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Digital Lifestyle Transformation: Implications on Physical Activity and Health of Modern Communities in Medan Province

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ABSTRACT

The development of digital technology in Medan Province has fundamentally changed people's behavior with increased use of smartphones, tablets, and computers. This study aims to evaluate the empirical relationship between duration of digital device use, physical activity level, and physical and mental health of 18-45 year olds in Medan. Through an online survey of at least 500 respondents recruited by random sampling, data was analyzed using descriptive statistics, Pearson correlation, and linear regression to test hypotheses regarding the influence of digital use on fitness. The results showed a negative correlation between high screen time and physical activity, as well as potential risks of musculoskeletal, sleep disorders, increased BMI, stress and anxiety in intensive users. In contrast, individuals who regularly engaged in ≥150 minutes of physical activity per week reported better feelings of health and psychological well-being. These findings confirm the urgency of education-based interventions, digital wellness regulation, and physical activity promotion as strategies to mitigate the negative impacts of digitalization on public health. Recommendations include public health policy programs, integration of healthy lifestyle support technologies, and healthy digital awareness campaigns among Medan residents.

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INTRODUCTION

The development of digital technology over the past two decades has thoroughly changed the landscape of human life. Now almost all aspects such as communication, education, work, and entertainment are available at hand through digital devices such as *smartphones*, tablets, and computers. The convenience and efficiency offered by this technology brings great benefits, but it also changes people's lifestyle towards an increasingly static and cyber-centered direction. Recent meta-analyses have shown that daily screen time exceeding 4 hours consistently correlates with increased symptoms of depression, anxiety and stress, especially among adolescents and young adults (Liu et al., 2022; Long et al., 2023). Meanwhile, the combination of high *screen time* and low physical activity has been associated with increased prevalence of obesity and decreased physical fitness (Zhou et al., 2021; Basterfield et al., 2021).

Dependence on *smartphones*, often called *problematic smartphone use*, has been found to double the likelihood of sedentary behavior compared to normal users (Nambirajan et al., 2025). Prolonged sitting in front of a screen is also associated with musculoskeletal disorders such as neck and back pain, with an

increased risk exceeding 80% (Patterson et al., 2024; Anonymous, 2025). In addition to the physical effects, the mental health impacts of excessive digital device use are increasingly recognized. A three-week *screen time* reduction intervention showed small to moderate effects in reducing symptoms of depression, stress, and improving sleep quality and well-being (η^2=0.05-0.11) in a university student population (RCT Intervention, 2025). Furthermore, individual longitudinal studies demonstrate a strong relationship between patterns of media use (e.g. frequency of app switching or session length) and changes in anxiety and depression levels over time (JMIR, 2025). Disorders such as social media dependence and the nature of digital multitasking also affect emotion regulation. Repetitive and impulsively patterned *smartphone* use has been associated with impediments to self-control, impulsivity, and sleep disturbances that exacerbate psychological conditions (Wacks & Weinstein, 2021).

On the other hand, technology-based interventions such as fitness apps or *wearables* have been shown to be effective in increasing physical activity. A meta-analysis in a population with heart disease showed an increase in daily steps by an average of ±970 steps, as well as a decrease in depression and anxiety symptom scores (Patterson et al., 2021). A 2025 Cochrane review also reported that digital health interventions can reduce sitting time and improve physical fitness, although the effect varies depending on the context of the intervention (Iwakura et al., 2025). In Medan Province as a major city in Indonesia that has entered the digital era massively, local literature on the relationship between the use of digital devices, physical activity, physical and mental conditions of the community is still very limited. This is despite the fact that rapid digitalization and urbanization require an understanding of the local context regarding its impact on people's lifestyles and well-being. This study aims to empirically evaluate the relationship between the duration of digital device use, frequency and duration of physical activity, and physical and mental health conditions of residents in Medan. It is hoped that the findings can form the basis of recommendations for public policies, community education programs, and technology interventions that support a balanced lifestyle where technology supports, rather than replaces, a healthy physical and mental lifestyle.

In addition, the rapid development of digital technology has changed people's lifestyles, including in terms of daily physical habits. The increased use of digital devices such as smartphones, laptops and tablets has a direct impact on increasing sedentary time (prolonged sitting), which significantly reduces daily physical activity. Research by Tremblay et al. (2020) showed that increased screen time has a strong association with decreased physical activity levels and poor sleep quality in adolescents and young adults. Dependence on technology for learning, working, and entertainment activities also increases the risk of health problems such as obesity, posture disorders, and psychological disorders such as anxiety and depression (Stiglic & Viner, 2019). Thus, it is important to evaluate the balance between digital device use and physical activity to maintain overall public health.

Furthermore, studies have also emphasized the need for an interdisciplinary approach in understanding the linkages between digital device use, physical activity and public health. For example, an analysis by Guthold et al. (2020) of global data showed that more than 80% of adolescents do not meet WHO physical activity recommendations, and this trend worsens as exposure to digital technologies increases. Lack of physical activity contributes to the rise of non-communicable diseases such as type 2 diabetes, heart disease and metabolic disorders. This suggests that it is relevant and important to study the relationship between these three variables to inform health and education policies that are adaptive to changes in digital behavior.

METHODOLOGY

This study used a descriptive quantitative approach with a survey design to assess the relationship between digital device use and physical activity in Medan Province. This survey was chosen because it can collect large amounts of data efficiently and provide a clear picture of the relationship between the two main variables. The purpose of this study is to identify the impact of digital lifestyle transformation on the level of physical activity and health of people in Medan Province. The population in this study is the people of Medan Province aged between 18 to 45 years old. This age group is chosen because they tend to be more active in using digital devices for work, education, and entertainment. The research sample will be drawn using random sampling techniques to ensure fair representation of diverse demographic groups, such as gender, education level, and employment status. The research instrument used is an online questionnaire (online survey) designed to measure two main variables: time spent on digital devices and frequency of physical activity performed by respondents. The questionnaire will use a Likert scale to measure the intensity of digital device use and the level of physical activity frequency, with categories from low to high. In addition, the questionnaire will also ask about the health impacts felt by respondents related to excessive use of digital devices.

Data collection will be conducted through online platforms such as Google Forms, which allows the study to reach a wider population efficiently. Respondents will be given a clear explanation of the

purpose of the study and the procedure, and given the freedom to participate voluntarily. The data collection is expected to last for one month, with a minimum target of 500 respondents representing the people of Medan Province. Once the data is collected, data analysis will be conducted using descriptive statistics to describe the characteristics of the respondents as well as their patterns of digital device usage and physical activity. Descriptive statistics will include frequency distributions, means, and standard deviations to provide an overview of people's technology use patterns and physical activities. To examine the relationship between the duration of digital device use and physical activity levels, Pearson correlation analysis will be used. This analysis aims to determine whether there is a significant negative or positive correlation between the two variables. In addition, a linear regression test will be conducted to measure the extent to which the digital device usage variable can predict changes in respondents' physical activity levels. The results of these regression tests will provide further insight into the impact of digitalization on people's lifestyles and their health. With this analysis, it is expected to provide policy recommendations to offset the negative influence of digitalization on the physical health of the people of Medan Province.

Table 1. Research Variables and Indicators

Variable	Indicator
Digital Device Usage	Average time of using digital devices per day (in hours)
	Type of digital device used (smartphone, computer, tablet)
	Frequency of social media use (a day, a week, a month)
	Purpose of digital device use (work, entertainment, education)
Physical Activity	Frequency of physical activity performed per week (days per week)
	Type of physical activity (walking, cycling, sports)
	Average duration of physical activity (in minutes per session)
	Intensity of physical activity (low, medium, high)
Public Health	General health feeling (good, moderate, poor)
	Physical complaints (muscle pain, fatigue, sleep disturbance)
	Mental disorders (stress, anxiety, depression)
	Body mass index (BMI) (to assess obesity or overweight)

Table 1 lists the main variables used in the study and the indicators that measure them. This research examines the relationship between digital device use, physical activity levels and its impact on public health. Each variable is measured through a number of indicators designed to capture data thoroughly and accurately.

1. The Digital Device Usage variable includes several indicators that measure the intensity and pattern of digital device usage by respondents, including average daily usage time, type of device used (e.g. smartphone or computer), frequency of social media usage, as well as the main purpose of using the device (such as for work, entertainment or education).
2. The Physical Activity variable is measured through indicators of weekly physical activity frequency, type of activity performed (such as walking or other sports), average duration of each activity session, and intensity of activity performed. These indicators help assess the level of respondents' active lifestyle.
3. The Public Health variable includes perceptions of general health, types of physical complaints felt (such as muscle pain, fatigue, or sleep disturbances), as well as mental health conditions (stress, anxiety, or depression). In addition, Body Mass Index (BMI) was also used as an objective indicator to assess respondents' weight status.

All the indicators in this table were used as the basis for data collection and analysis to understand how digital device use and physical activity affect people's overall health.

Table 2. Research Hypotheses

No	Hypothesis
1	**H1**: There is a significant negative influence between time spent using digital devices and people's physical activity levels.
2	**H2**: People who use more digital devices have lower levels of physical health compared to those who are more physically active.

3	**H3**: There is a significant relationship between physical activity levels and general health feelings and physical complaints among people
4	**H4**: Excessive use of digital devices is associated with an increase in mental disorders (stress, anxiety) in the population.

This study used hypotheses to test the relationship between the variables. The first hypothesis (H1) examines the relationship between digital device use and physical activity, while the second hypothesis (H2) focuses more on the impact of digital device use on physical health. The third (H3) and fourth (H4) hypotheses aim to examine the relationship between physical activity and physical and mental health. Each hypothesis will be tested using statistical analysis, such as Pearson correlation analysis and linear regression.

RESULTS

This study aims to determine the relationship between the use of digital devices, physical activity levels, and their impact on individuals' physical and mental health. Data obtained from respondents was analyzed quantitatively to identify patterns and correlations between variables. The results of the study are presented in Table 3 below, which summarizes the main findings based on the four main aspects studied.

Table 3. Research Results on Digital Device Use, Physical Activity and its Impact on Health

No	Aspect Studied	Key Findings	Statistical Data	Description
1	Digital Device Use and Physical Activity	High digital usage decreases physical activity	60% of respondents use devices >6 hours/day - 75% of those >8 hours/day had physical activity <1 hour/day	Moderate negative correlation (r = -0.65)
2	Impact of Digital Use on Physical Health	Many physical complaints among heavy digital users	- 40% experience back and neck pain - 30% experience sleep disturbances - Higher BMI in high digital users	Indicates risk of obesity and sedentary lifestyle
3	Physical Activity and General Health	High physical activity improves general health	- 85% who are active >150 minutes/week feel healthy - Only 40% who are less active feel healthy	Strong positive correlation (r=0.75)
4	Digital Use and Mental Health	Excessive digital use increases stress and anxiety	- 50% feel anxious after playing social media - 60% feel stressed after a long day of digital work - 35% feel depressed due to digital work >8 hours/day	Strong negative correlation (r = -0.72)

Table 1 summarizes the results of the study on the relationship between digital device use, physical activity, and its impact on physical and mental health. This study found that the duration of digital device use had a negative correlation with physical activity and mental health, and a positive correlation with the occurrence of physical disorders such as muscle pain, fatigue and sleep disturbances. In contrast, high levels of physical activity showed a significant positive correlation to general health, both physical and mental.
Each aspect in the table is explained through four main points:

1. Digital Device Use and Physical Activity shows that the higher the time spent with digital devices, the lower the level of physical activity.
2. The Impact of Digital Use on Physical Health highlights the physical symptoms experienced by intensive users of digital devices.
3. Physical Activity and General Health illustrates that regular physical activity contributes to feelings of well-being and positive energy.

4. Digital Use and Mental Health reveals that excessive digital use, especially for social media and work, increases levels of stress and anxiety.

The findings in this table indicate the need for a balance between technology use and an active lifestyle to maintain overall health.

DISCUSSION

Negative Correlation between Digital Device Use and Physical Activity

Intensive digital device use tends to be associated with decreased physical activity. A meta-analysis by Huang et al. (2023) found that smartphone addiction proneness was associated with low physical activity, with a negative correlation ($r \approx -0.24$, $p < .001$) among adolescents and young adults. That is, the higher the smartphone addiction, the lower the frequency of daily physical movement. This is in line with the findings of another cross-sectional study that reported a marked reduction in physical activity in a group of heavy smartphone users. Furthermore, observational data suggests that high screen time – specifically smartphone and social media use - displaces time that would normally be spent on active pursuits such as walking or moderate exercise. A cross-sectional study in China of 19,015 preschool-aged children confirmed that screen time ≥ 4 hours/day increased the odds of mental health problems and simultaneously decreased MVPA and outdoor activity (OR > 1.3) after adjusting for confounders.

These negative effects are not only related to the amount of screen time, but also to impulsive use patterns and digital multitasking. Media multitasking has been associated with higher levels of anxiety and impaired emotion regulation, which in turn reduces motivation to be active (Twenge & Haidt, 2022). Therefore, the intensity and pattern of digital interactions also play an important role in inhibiting physical activity. In populations, longitudinal studies have even shown that increased screen time consistently worsens mood and reduces sleep quality, which in turn negatively impacts fitness and physical activity (Wang et al., 2022). So not only a sedentary lifestyle, but also the psychological effects of screen time hinder physical activity. Thus, in the context of Medan, where digital use is increasingly massive, the combination of high screen time and limited public space for exercise may exacerbate low physical activity patterns. This finding confirms hypothesis H1 on the significant negative effect between digital use and physical activity.

Impact of Excessive Digital Use on Physical Health

Prolonged use of digital devices has been significantly correlated with musculoskeletal disorders, especially neck and back pain. A systematic review from BMC Public Health (2025) reported that sitting for more than six hours a day increases the risk of neck pain by 82% especially when using a mobile phone. This finding is in line with the urban community in Medan who are increasingly working-from-home or non-stop digital entertainment. In addition, the sedentary lifestyle induced by high screen time contributes to the increase in Body Mass Index (BMI). A meta-analysis by Huang et al. (2022) found a direct relationship between smartphone dependence and higher BMI and increased obesity among young adults in Asia. This demonstrates the real physiological risks of excessive digital use without the intervention of physical activity. Furthermore, sleep disruption caused by blue light exposure from digital screens at night also impacts physical health. Literature suggests that late-night screen time disrupts melatonin production and prolongs sleep onset (screen_time review, 2023). This worsens muscle recovery and metabolism.

Digital interventional studies show that mHealth apps and wearables can reduce sitting time and increase light activity. A meta-analysis of RCTs (JMIR 2025) showed an average reduction in sitting time of ~50 min/day and an increase in proportion of whole-day activity of ~4.6% ($d = -0.47$) in populations with chronic diseases. This emphasizes the potential of digital to reduce negative physical impacts if utilized appropriately. Overall, the combination of high digital usage with sedentary time has the potential to increase the risk of musculoskeletal pain, obesity and sleep disturbances. In Medan, these behaviours are likely to increase due to urbanization and digitalization, so interventions that facilitate the insertion of physical activity are urgently needed.

The Role of Physical Activity in Improving General Health

Recent studies have shown that regular physical activity-especially ≥150 minutes per week-has a positive impact on both mental and physical health. A *systematic review and meta-analysis of* children and adolescents found that active participation was strongly associated with reduced symptoms of depression, anxiety, stress, and improved subjective well-being, although the effects were relatively small (Fisher's $z \approx -0.20$ to $+0.17$, $p < .001$). Intervention trials also support this. A meta-analysis of various physical activity interventions in children and adolescents reported SMD = 0.37 (95 % CI: 0.20-0.53) for mental health improvements, and the largest effects were seen in stress reduction (SMD = 0.86) as well as improved social competence (SMD = 0.56). Among the adult population, a network meta-analysis of 218 RCTs-with more than 14,000 participants-showed that exercise types such as jogging, yoga and strength training were as effective as psychotherapy or medication in reducing depressive symptoms. Medium to high-intensity

exercise showed greater effectiveness, and strength training was particularly beneficial for younger age groups.

Studies during the COVID-19 pandemic are faced with the limitations of physical social interaction. However, extrapolation of meta-findings suggests that regular exercise (30-40 minutes/session, 3-5 times/week) does significantly reduce symptoms of anxiety, depression and stress and improve quality of life in times of crisis. Overall, scientific evidence from a broad age group suggests that physical activity not only lowers the risk of mental illness, but also strengthens general well-being - in line with the results of the Medan survey which showed a strong positive correlation (r=0.75) between high physical activity and general health perceptions. These findings support the importance of policies and programs to increase active movement in the community.

Digital Device Usen and Mental Health

Various longitudinal studies have shown that prolonged screen time is associated with an increased risk of depression, anxiety, and stress, especially in groups with screen time ≥4 hours/day. For example, prospective data from the ABCD Study found that increased screen time significantly increased depression, anxiety, ADHD, and oppositional behavior symptom scores in 9-10 year olds. Cohort meta-analyses also confirmed that screen time ≥1 hour/day increased the risk of depression, especially in females and younger age groups. This effect was consistent even after adjusting for variables such as physical activity and sleep, supporting the displacement hypothesis that screen time replaces healthy activities.

Recent interventional studies have also shown positive effects with reduced screen time. A three-week RCT in university students reduced smartphone use to ≤2 hours/day and successfully decreased symptoms of depression ($\eta^2 \approx 0.11$), stress ($\eta^2 \approx 0.085$), and improved sleep quality and subjective well-being. In addition, analysis of media types revealed that passive scrolling, texting, video games, and video chats had strong associations with negative mental symptoms. This suggests that not just duration but patterns and types of digital use affect mental health differently. Thus, the Medan survey findings showing a strong association between digital device use >8 hours/day with stress and anxiety (r = -0.72) are in line with global evidence. This underscores the urgency of screen time regulation, healthy digital education, and promotion of fitness-based devices as mitigation strategies for public mental health.

CONCLUSION

Based on the results of the analysis, it can be concluded that digital lifestyle transformation negatively affects people's physical activity and physical health. Excessive use of digital devices can reduce time for physical activity, which in turn increases the risk of health problems, such as obesity, sleep disorders, and other physical complaints. In addition, digital device use also affects mental health, with a significant increase in stress and anxiety among those who spend a lot of time with digital devices.

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