severe health issues. A non-probability purposive sampling technique was used to select participants, ensuring that individuals who met the inclusion criteria were selected for the study.

Variables

The study included both independent and dependent variables:

Independent Variables: Family History of Hypertension: This variable was categorized as either "yes" (having a first-degree relative with hypertension) or "no" (no known family history of hypertension). Physical Activity: This variable was measured based on the level of physical activity using a questionnaire. Respondents were asked about the frequency and intensity of physical activity over the past month. Based on their responses, physical activity was categorized as "Good" (engaging in moderate to vigorous physical activity at least 3 times per week for 30 minutes or more). "Poor" (engaging in low physical activity or not exercising regularly).

Dependent Variable: Hypertension: Hypertension was defined as having a systolic blood pressure of 140 mmHg or higher or a diastolic blood pressure of 90 mmHg or higher, per the World Health Organization (WHO) guidelines. Blood pressure was measured using a validated automated sphygmomanometer.

Data Collection

Data were collected from June 2024 to July 2024. The following methods were used for data collection: A structured questionnaire was developed to assess the participant's family history of hypertension and their level of physical activity. The questionnaire included both closed-ended and open-ended questions. The family history section asked about hypertension in immediate family members (parents or siblings). The physical activity section assessed the frequency, intensity, and duration of physical activities such as walking, jogging, cycling, and other aerobic exercises. Trained enumerators administered the questionnaire face-to-face to ensure clarity and accuracy. Blood Pressure Measurement: Blood pressure measurements were taken using a validated automated sphygmomanometer (Omron HEM-907, for example) after participants had rested for at least 5 minutes. Blood pressure was measured twice, and the average value was recorded to ensure accuracy. Participants who had readings of 140/90 mmHg or higher were classified as having hypertension. Informed Consent: Before data collection, all participants were informed about the purpose of the study, the procedures involved, and the voluntary nature of participation. Written informed consent was obtained from each participant.

Data Analysis

Data analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 25 to ensure the accuracy and reliability of the results. The following statistical techniques were used: Univariate Analysis: Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to summarize the demographic characteristics of the respondents, including age, gender, and family history of hypertension. This analysis provided an overview of the study population. Bivariate Analysis: A Chi-square test was used to examine the relationship between the independent variables (family history of hypertension and physical activity) and the dependent variable (hypertension). This test assessed whether there was a statistically significant difference between the case and control groups regarding the prevalence of family history and physical activity levels. Odds Ratio (OR): To quantify the strength of the association between family history and physical activity with hypertension, the odds ratio (OR) and its corresponding 95% confidence interval (CI) were calculated. The OR indicates the odds of hypertension occurring in individuals with a family history or poor physical activity compared to those without these risk factors. Significance Level: A p-value of less than 0.05 was considered statistically significant, indicating a meaningful relationship between the variables.

RESULT

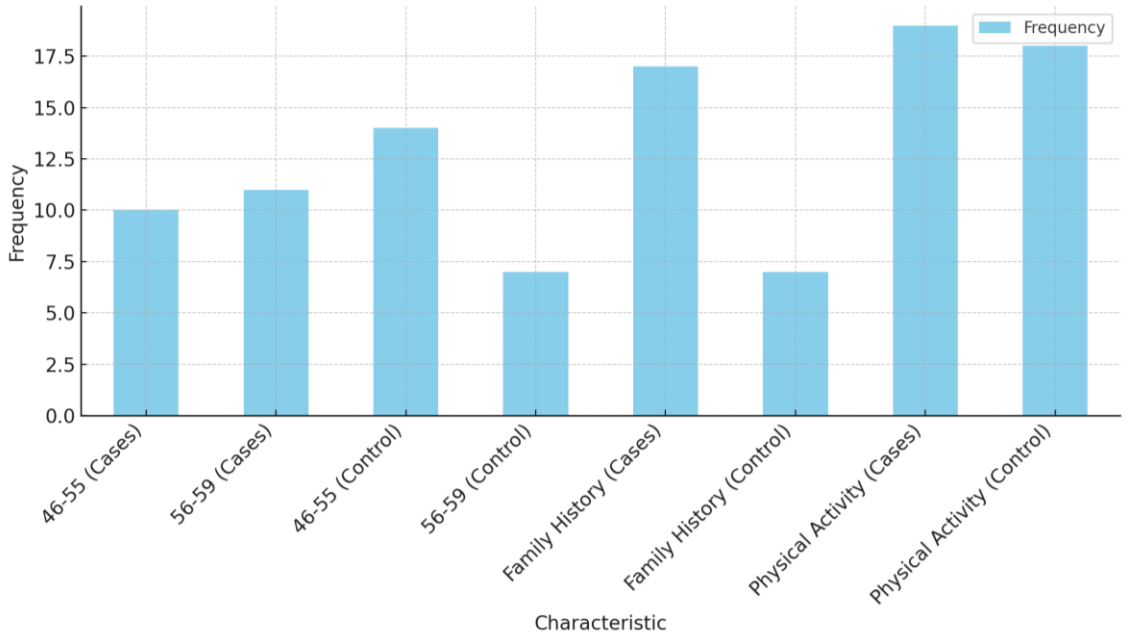

Chart 1. Distribution of Respondents by Age Group, Family History, and Physical Activity

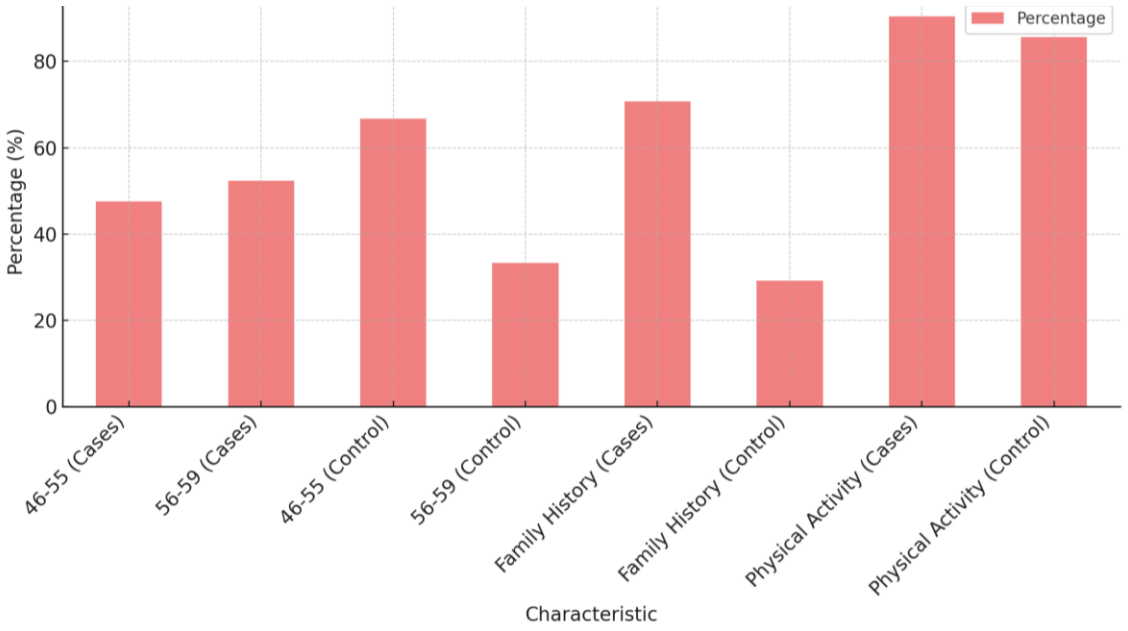

Chart 2. Distribution of Respondents by Age Group, Family History, and Physical Activity (Percentage)

Frequency Distribution: This chart shows the frequency of respondents based on age group, family history, and physical activity. Percentage Distribution: This chart presents the percentage of respondents in each category (age group, family history, and physical activity).

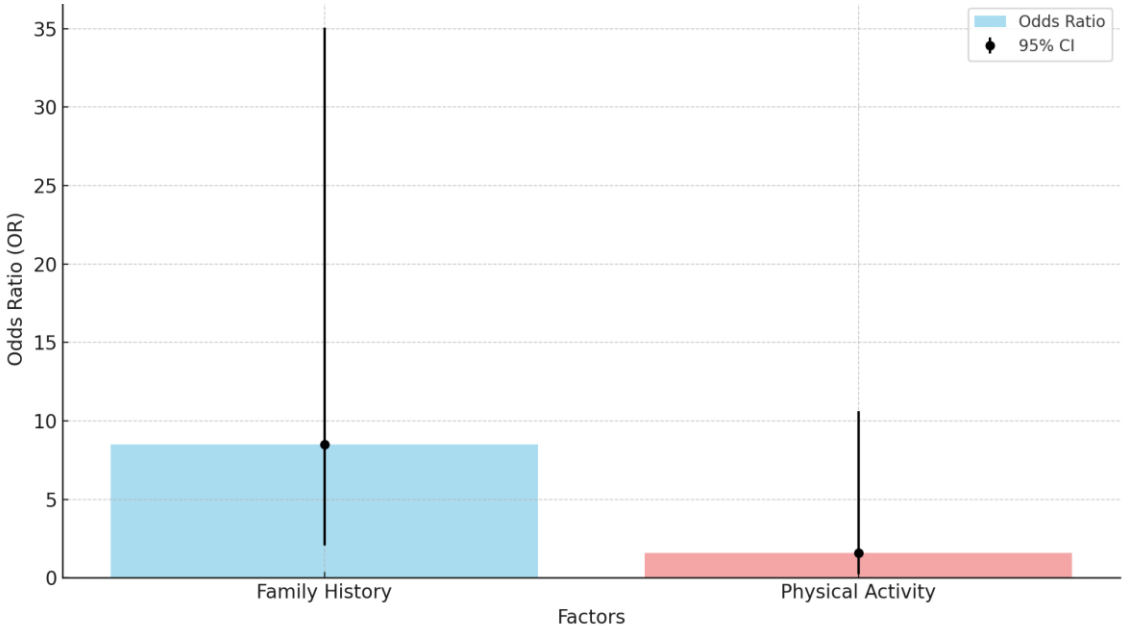

Chart 3. Odds Ratios and 95% Confidence Intervals for Family History and Physical Activity

Here is the bar chart showing the Odds Ratios and 95% Confidence Intervals (CIs) for Family History and Physical Activity related to hypertension. The blue bar represents the Odds Ratio (OR). The black error bars indicate each factor's 95% Confidence Interval (CI). As you can see, the Family History factor has a much higher OR and a narrower CI, suggesting a strong and statistically significant relationship with hypertension. In contrast, Physical Activity shows a lower OR and a wider CI, indicating that the relationship is not statistically significant.

Based on the results of Chi-square and Odds Ratio (OR) analysis conducted on family history factors and physical activity on the incidence of hypertension in the pre-elderly population, the following can be concluded: Family History and Hypertension: There is a significant relationship between family history and the incidence of hypertension in the pre-elderly. This is evidenced by the value of $p = 0.005$, which is smaller than the significance limit ($p < 0.05$), as well as the Odds Ratio (OR) value = 8.5, which indicates that individuals with a family history of hypertension have an 8.5 times greater chance of developing hypertension compared to those without a family history of hypertension. The 95% confidence interval (CI) for the Odds Ratio (2.06 – 35.08) does not include the number 1, confirming that this relationship is statistically significant. Therefore, family history is a substantial risk factor in the incidence of hypertension in this group. Physical Activity and Hypertension: No significant association was found between physical activity and the incidence of hypertension in the pre-elderly. A $p = 1.0$ value ($p > 0.05$) showed that the difference between the physically active and less physically active groups was not related to the incidence of hypertension in this group. Odds Ratio (OR) = 1.58 indicates that people with low levels of physical activity are 1.58 times more likely to develop hypertension. However, this figure is not statistically significant, as a 95% CI (0.24 - 10.61) includes a figure of 1, which indicates uncertainty in this association.

DISCUSSION

Hypertension is a significant public health challenge worldwide, particularly as it affects a large portion of the adult population. It is a considerable risk factor for cardiovascular diseases, stroke, kidney failure, and other severe health conditions. Hypertension is often referred to as a "silent killer" because it usually does not present symptoms until it leads to severe complications. Its increasing prevalence among the pre-elderly population, particularly in rural areas such as Mojopurno Village in Madiun Regency, Indonesia, has raised concerns regarding early intervention and preventative strategies. This study aimed to explore the relationship between family history and physical activity with the incidence of hypertension among the pre-elderly population. The results revealed a significant association between family history and hypertension, while physical activity did not significantly impact this population's hypertension (Syaharuddin *et al.*, 2024).

Family History as a Risk Factor for Hypertension. The findings from this study suggest that family history of hypertension is a strong predictor of hypertension among the pre-elderly population. The Chi-square test revealed a statistically significant association between family history and the incidence of hypertension ($p = 0.005$), with an odds ratio (OR) of 8.5. This means that individuals with a family history of hypertension are 8.5 times more likely to develop hypertension compared to those without a family history of the condition. The 95% confidence interval (CI) for the odds ratio ranged from 2.06 to 35.08, further supporting the significance of this association.

The role of genetics in hypertension has been widely studied and documented in medical literature. Numerous studies have shown that genetic predisposition significantly contributes to the development of hypertension, particularly in individuals who have close family members with a history of the condition (Ocrospoma and Restrepo, 2024). Hypertension is influenced by genetic factors that affect various physiological processes, including blood pressure regulation, kidney function, and vascular health. Genetic mutations affecting the renin-angiotensin-aldosterone system (RAAS) and other blood pressure-regulating mechanisms are often passed down through generations (Zheng *et al.*, 2024). Furthermore, individuals with a family history of hypertension tend to have a similar set of risk factors, including an increased tendency to develop conditions such as arterial stiffness, increased salt sensitivity, and dysfunction in the autonomic nervous system, which all contribute to higher blood pressure levels (Suprapto and Salah Jalal, 2024). Where hypertension prevalence among the pre-elderly population is on the rise, the findings suggest that monitoring and early intervention, especially for those with a family history of hypertension, could play a crucial role in preventing the condition. Family history is a strong warning signal, indicating the need for routine blood pressure checks and lifestyle modifications to mitigate the risks (Huo *et al.*, 2024).

Physical Activity and Hypertension. On the other hand, physical activity did not show a statistically significant effect on the incidence of hypertension among the pre-elderly population in this study. The Chi-square test yielded a p-value of 1.0, indicating no significant association between physical activity and hypertension in the sample. The odds ratio for physical activity was 1.58, suggesting that individuals with poor physical activity levels were 1.58 times more likely to develop hypertension compared to those with good physical activity. However, this result is not statistically significant as the 95% confidence interval for the odds ratio ranged from 0.24 to 10.61, crossing the value of 1.

The findings of this study contrast with existing research that generally emphasizes the importance of regular physical activity in preventing and managing hypertension (Fujita *et al.*, 2025). Numerous studies have documented that regular physical activity, particularly aerobic exercise, helps lower blood pressure by improving vascular function, reducing arterial stiffness, and enhancing cardiovascular health. Found that moderate to vigorous physical activity can reduce systolic blood pressure by 4-9 mmHg in individuals with hypertension. Furthermore, physical activity is associated with improvements in weight management, which is another key factor in controlling blood pressure (Hsu *et al.*, 2025).

However, this study's lack of significant findings may be due to several factors. First, this study's measurement of physical activity was based on self-reported data, which can introduce recall and reporting biases. Individuals may not accurately report their physical activity frequency, duration, and intensity, leading to misclassifying their physical activity levels. Additionally, the sample size of 42 respondents is relatively small, which may limit the power of the study to detect a significant relationship between physical activity and hypertension. Larger sample sizes and more objective measures of physical activity, such as wearable fitness trackers or activity logs, could provide more accurate results (Cao *et al.*, 2025).

Furthermore, it is essential to consider that physical activity is just one of many factors influencing blood pressure. Other lifestyle factors, such as dietary habits, stress levels, sleep quality, and alcohol consumption, also play a role in hypertension (Fang *et al.*, 2025). It is possible that the combined effects of these factors, rather than physical activity alone, contribute more significantly to the incidence of hypertension in the pre-elderly population (Lu *et al.*, 2025).

Comparing the Findings to Existing Literature. The results of this study are consistent with previous research showing that family history is a critical risk factor for the development of hypertension. Individuals with a family history of hypertension were significantly more likely to experience high blood pressure, echoing the findings of this study (Liu *et al.*, 2025). Genetic factors play a central role in the occurrence of hypertension, with individuals from hypertensive families being at a substantially higher risk (Gao *et al.*, 2025). However, the relationship between physical activity and hypertension has been more contentious in some studies. While most research supports the beneficial effects of exercise on blood pressure, some studies have reported insignificant findings or conflicting results (Susilawati *et al.*, 2025). For example, physical activity was not strongly associated with hypertension in their sample of office workers, which is somewhat similar to the findings of this study. This highlights the complexity of the relationship between physical activity and hypertension, suggesting that other mediating factors, such as diet, stress, and genetics, might also play a significant role (Wang *et al.*, 2025).

The findings of this study have several important implications for public health, particularly in rural areas such as. Given the strong association between family history and hypertension, healthcare providers should prioritize screening and early intervention for individuals with a family history of hypertension. Routine blood pressure monitoring, along with educational programs on lifestyle modifications, should be implemented to reduce the risk of hypertension in high-risk individuals. Furthermore, although the study did not find a statistically significant association between physical activity and hypertension, promoting physical activity remains a key strategy for improving overall

health. Public health campaigns should encourage regular exercise as part of a broader strategy to prevent hypertension and improve cardiovascular health, especially in older adults. Future research should explore the combined effects of multiple risk factors, including family history, physical activity, diet, and other lifestyle factors, on hypertension. A larger, more diverse sample, coupled with objective measurements of physical activity, could provide more robust and generalizable results. Additionally, longitudinal studies are needed to examine causal relationships between physical activity and hypertension rather than the cross-sectional design used in this study.

CONCLUSION

This study highlights the importance of family history in the development of hypertension in the pre-elderly population. While physical activity did not significantly affect hypertension in this group, it remains an essential factor for overall health improvement. Future interventions should focus on regular blood pressure monitoring, particularly for individuals with a family history of hypertension, and continue to promote physical activity as part of a healthy lifestyle. Further research with larger sample sizes and more comprehensive risk factor measurements is needed to understand better the complex relationships between lifestyle, genetics, and hypertension.

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Conflict of Interest

There are no potential conflicts of interest relevant to this article.

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