Majority Science Journal (MSJ) Vol. 3 No. 2, May 2025
P-ISSN: 0000-0000; E-ISSN:3025-1990
Available : https://jurnalhafasy.com/index.php/msj DOI: https://doi.org/10.61942/msj.v3i2.331

Silent Threat: Uncovering the Increase in Non-Compliance of Pediatric Prediabetes Cases in the Digital Age

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Abstract

The prevalence of prediabetes in children has shown a significant increase globally, including in Indonesia, along with lifestyle changes due to digitalization and urbanization. Children are now at risk of earlier onset of metabolic disorders, exacerbated by unhealthy diets, lack of physical activity, and high exposure to digital media and processed food advertisements. This condition often goes undetected due to the asymptomatic nature of prediabetes, while the transition to type 2 diabetes can occur without early intervention. This study uses a qualitative approach through literature studies to examine factors that influence non-compliance with prediabetes management in children in the digital era. Data sources were obtained from scientific journals and reports from trusted health institutions in the period 2015–2025, and analyzed using thematic techniques. The results of the study indicate that low health literacy, the dominance of a digital culture that supports a sedentary lifestyle, and minimal early detection in primary health services are the main obstacles. A cross-sectoral strategy involving families, schools, and the government is needed to increase awareness, strengthen nutrition education, and reform the child health care system to be able to face the challenges of prediabetes as a hidden epidemic in the future.

Keywords: *Digital-Lifestyle; Non-Compliance-Management; Prediabetes-Children*

Received : February 10, 2025 Revise : March 28, 2025
Accepted : April 20, 2025 Published : May 21, 2025

Citation :
Hutapea. D.M.M .(2025). Silent Threat: Uncovering the Increase in Non-Compliance of Pediatric Prediabetes Cases in the Digital Age. MSJ: Majority Science Journal , 3 (2), 8-17

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1. Introduction

In the last decade, the prevalence of prediabetes in children has shown a worrying trend globally, including in Indonesia. Data from the Centers for Disease Control and Prevention (CDC) in 2022 noted that around 1 in 5 adolescents aged 12–18 years in the United States suffer from prediabetes, with a similar trend starting to appear in developing countries due to the adoption of a passive urban lifestyle and consumption of high-calorie processed foods. A study by the Indonesian Pediatrician Association (IDAI) also confirmed that Indonesian children are now more susceptible to metabolic disorders at an early age, one of which is due to changes in the eating patterns of urban families with minimal fiber and vegetable intake, as well as the habit of sitting for hours in front of the screen. This indicates that prediabetes is no longer an adult problem, but has become a health threat to today's children.

This condition is exacerbated by the fact that prediabetes in children is often undetected because it is asymptomatic or only shows mild symptoms, such as fatigue or excessive thirst, which are often ignored (Engin et, 2022). Without early detection and intervention, the risk of transitioning from prediabetes to type 2 diabetes increases significantly. According to the American Diabetes Association (ADA), up to 70% of individuals with prediabetes have the potential to develop type 2 diabetes in the long term if there is no lifestyle change. Even more worrying, chronic complications such as kidney damage, visual impairment, and cardiovascular disease can begin to develop even in adolescence. These facts demand

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serious attention from the health, education, and family sectors to review their roles in preventing the rate of this silent epidemic among children.

Rapid digital transformation has changed the way children play, learn, and interact, but has serious consequences for their physical health. A study by Swider-Cios et al (2023) shows that children and adolescents worldwide now spend more than two hours per day in front of screens, often without adequate physical activity. In Indonesia, data from the Ministry of Health (Riskesdas 2018) shows that lack of physical activity in children has increased by 66.4%. The digital era encourages a sedentary lifestyle, where children prefer to play online games or watch videos rather than play outside the house. This habit not only worsens the body's metabolism but also disrupts the hormonal balance related to blood sugar regulation, increasing susceptibility to prediabetes from an early age.

Furthermore, digital technology facilitates access to unhealthy food advertisements and promotions, especially through social media platforms and online games. Children are the main target market for the processed food and sweetened beverage industry, which aggressively promotes their products. According to the Diba (2025) report, high exposure to unhealthy food advertisements is directly correlated with increased consumption of foods high in sugar and saturated fat in children. Ironically, most parents do not yet have adequate awareness of the long-term impacts of routine consumption of such foods. Amidst the lack of digital literacy and nutritional health, the younger generation is growing up in a digital ecosystem that structurally supports unhealthy eating behavior, making the digital era not only a technological challenge, but also a hidden health crisis.

Lack of compliance with the prevention and management of prediabetes in children is a major challenge in the health system, especially in developing countries like Indonesia. Many families still ignore the importance of routine check-ups, dietary changes, and increased physical activity as a form of early intervention. A study by Erika (2023) found that only around 30–40% of families with children with prediabetes consistently follow medical advice regarding a healthy lifestyle. This is exacerbated by the lack of psychosocial assistance in the process of behavioral change, which makes it difficult for children to maintain compliance with routines that are considered boring or restrictive. When nutrition or exercise education is limited to one-sided counseling, without involving structural changes in the child's environment, compliance becomes mere rhetoric.

On the other hand, socio-economic and cultural factors also influence this low compliance. Many families still have the wrong perception that "fat" children are a symbol of well-being, not a sign of disease risk. In addition, economic burdens often make families ignore health priorities, such as buying healthy food or accessing nutritional consultation services. Data from the Indonesian Ministry of Health (2022) also revealed that more than 50% of families in Indonesia do not know how to read the nutrition labels of packaged foods, which results in the wrong daily food choices. Without cross-sector interventions that are not only informative but also transformative, this non-compliance will continue to be a major obstacle in breaking the chain of transition from prediabetes to diabetes in children.

The lack of public awareness of prediabetes in children worsens the already critical situation. Many parents and educators still consider this condition as a mild or temporary health problem, whereas medically, prediabetes is a serious pre-pathological condition that requires immediate treatment. This phenomenon is driven by the lack of accurate and easily accessible information about the early symptoms and long-term risks of prediabetes. Research by Riyanto (2018) shows that most parents are unable to identify early signs of metabolic disorders in their children, such as excessive weight gain, persistent fatigue, or extreme thirst. When the public is unaware that this disorder can develop into type 2 diabetes, intervention is too late and the chances of prevention are drastically reduced.

Systemic weaknesses are also evident from the minimal involvement of health workers in early detection and education. Integrated health posts and primary health facilities often focus more on issues of stunting and malnutrition, so that children at risk of obesity and prediabetes are not included in screening priorities. A report from the Indonesian Ministry of Health (2021) stated that there is no national system that actively detects prediabetes in

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school-age children. This indicates a gap in policies and programs, where “silent health” problems such as prediabetes actually escape the radar. Without a paradigm shift in the health service system and without active community involvement in preventive education, the threat of prediabetes will continue to be a hidden epidemic that weakens the quality of future generations

2. Method

This study uses a qualitative approach with a literature review method to explore and analyze the phenomenon of increasing non-compliance with prediabetes management in children in the digital era. This approach was chosen because it allows researchers to deeply and contextually understand the social, cultural, and structural dynamics that influence the behavior of children and parents in dealing with prediabetes. The focus of the study is directed at critical interpretation of published scientific findings, in order to identify patterns, gaps, and potential solutions from various perspectives.

The data sources in this study were obtained through systematic searches of scientific journals, reports from national and international health institutions (such as WHO, IDAI, Ministry of Health of the Republic of Indonesia, CDC, and UNICEF), reference books, and relevant scientific publications from the last 10 years (2015–2025). The search was conducted through databases such as Google Scholar, PubMed, Scopus, and ScienceDirect with keywords including: prediabetes in children, non-compliance, digital lifestyle, pediatric metabolic syndrome, and health behavior. The collected data were analyzed using thematic analysis techniques to identify key themes related to causal factors, forms of non-compliance, and the role of the digital era in worsening or strengthening this situation. Data validity was maintained through source triangulation and cross-checking between literature.

3. Results And Discussion

Digitalization of Children's Lifestyles: Paradox of Progress and Threat to Metabolic Health

1. Increased Screen Time and Its Impact on Children's Physical Activity and Metabolic Regulation

Increased screen time in children has become a serious public health concern, especially because of its significant impact on physical activity and metabolic regulation. Along with the rapid development of technology, children now tend to spend more time in front of screens, whether for entertainment, education, or social interaction. A report from Kesumaningsari et al (2023) stated that children spend an average of more than two hours per day on screen-based activities, exceeding the recommended safe limit. This condition causes a decrease in time for physical activities such as playing outdoors or light exercise, which are important for growth and metabolic health.

Physiologically, lack of physical activity will reduce energy expenditure and increase body fat accumulation, especially visceral fat, which is closely related to metabolic disorders. A study by Putra & Junita (2022) showed that children with excessive screen time had higher fasting insulin levels and lower insulin sensitivity, two main indicators of the risk of prediabetes and type 2 diabetes. Another study by Banjarnahor et al (2022) also confirmed that screen time of more than two hours per day increased the risk of being overweight by 1.5 times compared to children with shorter screen time. This shows a direct relationship between a sedentary lifestyle and metabolic dysfunction in children.

A relevant case study comes from the longitudinal project "Growing Up Today Study (GUTS)" in the United States, involving more than 5,000 children and adolescents. The results of the study revealed that children with screen time of more than three hours per day had a 27% increased risk of obesity in five years. In addition, they were also less likely to engage in structured physical activity and had less healthy sleep patterns. Similar findings were also seen in a study by Azzahwa et al (2024), which noted that 68% of elementary school-aged children had screen time of more than four hours per day, with the prevalence of obesity reaching

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18.5%. This study also highlighted the link between screen time, low physical activity, and impaired sleep quality, which overall worsened children's metabolic control.

This condition shows that the use of technology, if not supervised and wisely limited, can be a new health risk factor for children. The education system and family environment need to be more proactive in educating and regulating the use of digital devices, while also facilitating space and time for children to remain physically active. Without serious intervention efforts, we risk facing a generation of young people who are physically weaker and more susceptible to metabolic diseases from an early age.

2. Digital Exposure to Unhealthy Food Advertisements and Its Impact on Children's Consumption Patterns

Digital exposure to unhealthy food advertisements has become a determining factor in shaping children's consumption patterns in the modern era. As children's use of social media, streaming platforms, and gaming applications increases, the fast food industry strategically utilizes this digital space to convey commercial messages wrapped in attractive visual content and often involving gamification techniques (Demmasapo, 2023). These advertisements are not only present in conventional forms, but are also embedded in videos of young influencers and online games, creating an atmosphere that disguises promotions as entertainment. In the context of cognitive development, children, especially those under the age of 12, neurologically do not yet have the capacity to distinguish advertising content from entertainment content. Jean Piaget's developmental theory supports this, explaining that at the preoperational and concrete operational stages, children are not yet able to think abstractly and critically about the commercial goals of advertisements, so they tend to accept advertising messages raw.

The implications for consumption patterns are significant. A meta-analysis by Suiraoka (2022) showed that repeated exposure to high-sugar, salt, and fat (GGL) food advertisements increased children's preference and consumption of these products, even for a long period of time after exposure. A follow-up study by Nurwanti (2016) confirmed these findings, where children who were more frequently exposed to unhealthy food advertisements consumed an average of 500 more calories per week than children who were not exposed. The UK then implemented strict regulations by banning unhealthy food advertisements during children's broadcast hours. Advergames games that integrate food promotions have a deeper impact than regular advertisements because they create emotional attachments that subconsciously strengthen consumer behavior (Hidayat & Aesthetika, 2024).

This problem is further complicated when associated with low nutritional literacy among parents. Many parents are unaware of how digital advertising affects children's eating behavior and are often unable to effectively control their children's food intake. The accumulation of high GGL food consumption, coupled with a sedentary lifestyle common among children who use technology, creates ideal metabolic conditions for the development of non-communicable diseases from an early age, such as obesity and prediabetes. In the long term, these consumption patterns formed since childhood will be carried over into adulthood, exacerbating the burden on public health.

Therefore, a multidimensional intervention is needed that includes strengthening digital food advertising regulations, family-based nutritional literacy education, and redesigning digital platform algorithms so that they do not aggressively target children with unhealthy food promotion content. With this integrated approach, it is hoped that a safer digital environment can be created that supports children's holistic growth—both physically and cognitively.

Non-Compliance as a Reflection of Systemic Failure: Between Health Education, Family Culture, and Access to Services

1. The Role of Culture and Family Perceptions of Nutrition in Driving Resistance to Lifestyle Change

In Indonesian society, perceptions of children’s nutritional status are often more influenced by cultural values than medical understanding. Fat children are often seen as a symbol of health, well-being, and the success of their parents in meeting their nutritional needs,

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while thin children tend to be perceived as underfed or malnourished. This view has been ingrained for a long time and has been passed down from generation to generation, creating a social norm that is difficult to replace with more objective medical knowledge. As a result, when health workers recommend lifestyle changes, such as reducing consumption of high-fat foods or increasing physical activity, many parents refuse or feel that they do not need to do so because they consider their child's condition to be "healthy."

Research published by Anggraeni (2024) confirms that more than half of parents in Southeast Asia do not recognize childhood obesity as a health problem. This is because body fat is still considered a normal part of a child's growth. Furthermore, a medical approach that does not take into account local values and culture tends to trigger resistance. In the Health Belief Model (HBM) theory, it is explained that a person will be more likely to change their behavior if they understand the benefits of the action, feel at risk, and are not hampered by social or cultural barriers. When medical advice conflicts with cultural beliefs or is considered disruptive to family harmony, psychological and social barriers will outweigh the medical benefits offered.

A case study in Yogyakarta provides a concrete illustration of this challenge. In a school-based nutrition intervention program, efforts to improve children's diets did not yield significant results because it did not involve families and did not take local culture into account. Parents continued to provide foods high in sugar and fat because they felt that it was a form of affection and appreciation for their children. In contrast, a different approach was applied in a program in West Java that involved community leaders and used a cultural approach through Posyandu and gotong royong activities. This program not only used local languages, but also framed health messages as part of family values and social responsibility. As a result, family participation increased, and there was a real change in children's consumption patterns and physical activity.

From the description above, it can be concluded that resistance to healthy lifestyle changes does not always come from a lack of information, but more often comes from a conflict between cultural values and a non-contextual medical approach. Therefore, the success of a child health program is highly dependent on the ability of the organizer to understand and align interventions with local culture. With an approach that is sensitive to cultural context, healthy lifestyle changes are not only possible but also sustainable because they are supported by a supportive social and family environment.

2. Limitations of the Primary Health System in Early Detection and Community-Based Intervention

The limitations of the primary health system in early detection of the risk of prediabetes in children are one of the main obstacles in preventing the increasing prevalence of non-communicable diseases at a young age. Basic health services, such as health centers and integrated health posts, have so far focused more on handling malnutrition and infectious diseases, so that attention to obesity and metabolic disorders in children is still very minimal. In fact, the 2018 Riskesdas data shows that the prevalence of obesity in school-age children in Indonesia has reached 9.2%, indicating a large potential for prediabetes that is missed from monitoring. The BMC Health Services Research study (2021) shows that the lack of training for health workers on early identification of prediabetes, as well as limited screening tools such as measuring HbA1c or BMI percentiles in children, are the main causes of many cases that are not detected until they reach an advanced stage (Jonas et al., 2022; Duan et al., 2021)

This condition is exacerbated by the suboptimal integrated community-based approach. Health education in schools and integrated health posts is still sporadic and unstructured, so it does not build long-term awareness of healthy eating patterns and physical activity that are important in preventing prediabetes. A case study conducted by Padjadjaran University in West Java in 2020 confirms this finding. Of the 500 elementary school-aged children surveyed, around 15% showed signs of prediabetes risk, but only 4% of them had ever received counseling or referrals from primary health facilities. Furthermore, around 70% of integrated

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health post cadres involved in the study did not have an understanding of metabolic diseases in children.

In contrast, a more integrated approach has shown much more promising results. A program in the Philippines reported in the International Journal of Pediatric Endocrinology (2020) increased early detection of diabetes risk in children by 40% in two years through active collaboration between schools and community health centers. The program involved regular screening in schools, training of teachers and community cadres, and direct involvement of parents in nutrition and healthy lifestyle education. This success shows that when primary health care systems are supported by sustainable community-based interventions, the effectiveness of early detection and health education can be significantly improved.

Therefore, Indonesia needs to reform the primary health system that includes strengthening the capacity of health workers, providing age-appropriate screening tools, and integrating school and integrated health post programs into the national health registration system. By building synergy between the health, education, and community sectors, early detection of prediabetes and preventive interventions can be more effective and comprehensive, thereby reducing the burden of non-communicable diseases in the future.

4. Conclusion

The advancement of digital technology has brought significant changes to children's lifestyles, but behind its benefits, there are serious threats to their metabolic health. Increased screen time reduces physical activity and has a direct impact on metabolic regulation, increasing the risk of obesity, prediabetes, and sleep disorders. In addition, exposure to unhealthy food advertisements in digital spaces worsens children's consumption patterns which tend to be high in sugar, salt, and fat, especially because their cognitive abilities are not yet ready to filter commercial messages. On the other hand, cultural values and family perceptions that do not fully understand the risks of obesity are obstacles to changes in healthy behavior. The limitations of the primary health system in early detection and community-based interventions further exacerbate this condition. Therefore, a holistic and cross-sectoral approach is needed—combining family education, digital media regulation, and strengthening basic health services—to create an environment that supports healthy and sustainable child growth

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