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Enhancing Physical Activity Awareness and Participation among Informal Workers through a Participatory Community Service Program

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Abstract:
Physical inactivity among informal workers has become a growing public health concern, as demanding work routines often limit opportunities for regular exercise and increase the risk of non-communicable diseases. This community service program aimed to improve awareness and participation in physical activity among members of the Used-Vehicle Micro, Small, and Medium Enterprise (MSME) Association in Tulangan District. The program was implemented using a participatory educational and mentoring approach, consisting of health education sessions, practical training on simple physical activities that can be integrated into daily work routines, and short-term post-activity mentoring. Program evaluation was conducted through observations, questionnaires, and participant feedback to assess changes in awareness and participation levels. The results showed an improvement in participants' understanding of physical activity concepts, with participants recognizing that daily movements such as walking and stretching also contribute to health. Participation in regular physical activity increased from approximately 30% before the program to 70% after implementation, and participants reported reduced work-related fatigue and musculoskeletal discomfort. In conclusion, this community service program demonstrates that simple, contextual, and participatory interventions are effective in fostering awareness and encouraging sustainable physical activity habits among informal worker communities
Keywords: physical activity promotion; informal sector workers; health literacy; participatory mentoring; workplace exercise; community service

1. Introduction

Physical activity is a fundamental component in maintaining health and physical fitness. However, the fast-paced and demanding nature of modern lifestyles often leads individuals to neglect the body's basic need for regular movement. Many people, particularly those working in the informal sector such as used-vehicle micro, small, and medium enterprise (MSME) operators, tend to focus primarily on repetitive work activities without considering the balance between physical workload and physical fitness. This condition contributes to decreased daily physical activity levels and increases the risk of non-communicable diseases, including hypertension, diabetes, and obesity (Mbabho & Indra Kusuma, 2024).

Public awareness of the importance of physical activity remains relatively low, especially among productive-age individuals who are heavily occupied with work responsibilities (Gede et al., 2022). Physical activity is often perceived narrowly as structured exercise, such as

aerobic workouts (Alhafis et al., 2024), running (Kusuma & Utamayasa, 2025), or participation in specific sports. In fact, physical activity can also be achieved through simple and spontaneous daily movements that are easy to perform (Grant et al., n.d.). This limited understanding has become one of the primary factors contributing to low public participation in health-promoting physical activities (Rosa et al., 2024).

This situation is concerning, as sedentary lifestyles are recognized as a major risk factor for various chronic diseases. Reports indicate that more than 30% of the population is classified as physically inactive, and this proportion continues to increase annually. Insufficient physical activity not only affects physical health but also has negative implications for work productivity and overall quality of life (Mendonça et al., 2022; Larasati & Fertilita, 2020; Yu et al., 2021). These conditions emphasize the urgency of implementing systematic efforts to promote physical activity that is simple, affordable, and adaptable to daily work environments.

Within the context of community service, increasing awareness and participation in physical activity represents a practical strategy for fostering a healthier and more productive society. Community-based programs that target working populations, particularly informal workers, are essential, as this group often experiences high work demands while paying limited attention to physical fitness (Zorlu & Akca, 2021). Educational approaches alone are often insufficient; therefore, participatory strategies that actively involve community members are required to ensure that knowledge is translated into sustainable behavior change (Zavlis et al., 2021).

Used-vehicle MSME operators in Tulangan District were selected as community partners due to the relatively static and economically target-driven nature of their work. Daily activities frequently involve prolonged sitting or standing, increasing the risk of musculoskeletal complaints and reduced physical fitness (Heileson et al., n.d.). In addition, low participation in physical exercise among informal workers is often influenced by time constraints (Fu et al., 2020), limited access to facilities (Lino-González et al., 2024), and lack of motivation (Niza et al., 2024). These barriers necessitate educational strategies that can be integrated into work routines without compromising productivity (Garofalo et al., 2020; Seleng et al., 2025).

Through counseling and practical training activities, community members were encouraged to develop a broader understanding of physical activity. The program emphasized not only theoretical knowledge but also simple and practical exercises, including workplace stretching, short walking sessions, and relaxation techniques aimed at reducing muscle tension (DeLucia et al., 2023). This approach reinforces the concept that physical activity is not limited to strenuous exercise (Ryan et al., 2022), but rather represents a sustainable active lifestyle (Sundukova et al., 2024).

Moreover, this community service initiative served as a platform for strengthening social networks and fostering mutual support among community members in adopting healthy lifestyle practices. Collaboration between academics and the community is expected to promote long-term behavioral change rather than temporary intervention. Shared commitment among program implementers, participants, and the surrounding environment plays a crucial role in instilling awareness of active living within the community (Clark & Malecki, 2022).

Overall, this physical activity awareness and participation enhancement program was designed to serve as an applicable and sustainable model of community service. By directly involving community members, the program aims to encourage the development of independent, productive, and health-oriented behaviors that contribute to improved quality of life (Zeng et al., 2024). This initiative also represents a tangible contribution of higher education institutions in supporting the government's Healthy Living Community Movement (GERMAS).

2. Materials and Methods

This community service program employed a participatory approach based on education and active mentoring to enhance public awareness and engagement in physical activity. This approach positioned community members as active participants throughout all stages of the program, including planning, implementation, and evaluation. By emphasizing collaboration, participants were encouraged not only to receive information but also to internalize knowledge and develop healthy habits through direct experience.

The program was conducted at the Used-Vehicle Micro, Small, and Medium Enterprise (MSME) Association in Tulangan District, Sidoarjo Regency, from September to November 2025. The selection of this location was based on preliminary observations indicating low awareness of physical activity, high levels of work-related fatigue, and frequent musculoskeletal complaints among informal workers due to repetitive tasks and limited movement during daily work activities.

The target participants were members and administrators of the Used-Vehicle MSME Association, consisting of traders, vehicle technicians, and administrative staff. Most participants were between 25 and 50 years old and worked long daily hours. A total of 35 participants were involved in this program. This group was considered to have strong potential to adopt and disseminate healthy behavior practices within their community when supported with appropriate knowledge and practical skills.

The implementation of the program was carried out in four main stages: planning, socialization, training, and evaluation.

The planning stage involved coordination between the community service team and community leaders to identify priority needs, determine the program schedule, and prepare educational materials related to physical activity and healthy lifestyles.

The socialization stage focused on delivering educational content regarding the benefits of physical activity, the health risks associated with sedentary behavior, and practical strategies for maintaining physical fitness within daily work routines. This stage aimed to broaden participants' understanding of physical activity beyond formal exercise.

The training stage emphasized hands-on practice through simple and practical physical activities that could be easily integrated into the workplace. These activities included stretching exercises, breathing techniques, and light movements designed to reduce muscle tension and improve circulation without disrupting work productivity. Training sessions were conducted interactively to allow participants to directly experience the benefits of the introduced activities.

The evaluation stage aimed to assess changes in participants' awareness and participation in physical activity. Data were collected through observations, brief interviews, and questionnaires administered before and after program implementation. Behavioral observations were also conducted to examine participants' engagement during activities and their willingness to independently perform physical activity practices.

To support sustainability, a two-week post-program mentoring phase was implemented. During this period, participants were encouraged to continue practicing the introduced physical activities independently, while the service team monitored progress and provided feedback. This follow-up stage was intended to reinforce behavioral changes and promote the adoption of active lifestyle habits within the community.

Data obtained from the program were analyzed using a descriptive qualitative approach, focusing on changes in awareness, motivation, and community participation related to physical activity. The analysis served as a basis for evaluating program effectiveness and formulating recommendations for future community service initiatives.

3. Results

The community service program aimed at increasing awareness and participation in physical activity among members of the Used-Vehicle MSME Association in Tulangan District was implemented as planned. Program activities were conducted through three main phases: socialization, training, and post-program mentoring. Overall, participants demonstrated positive engagement throughout the implementation process.

During the socialization phase, participants actively participated in discussions related to the importance of physical activity for health and work productivity. Many participants asked questions regarding the relationship between physical activity, disease prevention, and fatigue reduction. Observations indicated that participants showed increased interest in understanding how light physical activities could be incorporated into their daily work routines without disrupting productivity.

In the training phase, participants were guided to perform simple physical activities, including stretching exercises targeting the shoulders, back, and lower limbs, as well as breathing techniques aimed at reducing muscle tension caused by prolonged static working positions. These activities were conducted directly in the workplace environment. Post-training observations showed that approximately 90% of participants reported feeling fresher and more energized after completing the exercises. In addition, participants expressed increased awareness that physical activity does not necessarily require specialized facilities or structured exercise programs.

Changes in participation levels were also observed following the implementation of the program. Prior to the activity, approximately 30% of participants reported engaging in regular physical activity at least twice per week. After the program, this proportion increased to around 70%. Furthermore, several participants initiated small group activities, such as collective stretching sessions conducted in the morning before starting work.

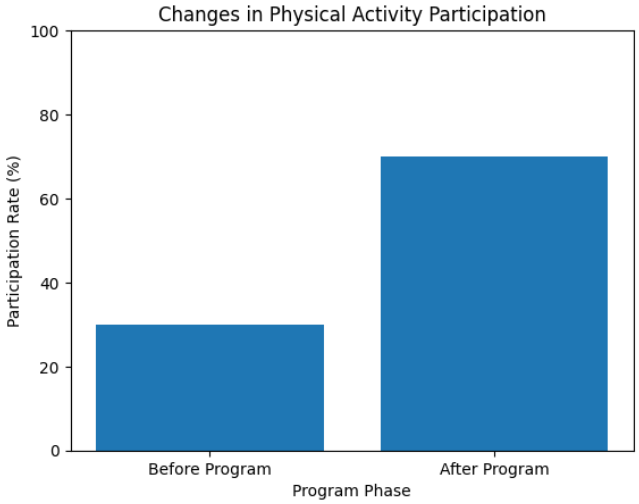

Figure 1. Changes in Physical Activity Participation Before and After the Community Service Program

The post-program mentoring phase, conducted over a two-week period, indicated consistent engagement among participants. Observations and participant feedback revealed a reduction in complaints related to work-related fatigue, back pain, and muscle stiffness among those who routinely practiced light physical activities during work breaks. Participation in community-organized physical activities, including group walking and light aerobic exercises, also increased during this period.

Overall, the results demonstrate an improvement in participants' awareness, participation, and engagement in physical activity following the implementation of the community service program. The observed outcomes highlight changes in behavior patterns related to physical activity within the workplace context, as reflected by increased participation rates and the initiation of independently organized physical activity practices.

4. Discussion

The findings of this community service program indicate that a participatory educational and mentoring approach can enhance awareness and participation in physical activity among informal workers. The increase in physical activity participation observed after the program reflects a positive behavioral shift, particularly in how participants perceive and integrate physical activity into their daily routines. Previous studies have shown that participatory and community-based physical activity interventions are more effective in promoting behavior change than purely informational approaches, as they actively involve participants in the learning and implementation process (Zavlis et al., 2021; Zorlu & Akca, 2021). These findings support the relevance of participatory strategies in addressing physical inactivity among working populations with high occupational demands.

A key outcome of the program was the change in participants' perceptions of physical activity. Prior to the intervention, physical activity was commonly perceived as structured exercise requiring specific time, facilities, and financial resources. After participating in the program, community members demonstrated an improved understanding that simple daily movements, such as stretching, walking, and light physical activities during work breaks, also contribute to health and physical fitness. This shift is consistent with research indicating that increased health literacy is associated with higher engagement in physical activity and healthier lifestyle behaviors among adults (Rosa et al., 2024; Sundukova et al., 2024). Improving conceptual understanding therefore appears to be a critical factor in reducing psychological barriers to physical activity among informal workers.

The integration of simple physical activities into the workplace environment also played an important role in increasing participation. Informal workers often face barriers such as limited time, lack of facilities, and competing economic priorities, which reduce opportunities for regular exercise (Fu et al., 2020; Lino-González et al., 2024). By introducing light and feasible physical activities that did not disrupt work productivity, the program provided practical solutions aligned with participants' daily routines. Similar workplace-based interventions have been reported to reduce musculoskeletal discomfort and improve perceived energy levels when physical activity is incorporated into regular work processes (Garofalo et al., 2020; Mendonça et al., 2022).

Social interaction and peer support emerged as additional factors supporting sustained engagement in physical activity. The formation of small group activities, such as collective stretching sessions, reflects the development of a supportive social environment within the community. Previous studies have emphasized that social support and collective participation are important determinants of long-term adherence to physical activity, particularly in occupational and community settings (Clark & Malecki, 2022; DeLucia et al., 2023). The presence of peer-led initiatives in this program suggests that community empowerment may strengthen motivation and foster shared responsibility for maintaining healthy behaviors.

Participants also reported reductions in work-related fatigue and musculoskeletal discomfort after routinely performing light physical activities during work breaks. Although these outcomes were based on self-reported feedback and observational findings, they align with existing evidence demonstrating that short bouts of stretching and movement can alleviate physical strain associated with prolonged static postures and repetitive work tasks (Yu et al.,

2021; Heileson et al., n.d.). These practical benefits may further reinforce participants' motivation to continue engaging in physical activity as part of their daily routines.

Despite these positive outcomes, challenges related to the sustainability of behavior change were identified. Some participants tended to revert to previous sedentary work patterns after the structured mentoring period ended. This finding is consistent with previous community-based physical activity programs, which have reported difficulties in maintaining long-term behavioral change without continuous support or environmental reinforcement (Zavlis et al., 2021; Zeng et al., 2024). To address this issue, strategies such as establishing regular community activity schedules, involving local leaders as facilitators, and providing visual reminders in the workplace may be necessary to strengthen long-term adherence.

Overall, the results of this community service program reinforce the value of participatory, context-sensitive approaches in promoting physical activity among informal workers. By emphasizing simplicity, relevance to daily work routines, and social engagement, the program demonstrates potential as a scalable model for similar communities. These findings support the role of higher education institutions in contributing to public health promotion through community empowerment and practical interventions that address real-world challenges related to physical inactivity.

Research Limitations

Despite the positive outcomes of this community service program, several limitations should be acknowledged. First, the program was conducted within a single informal worker community, namely the Used-Vehicle MSME Association in Tulangan District. As a result, the findings may not be directly generalizable to other informal worker groups or occupational settings with different work characteristics and socio-cultural contexts.

Second, the evaluation of program outcomes relied primarily on self-reported data, observations, and participant feedback. Although these methods are commonly used in community service activities and provided valuable insights into participants' perceptions and experiences, they may be subject to response bias, including overreporting of positive behaviors or outcomes. The absence of objective measurements, such as physical fitness assessments or wearable activity monitoring, limits the ability to quantify changes in physical activity levels more precisely.

Third, the duration of post-program mentoring was relatively short, lasting two weeks. While initial behavioral changes were observed during this period, the short follow-up duration does not allow for a comprehensive assessment of long-term sustainability. Some participants showed tendencies to return to previous work routines after structured support ended, indicating the need for longer monitoring periods.

Finally, external factors such as workload variability, economic pressures, and environmental conditions were not systematically controlled during program implementation. These factors may have influenced participants' ability to consistently engage in physical activity and could have affected the observed outcomes.

Directions for Future Research

Future community service programs and studies are encouraged to involve more diverse informal worker populations across different sectors and regions to improve the generalizability of findings. Expanding program implementation to various occupational contexts may provide a broader understanding of how participatory physical activity interventions can be adapted to different community needs.

Further research is also recommended to incorporate objective measurement tools, such as simple physical fitness tests, pedometers, or wearable activity trackers, to complement self-

reported data. The use of mixed-method approaches may strengthen the evaluation of program effectiveness and provide more robust evidence of behavioral and physical health changes.

Longer-term follow-up studies are needed to examine the sustainability of physical activity behaviors after community service interventions. Future programs could integrate extended mentoring periods or periodic reinforcement sessions to better assess long-term adherence and habit formation among participants.

In addition, future research may explore the role of environmental and organizational support systems, such as workplace policies, leadership involvement, and digital reminders, in sustaining physical activity practices within informal work settings. Examining these factors could contribute to the development of more comprehensive and scalable models for promoting active lifestyles through community-based interventions.

5. Conclusions

This community service program demonstrated that participatory education and mentoring can effectively enhance awareness and participation in physical activity among informal workers. By aligning educational content with participants' daily work routines, the program successfully broadened community understanding of physical activity beyond formal exercise and encouraged the adoption of simple, feasible movements within the workplace context.

The integration of light physical activities into daily work processes, supported by direct practice and short-term mentoring, contributed to positive behavioral changes and increased engagement in physical activity. The emergence of peer-led initiatives, such as collective stretching sessions, further indicates that community involvement and social support play an important role in fostering active lifestyle habits among informal workers.

Overall, the findings highlight that community-based physical activity promotion does not necessarily require extensive facilities or complex interventions. Instead, practical, low-cost, and context-sensitive strategies can serve as effective approaches to improving health awareness and participation in physical activity. This program provides a useful model for similar community service initiatives aimed at promoting healthy lifestyles and supports the role of higher education institutions in contributing to public health promotion through community empowerment.

Recommendations

Based on the findings of this community service program, several recommendations are proposed to strengthen the sustainability and broader impact of similar initiatives in the future. First, community-based physical activity programs targeting informal workers should emphasize participatory and context-sensitive approaches. Activities that are simple, flexible, and integrated into daily work routines are more likely to be accepted and maintained, particularly in settings with limited time and facilities.

Second, the involvement of local leaders or community representatives as facilitators is strongly recommended. Empowering selected community members to lead routine physical activity sessions, such as stretching or group walking, may enhance long-term adherence and foster a sense of collective responsibility for health. Peer-led initiatives can also reduce dependence on external facilitators once the program concludes.

Third, future programs should consider extending the mentoring or follow-up period to reinforce behavioral changes. Periodic reinforcement activities, such as refresher sessions or scheduled group exercises, may help prevent participants from reverting to sedentary habits and support the development of sustained active lifestyle behaviors.

In addition, collaboration between higher education institutions, local organizations, and community stakeholders should be strengthened to ensure continuity and scalability of physical

activity promotion programs. Integrating community service initiatives with existing public health programs, such as the Healthy Living Community Movement (GERMAS), may further enhance program effectiveness and reach.

Finally, it is recommended that future community service activities incorporate simple monitoring and evaluation tools to better document program outcomes. Combining self-reported measures with basic objective indicators may provide more comprehensive evidence of program impact and support continuous improvement of community-based physical activity interventions.

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Conflict of Interest

The authors declare no conflict of interest.

6. References

Angga Indra Kusuma, & Utamayasa, I. G. D. (2025). The effect of differences in work and rest ratios in high intensity interval training on physical performance. Bravo's: Journal of Physical Education and Sport Science, 13(Special Issue 2), 333–340. https://doi.org/10.32682/bravos.v13si2/141

Barrio, E. D., Alvarez, C., Thapa, R. K., Ramachandran, A. K., Singh, U., & Ramirez-Campillo, R. (2023). Jump rope training for health and fitness in school-age participants: Secondary analyses from a systematic review. International Journal of Kinesiology and Sports Science, 11(1), 27–41. https://doi.org/10.7575/aiac.ijkss.v.11n.1p.27

Clark, K. N., & Malecki, C. K. (2022). Adolescent mental health profiles through a latent dual-factor approach. Journal of School Psychology, 91, 112–128. https://doi.org/10.1016/j.jsp.2022.01.003

DeLucia, C. M., Tavoian, D., Debonis, D. R., Snell, E. W., Schwyhart, S. M., & Bailey, E. F. (2023). A short course of high-resistance, low-volume breathing exercise extends respiratory endurance and blunts cardiovascular responsiveness to constant-load respiratory testing in healthy young adults. Respiratory Physiology & Neurobiology, 307, 103974. https://doi.org/10.1016/j.resp.2022.103974

Fu, W., Wang, C., Zou, L., Guo, Y., Lu, Z., Yan, S., & Mao, J. (2020). Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China. Translational Psychiatry, 10(1), 225. https://doi.org/10.1038/s41398-020-00913-3

Garofalo, S., Picard, K., Limatola, C., Nadjar, A., Pascual, O., & Tremblay, M. È. (2020). Role of glia in the regulation of sleep in health and disease. Comprehensive Physiology, 10(2), 687–712. https://doi.org/10.1002/cphy.c190022

Gede, I., Utamayasa, D., Hanafi, M., & Kusuma, A. I. (2022). Dampak latihan intensitas sedang dan intensitas submaksimal terhadap kebugaran kardiorespirasi pada wanita muda. Jurnal Pendidikan Kesehatan Rekreasi, 8(2), 327–335. https://doi.org/10.5281/zenodo.6762606

Grant, G., Machaczek, K., Pollard, N., & Allmark, P. (n.d.). Walking, sustainability and health: Findings from a walking for health group.

Haykal Alhafis, M., Putra, I. B., & Indra Kusuma, A. (2024). Tantangan 14 hari terbaik: Perjalanan menjadi pemain tim nasional sepak bola U23 Indonesia. Jurnal Ilmiah ADIRAGA, 10(2), 44–57. https://doi.org/10.36456/adiraga

Heileson, J. L., Macartney, M. J., Watson, N. L., Sergi, T. E., Jagim, A. R., Anthony, R., & Peoples, G. E. (n.d.). Nutrition and physical performance: Nutritional optimization for brain health in contact sports. OSF Preprints. https://doi.org/10.17605/OSF.IO/EY5QW

Larasati, V., & Fertilita, S. (2020). Maintaining healthy skin during COVID-19 pandemic. Conferences of Medical Sciences Dies Natalis Faculty of Medicine Universitas Sriwijaya, 2(1), 1–9. https://doi.org/10.32539/dies.v2i1.37

Lino-González, A. L., Téllez-Alanís, B., Carrillo-Mora, P., Palacios-Hernández, B., Hernández-Galván, A., & Durand-Rivera, A. (2024). Physical activity, mental health, support networks, lifestyle, and memory in older adults during the COVID-19 pandemic. Neurology Perspectives, 4(2), 100146. https://doi.org/10.1016/j.neurop.2024.100146

Mbabho, F., & Indra Kusuma, A. (2024). Physical activity and intermittent fasting interventions to improve the physical fitness of physical education teachers. Wahana: Tridarma Perguruan Tinggi, 76(2). http://jurnal.unipasby.ac.id/index.php/whn

Mendonça, F. R., Ferreira de Faria, W., da Silva, J. M., Massuto, R. B., dos Santos, G. C., Correa, R. C., Sasaki, J. E., & Neto, A. S. (2022). Effects of aerobic exercise combined with resistance training on health-related physical fitness in adolescents: A randomized controlled trial. Journal of Exercise Science & Fitness, 20(2), 182–189. https://doi.org/10.1016/j.jesf.2022.03.002

Niza, I. L., Bueno, A. M., Gameiro da Silva, M., & Broday, E. E. (2024). Air quality and ventilation: Exploring solutions for healthy and sustainable urban environments in times of climate change. Results in Engineering, 24, 103157. https://doi.org/10.1016/j.rineng.2024.103157

Rosa, G. B., Staiano, V., Ponikvar, K., Magalhães, J. P., Correia, I. R., Hetherington-Rauth, M., & Sardinha, L. B. (2024). Cardiorespiratory fitness and muscular fitness correlates in youth: A hierarchy of behavioral, contextual, and health-related outcomes. Journal of Science and Medicine in Sport, 27(7), 486–492. https://doi.org/10.1016/j.jsams.2024.03.003

Ryan, G. V., Callaghan, S., Rafferty, A., Higgins, M. F., Mangina, E., & McAuliffe, F. (2022). Learning outcomes of immersive technologies in health care student education: A systematic review. Journal of Medical Internet Research, 24(2), e30082. https://doi.org/10.2196/30082

Seleng, J., Celovska, D., Procka, P., Labuda, M., & Borik, S. (2025). Camera-based evaluation of deep breathing effects on plantar foot microcirculation: A pilot study on young healthy individuals. Computers in Biology and Medicine, 189, 109996. https://doi.org/10.1016/j.compbiomed.2025.109996

Sundukova, I., Stasenko, O., Lohvinova, Y., Kovalova, Y., & Radionova, O. (2024). Physical culture as a means of physical activity and strengthening the health of young students. Sport TK–Revista Euroamericana de Ciencias del Deporte, 13, 1–9. https://revistas.um.es/sportk

Yu, H. B., Tai, W. H., Li, J., Zhang, R., Hao, W. Y., & Lin, J. Z. (2021). Effects of shoe midsole hardness on lower extremity biomechanics during jump rope in healthy males. Healthcare, 9(10), 1394. https://doi.org/10.3390/healthcare9101394

Zavlis, O., Butter, S., Bennett, K., Hartman, T. K., Hyland, P., Mason, L., McBride, O., Murphy, J., Gibson-Miller, J., Levita, L., Martinez, A. P., Shevlin, M., Stocks, T. V. A., Vallières, F., & Bentall, R. P. (2021). How does the COVID-19 pandemic impact population mental health? A network analysis of COVID influences on depression, anxiety and traumatic stress in the UK population. Psychological Medicine, 1–9. https://doi.org/10.1017/S0033291721000635

Zeng, H., He, Y., Zhao, R., Li, Z., Wang, W., Yang, M., Li, P., Tao, G., Sun, J., & Hou, C. (2024). Intelligent health and sport: An interplay between flexible sensors and basketball. iScience, 27(3), 109089. https://doi.org/10.1016/j.isci.2024.109089

Zorlu, D., & Akca, V. (2021). Sleep characteristics of healthcare professionals in the COVID-19 pandemic. Journal of Biomedical Research & Environmental Sciences, 2(7), 604–609. https://doi.org/10.37871/jbres1285