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Original Article

Physical Activity among Adolescents in Urban and Rural Areas in South Sulawesi, Indonesia: Exploring the Influence of Environmental Factors

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Abstract

Background: Neighbourhood environments play an important role in shaping adolescents' physical activity (PA), yet environmental influences differ between urban and rural settings. Understanding these contextual differences is essential for developing effective strategies to promote PA among adolescents.

Aim: This study aimed to explore environmental determinants influencing adolescents' participation in physical activity in urban and rural areas.

Method: A qualitative study was conducted using a snowball sampling technique. Twenty adolescents aged 13–15 years participated in offline and online semi-structured interviews comprising 17 questions. The photovoice method was used to support data collection. All interviews were analysed thematically using NVivo 12 software.

Results: Rural adolescents reported access to natural environments such as hills and small forests; however, limited awareness, poor management, inadequate infrastructure, long distances, road safety issues, and a lack of recreational facilities restricted their use for PA. Urban adolescents had access to safe, clean, and diverse sports facilities but often engaged in sedentary behaviours, particularly excessive use of smartphones and tablets during leisure time.

Conclusion:

Targeted health promotion and PA education programmes are needed, particularly in urban areas, to reduce sedentary behaviour. In rural settings, improving basic infrastructure and optimising natural resources may provide cost-effective and sustainable approaches to promote adolescent physical activity.

Keywords: *adolescents; physical activity; environmental factors; urban and rural; qualitative research.*

INTRODUCTION

The World Health Organisation reports that inadequate or insufficient physical activity is the fourth leading risk factor for death and disability. It can be estimated that 6% of total deaths or about 3.2 million deaths each year, can be attributed to lack of physical activity [1]. In addition, there is a myriad of evidence that physical inactivity is an important contributor to non-communicable diseases (NCDs) such as; heart disease, hypertension, cancer, diabetes, and osteoporosis [2]. This is not only a big problem in developed countries but also a big problem in developing countries, including Indonesia [3], [4]. In Indonesia, the prevalence of death due to NCDs increased rapidly from 41.7% in 1995 to 59.5% in 2007 [5]. In addition, the number of

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obesity cases increases from year to year, especially in adolescents aged 13-15 years, showing a significant increase from 1.4% in 2010 to 7.3% in 2013 and increasing to 16% in 2017 [5].

Insufficient levels of physical activity in adolescents can create behavioural patterns, which will directly affect the health of adolescents and increase the risk of suffering from chronic diseases in adulthood. Thus, initiatives to promote the habit of regular physical activity or exercise in children and adolescents have become the main focus of preventing illness and improving public health [6].

Globally more than 80% of the world's youth population is physically inactive [7]. In particular, Indonesia ranks fifth with the highest prevalence of physical inactivity among ASEAN countries [8]. The latest data shows an increase in the proportion of less activity in adolescents aged > 10 years, from 26.1% in 2013 to 33.6% in 2018 [5]. For activities of sitting or lying down (sedentary behavior), the latest research reports that Indonesian teenagers spend >8 hours of their free time with relaxed behavior, tend to be silent or carry out activities in a sitting or lying state such as watching television, playing PlayStation or games from a tablet or mobile phone [9].

PA consists of many structured and unstructured forms, including organized sport, recreational activities, motor skill development programs, dance, active transportation such as walking and biking, and work related [10]. Many factors affect the physical activity of adolescents [11]. In addition to cognitive factors, physical environmental factors are also known to be very significant in influencing the physical activity of adolescents [12]. Therefore, inactive habits will be very difficult to change, especially for teenagers who are left in an environment that does not support behavioral changes [13]. From the existing literature, it is reported that some obstacles or limitations of the surrounding physical environment can affect the physical activity of adolescents, including problems with the availability of sports or playing facilities [14], pedestrian walkway, field and environmental hygiene issues [15].

Furthermore, when discussing the influence of the environment on physical activity in adolescents, of course, the physical environment between urban and rural areas will have different effects [16], [17], [18], [19]. A study on adolescents in Portugal found that adolescents in urban areas were more active than adolescents in rural areas [16], [19]. Meanwhile, other literature reports that adolescents in rural areas are more active than adolescents who are left in urban areas [17], [19]. This difference is influenced by various factors in the surrounding physical environment, namely, access, security, availability of play and exercise facilities, green open space, and community. However, these factors have different effects on adolescents in rural and urban areas [2], [19], [20], [21]. This background and the results of previous studies related to physical activity in adolescents in urban and rural areas still produce results that are not firm (equivocal findings).

Meanwhile, in Indonesia, the latest data on physical activity among adolescents is very limited. This has led to the neglect of the problem of lack of physical activity in children and adolescents by policymakers and the public. As a result, intervention programs are very limited in targeting the issue of physical activity in Indonesia. Therefore, with this study, the researcher hopes to be able to understand the perspective of physical activity in this specific population, which is an attempt to prepare effective and efficient physical environmental interventions.

Furthermore, to the best of our knowledge, there are very limited studies that consider and discuss the influence of the physical environment on physical activity habits in adolescents in urban and rural areas. Adolescents in urban and rural areas face different obstacles or problems (unique) in terms of how the surrounding environment can affect their physical activity habits. In addition, research related to the influence of the physical environment on the physical

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activity of adolescents is dominated by survey or cross-sectional research, which causes a lot of information that is not explored or obtained. Therefore, this qualitative research will provide updates on deeper information related to the influence of the physical environment on the physical activity of adolescents. This study aims to explore the influence of the physical environment on the participation of adolescents' physical activity in urban and rural areas.

METHODS

Study Design and subjects

This is qualitative research with a *phenomenological approach* with photovoice and interview methods to directly involve adolescents in expressing and explaining their experiences and views regarding the surrounding environment on their physical activities. This research was conducted in two different locations that can represent urban and rural districts in Sulawesi Island, Indonesia. First location is in Makassar City (SMP. Athira Bukit Baruga) and rural area in Manuju Village Gowa District (SMP 01 Manuju).

Students were purposively recruited from an urban area in Makassar City and rural in Gowa District in South Sulawesi, Indonesia by the physical activity (PA) teacher. The sample in this study were teenagers aged 13-15 years who were taking grades 8-9 in junior high school (SMP) or equivalent. A total of 20 students participated 10 from urban (5 male, 5 female) and 10 from rural (8 female, 2 male).

Interview

Interviews were conducted before the photovoice method was carried out/taking pictures of the surrounding environment. Meanwhile, for the interview, the researcher used an interview guide consisting of five-item topic questions and each topic had a different number of questions; The concept and meaning of physical activity (3 questions), duration of physical activity (3 questions), the structure of the surrounding environment/facilities supporting physical activity (3 questions), What are the environmental factors (e.g., facilities/activities/people) that influence you to carry out activities physical? (7 questions), and Improvement or improvement (1 question). This list of questions refers to the interview guideline by Saimon [21]. See **Table 1.**

Table 1. ***Interview Checklist***

Item	Question
Concept and meaning of physical activity (PA)	What does physical activity mean to you?
Types of PA engaged	What type(s) of PA do you do during non-school time/free time to keep you healthy?
Duration of PA	Do you think you have enough physical activity? How often you do engage in physical activity? How often do you think adolescents like you should engage in physical activity?
Neighborhood structure/facilities to support physical activity	In your neighborhood, where do you go to be active and healthy?

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	Do you have places to engage in physical activity in your neighborhood? How do you get to these places?
What kind of neighborhood factors (facilities/ events/people influence adolescent PA? (SHOWed method)	You have taken photos around your neighborhood. Tell us more about the photos; What do you see here? Why did you take this photograph? What do you like/dislike about these places? What is happening here? How does this relate to or affect Our PA? Why does this situation/concern exist? What can we Do about it?
Improvement	What are the improvements to be made in the neighborhood to help you become more active?

Photovoice

With the photovoice method, researchers provided a camera or cellphone with a camera. Before photo-taking, facilitators explained how to use a camera or cellphone, photography techniques, photography ethics, and exhibit photos (photo cataloging). The procedures were photos (taking), choose (select), conceptualize (contextualizing) and (codifying activities), or code their activities [21].

Photo taking: using a digital camera or cellphone with a camera, each student takes 10-20 photos of the physical environment around the place of residence, which teenagers feel (perceived) to influence their physical activity or desire to play outside the home for the next two weeks. They conducted this activity in their free time and they wrote a diary about the reasons why they took each picture. *Selecting:* students select 10 photos that best reflect the influence of their surroundings on their outdoor activities. *Contextualizing:* The trained facilitator conducted 2 focus group discussions to listen, understand and describe the experiences of the participants and the reasons why they chose the photo. An interview guide, including 5 question items (SHOWeD methods), was used to guide the interview (see the Appendix). *Codifying:* The facilitator gives instructions to each group to code and summarize. Based on the group's agreement regarding the theme or issue/problem obtained from the picture.

Data Analysis

The data through the analysis processes by the trained bilingual researchers and two graduate research assistants to transcribed and translated the audio-taped to produce the English transcript. The processes of transcribing and checking, researchers listening and reading existing data (reading between the lines), coding data based on the identification of topics, problems, similarities and differences in information (coding), collecting all existing information based on the same theme (theming) based on the theoretical framework of this research. This data analysis process will be carried out using *NVivo* software.

Researchers, facilitators, and all informants discussed, coded, and grouped images based on existing themes for checking the reality (actual conditions) between one participant with

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another participant. Interpretive validity of the research results will be ensured to obtain validation by research participants.

Ethical Clearance

The researcher gave informed consent to the parents or guardians of all students before collecting the data. Supervision from adults or facilitators was carried out to ensure the safety of students when taking photos. This research is authorized by the institution Ethics Commission of the Indonesian Muslim University.

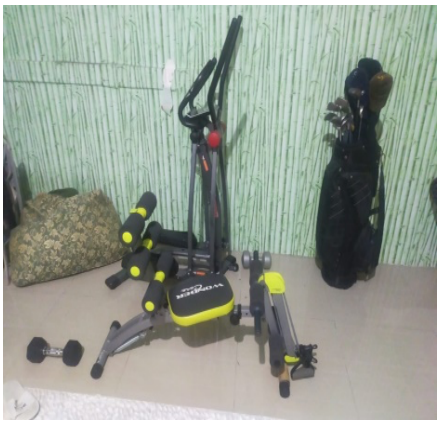
RESULTS

Participants from an urban area in this study determined "physical activity (PA)" as sports activities outdoor such as bicycling, aerobic, badminton, and jogging, as well as indoor sports with sports equipment such as the treadmill. While, youth in a rural area defined PA as sports activities or outdoor games and some activities inside the home such as mopping, sweeping, washing clothes, and cleaning the house. These definitions have limited uptake of PA (<60 minutes a day). The majority of boys in the urban area preferred bicycling, while females like to do jogging. Meanwhile, in rural areas, the boys are more likely to play football and sepaktakraw, and girls preferred to bicycling, badminton, as well as playing hide and seek.

However, most of the participants in the urban area reported that playing with a gadget such as a smartphone or a tablet and as their regular activity in their leisure time. While adolescents in the rural area mentioned that going out with friends and motorcycling as their regular activities.

Environmental Factors and Physical Activity in The Urban Area

Sports facilities inside the house



Nq, 13 yo "My parents have these sports types of equipment. Sometimes I use this for being physically active inside the home"

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Ab, 13 yo "I like to play inside the home with this sports equipment"

Sport facilities outdoor the house

Cal, 14 yo "this is tennis and badminton field near form my house. I feel comfortable and safe to play sport here"

Ns, 14 yo "close to my house there is a tennis field, I like to do sport here because it is so clement, with fresh air"

Ns, 14 yo "the field is so green, wide enough, and safe. I like to play here"

Mni 13 yo "this is beside my home, I always play table tennis, badminton with my family"

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Comfortable and Cleanliness of the neighborhood environment

Mni, 13 yo"this is the road around my neighborhood, I go jogging with my family here"

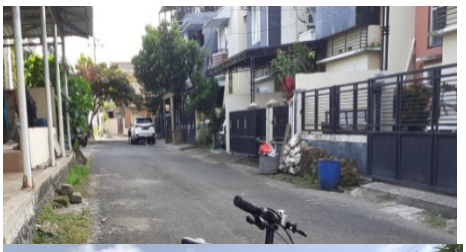
Ang, 14 yo "it is a big road many people and include me and parents sometimes do small running and cycling"

Cal, 14 yo "I love our neighborhood environment. fresh air in the city"

Ns, 14 yo "I like to play in front of my house it is quite big to do aerobic and play badminton"

Environmental Factors and Physical Inactivity in The Urban Area

Lack of pedestrian infrastructure and road safety



Ab, 13 yo "Cycling path is very important. Sometimes I feel unsafe cycling when a lot of cars are on the road, but I don't have any places to cling"

Arm, 13 yo "I always cycling in front of my home, it is wide enough for me"

Mni, 13 yo "No cycling path and pedestrian path".

Ns, 14 yo "A lot of cars, so sometimes we feel not safety".

Cal, 13 yo "also sometimes the bad smell from the gutter, make me feel uncomfortable to do physical activity"

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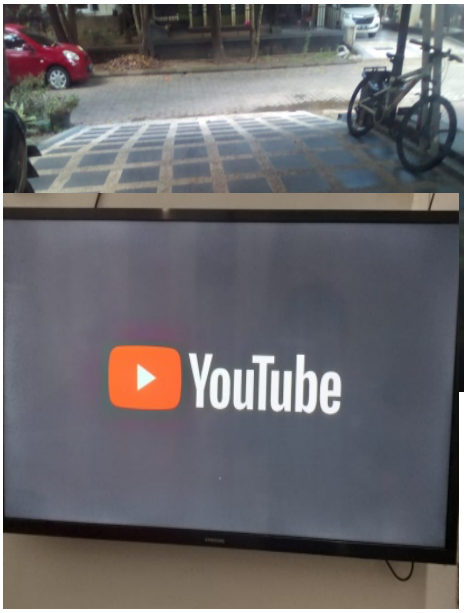
Smartphone and tablet

Despite the fact that it assumes that teenagers in metropolitan areas have sufficient opportunities for engaging in physical activities both within and outside the home (neighborhood environment). However, the majority of students stated that playing with a smartphone or tablet was more appealing and fascinating.



Mna, 14 yo "I have a bicycle, but I prefer to play with my phone to watch YouTube and playing games"

Cal, 14 yo "in my leisure time I like to study and watching movies or YouTube. It is more than 3 hours".

According to the results of the interviews, the majority of adolescents spend more than 3 hours of their free time indulging in sedentary behaviors.

Arm, 13 yo "4 hours. I never spend my day without playing with my gadget, strolling through social media, and watching YouTube"

Mni, 13 yo "I play social media for 2 or 3 hours every day"

Mna, 14 yo "more than four hours per day I play with my phone"

Nq, 13 yo "probably a half of my day I play with my gadget"

Ab, 13 yo "2 to 3 hours I watch YouTube and playing with my gadget"

And, 13 yo "playing games for 3 hours"

Ns, 14 yo "sometimes 3 hours sometimes even 4 hours I play social media"

Suggestion: Solution from youth in the urban area

Based on the interviews, it was discovered that adolescents in the urban area wish that the environment in their neighborhood area, particularly the gutter, will be kept clean. Furthermore, the majority of the youth advocate for the construction of new pedestrian and cycling paths to improve safety while participating in physical activities.

Arm, 13 yo "it is better to clean the gutter regularly and keep it closed so we cannot smell it"
Nq, 13 yo "please, build pedestrian and cycling path around the school"

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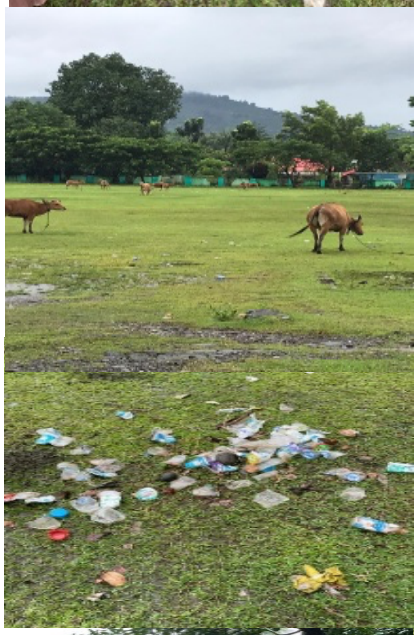
Cal, 14 yo "it is better to provide more open public space near school"
Ns, 14 yo "safety road. Provide pedestrian and bicycling path"

Environmental Factors and Physical Activity in The Rural Area

Poor maintenance of natural resources



Despite the fact that the communities have natural resources such as forests and hills that could support young physical activities, the youth were unable to use them for recreational purposes due to inadequate management or contamination. Fields, forests, and public spaces were exploited as public dumpsites and animal farms, as expressed by adolescents.

AR 15 yo"a lot of cow dung, smell bad, it is make us won't play here and even we play probably only in minutes"
RO 14 yo"I sometimes step on the cow dung, it yuck and stop me to play"
SA 13 yo"I am lazy to play here because of the cow dung. It is making me not comfortable to breath"
TA 14 yo"I don't want to play here, it is not comfortable to smell and play"
SA 13 yo "a lot of cows, it is not safe. I am afraid if the cow hurts me"

IP 14 yo" I am lazy and not interesting to play here, because of the trash and cow dung".

RO 13 yo "I am rarely to play here, it is very big but a lot of trash, cow and cow dung. I feel not comfortable to play here, so sometimes I decide just play in front of my home".

NS 14 yo"to much trash, sometimes it smells bad".

NU 13 yo"we really want to play but, it is muddy we cannot play here".

Lack of pedestrian infrastructure and road safety

The adolescents were well aware that playing in the street was risky. The streets were extremely congested. When adults went to and returned from work, the streets were busier in the morning and evening. As a result, some teenagers avoided engaging in physical exercise such

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as walking, jogging, or cycling on the streets. Many of them instead of moved around on motorbikes or switched to play gadget such us a smartphone or electronic games.

IP 13yo "I feel unsafe when do jogging or cycling, a lot of cars, especially in the morning and evening".
TA 14 yo"It is not safe and dangerous for running or cycling , many cars cross the road near field and sometimes there are really fast".
NA 13 yo "I am afraid a lot cars on the road, so I cycling in the big field".
NU 14 yo "no pedestrian path and cycling path. So feel unsafe".
RO 14 yo" I prefer using motor cycle it fast and no too much energy use, and I have more friend when I use motorcycle"
AR 14 yo "most of my friends use their parents' motorcycle in the evening so I go encourage to use motor cycle as well"

Lack of communities' facilities for physical activities

There were few suitable and safe community facilities for youth to engage in physical activity.

IP 13 yo "No community that encourage me for doing sport such as badminton club or other"

AR 13 yo "no takraw club, no football club"

DISCUSSION

Environmental factor of youth PA in the urban area

Although adolescents in metropolitan areas are generally assumed to have sufficient opportunities and facilities for engaging in physical activities both within and outside the home, this study found that most preferred spending their leisure time using smartphones or tablets. The attraction of digital entertainment often outweighed the motivation to participate in physical activity, leading to prolonged sedentary behavior. This finding is consistent with previous

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research indicating that technological engagement is a major contributor to reduced physical activity among adolescents in urban environments.

Nevertheless, our findings also revealed that environmental factors such as the availability of recreational facilities, residential density, and neighborhood walkability were positively associated with moderate-to-vigorous physical activity (MVPA) among adolescents, particularly for those who received higher levels of sibling or peer support. This interaction suggests that while the built environment provides opportunities for physical activity, the extent to which adolescents utilize these opportunities depends on the level of social support they perceive. Adolescents are not fully independent and often rely on encouragement and companionship from siblings or peers to engage in physical activity, especially outside of school hours. This result aligns with previous studies that found a positive interaction between walkability and social support on MVPA among U.S. adolescents [11,22].

Furthermore, peer and sibling support appeared to positively moderate the relationship between the availability of recreational facilities and residential density. In particular, recreation facilities within a 2 km radius, and walkable areas within 1–2 km, showed significant positive associations with MVPA outside school hours. However, the mere presence of facilities does not guarantee increased participation; lack of motivation, low social engagement, and limited parental or peer encouragement can reduce the use of such amenities.

In addition, several barriers were identified. The absence of safe pedestrian and cycling paths discouraged adolescents from engaging in outdoor activities such as walking or cycling. Concerns about traffic safety and environmental cleanliness (e.g., unpleasant odors from open gutters) also reduced adolescents' interest in using outdoor spaces for physical activity. Thus, even though urban adolescents live in environments rich with facilities, inadequate safety infrastructure and poor maintenance may hinder the optimal use of these spaces.

The built environment, therefore appears to have a stronger facilitating effect on MVPA among adolescents who experience favourable social support. This highlights the importance of a dual approach: improving environmental design and strengthening social support networks to encourage active lifestyles. Multilevel interventions are needed that target both environmental and social determinants of adolescent physical activity. Efforts should focus on improving pedestrian and cycling infrastructure, maintaining clean public spaces, and developing community-based programs that foster peer involvement and collective motivation to engage in physical activity outside of school hours.

Environmental factor of youth PA in the rural area

Poor maintenance of natural resources and pollution, lack of pedestrian infrastructure and inactive transportation, lack of community facilities for PA, and negative perceptions of ancestors' agricultural activities were identified as four environmental factors that have influenced adolescents' outdoor PA.

Despite having abundant natural resources such as the forest and hills, the adolescents and community did not take advantage of these abundant resources to encourage and engage in PA, as teenagers from other rural areas expressed [20], [22]. Because rural communities frequently lack basic environmental services like as street cleaning and waste collection, field and public places have been exploited as public dumpsites and sewage disposal sites. This places restrictions on the use of natural resources for leisure purposes. Adolescents who lived in a more attractive environment had a more favorable attitude toward being physically active, according to another study [23].

Streets were often used by the adolescents in this study to play football, sepaktakraw, and badminton, or simply to hang out with friends. Despite the fact that studies have shown that street play promotes a sense of independence, spontaneity, and social zones,9 road safety was a prominent concern in our study. In addition, the lack of pedestrian infrastructure has led to many teens riding motorcycles or engaging in indoor media entertainment. Neighborhood streets should include extended "street corners," suitable pedestrian infrastructure (sidewalks), street lights, traffic calming such as raised crosswalks, or enhance the aesthetics of the street to promote street-play and pedestrian safety [24].

This study indicated that there are insufficient sports or play facilities in the rural community to support adolescents' PA, as expected. This has led to sedentary behavior such as hanging out with friends, participating in social media activities, and riding motorcycles. Adolescents who routinely report high levels of boredom or simply "hanging around" during their leisure time are more likely to engage in substance use and delinquent behaviors [25]. In the United States, studies have shown that the quantity of basketball and tennis courts is related to children's PA levels [26].

In remote places, farming is a generational obligation for indigenous people. The elder generations would pass down farming to younger generations, providing an opportunity for young people to engage in physical activity. Unfortunately, teens saw farming as a shame, believing that it was just for persons with a poor level of education or for the elderly. In contrast, in Mozambique, where agricultural work involves the entire family and most children and adolescents participate in activities such as carrying water, farm duties, washing, and cleaning, they have high levels of total PA [27].

Limitations

The indigenous participants and research settings were limited to the Makassar tribe, which may not be indicative of other Indonesian rural populations.

CONCLUSION

It is proposed that health promotion and physical activity instruction for teenagers in urban areas is urgently needed, with a particular focus on limiting the use of gadgets and improving intervention-related safety. Basic amenities such as play places and pedestrian infrastructure are required in a rural region to promote adolescent PA. Any intervention should use of natural resources, which are less expensive, environmentally benign, and long-lasting.

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Declaration of Conflicting Interest

The authors have stated that there is no possible conflict of interest.

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