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- Original image
- Letter to the editor

B. References

C. Special Terms and Conditions

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ANATOL J FAMILY MED

The Anatolian Journal of Family Medicine

Volume 9 · Issue 1 · Year 2026

REVIEW

1 Artificial Intelligence-Driven Simulation Training in Medicine: A Contemporary Narrative Review

ORIGINAL ARTICLES

7 Evaluation of Rope Jumping and Strength Training in Children with Low Vision

12 Readability, Content Quality, and Reliability of Turkish Websites on Diabetes Mellitus

18 Perceived Social Support and its Determinants among Individuals with Substance Use Disorder: A Community-Based Cross-Sectional Study

25 Breast Cancer Knowledge and Awareness among Women in Two Socioeconomically Distinct Districts of Ankara

CASE REPORTS

33 Plethora of Characteristic Findings in Osteopetrosis: A Case Report

36 A Case of Malnutrition Inflamation Atherosclerosis Syndrome in Home Care

LETTER TO THE EDITOR

39 The Interdisciplinary Role of Family Medicine in the Age of Infodemic

ANATOL J FAMILY MED

Review

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Artificial Intelligence-Driven Simulation Training in Medicine: A Contemporary Narrative Review

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ABSTRACT

Artificial intelligence (AI) is increasingly transforming healthcare simulation training by enhancing learning experiences, optimizing skill acquisition, and providing personalized feedback. This review synthesizes current evidence on AI-driven simulation training across medical disciplines, exploring its applications, advantages, limitations, and future directions. Based on a comprehensive PubMed search identifying relevant literature, this review integrates the most significant contributions to provide a critical and integrative perspective. AI-driven simulation training enhances medicine by improving communication skills, surgical proficiency, diagnostic accuracy, and clinical decision-making. AI-powered tools provide real-time feedback, personalized learning, and standardized assessments across various healthcare disciplines. Despite its benefits, challenges such as data privacy, high costs, and ethical concerns hinder widespread adoption. Future efforts should focus on standardization, collaboration, and ethical integration to optimize AI's role in medical training. AI-driven simulation training is transforming medicine by providing personalized, data-driven learning and enhancing skill development. While challenges like cost, data security, and ethics persist, ongoing research and collaboration can facilitate AI's seamless integration. With continued advancements, AI holds the potential to improve competency and patient safety in healthcare training.

Keywords: Artificial intelligence, medical training, medicine, simulation training

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INTRODUCTION

Medical education has undergone significant changes with the integration of artificial intelligence (AI)-driven technologies, particularly in simulation-based training. Traditional medical training relies heavily on direct patient interactions, didactic lectures, and supervised clinical practice.[1,2] However, limitations such as patient safety concerns, variability in case exposure, and subjective skill assessments have led to the development of AI-enhanced simulation training tools.[3] These tools provide structured, repeatable, and adaptive learning experiences, allowing healthcare professionals to refine their competencies in a risk-free environment.[4-7]

The application of AI- in medicine extends beyond technical skills to include communication training, decision-making, and performance assessment.[8] AI-enhanced simulations can provide individualized feedback, improve skill retention, and facilitate standardization in training programs. Given the increasing adoption of AI-based training across multiple medical specialties, a systematic analysis of its effectiveness, challenges, and future potential is necessary.[9-12] This review aims to evaluate AI-driven simulation training, discuss its applications in various medical disciplines, and explore its future implications.

METHODS

This study is a narrative review that synthesizes and critically examines the current literature on AI-driven simulation training in medicine. The review follows a structured approach to ensure a comprehensive and balanced analysis of existing research while allowing for flexibility in exploring emerging themes and trends.

Literature search strategy

The PubMed and CINAHL databases were used for searching the same keywords and compared the results. Since PubMed provided the most comprehensive coverage, encompassing results from the other databases, researcher opted to focus solely on PubMed for analysis.

The search was performed using key terms such as "[Artificial intelligence], [AI], [Medicine], [Medical], [Healthcare], [Training], [Education], [Simulation]" in combination with Boolean operators (AND/OR) to refine the search. In addition to the database search, the reference lists of all relevant articles were manually screened, which resulted in the identification of six additional studies that met the inclusion criteria and were incorporated into the review.

Inclusion and exclusion criteria

Studies included in this review met the following criteria:

- Peer-reviewed articles
- Studies focusing on AI-driven simulation in medicine
- Articles published in English
- Publications from January 2020 to 2025

to ensure relevance to contemporary developments.

Studies were excluded if they were:

- Editorials, opinion pieces, dissertations, or preprints not subjected to peer review
- Focused on non-medical applications of the topic
- Lacking sufficient methodological transparency.

Data extraction and thematic analysis

Relevant articles were reviewed, and key concepts, findings, and methodological approaches were systematically extracted. A thematic analysis was conducted following Creswell's qualitative content analysis approach, in which recurring concepts across the included studies were coded, categorized, and synthesized into overarching themes. [13] The synthesis process involved:

1. Categorizing findings into key domains (e.g., technological advancements, training methodologies, effectiveness, challenges, and future directions)
2. Comparing and contrasting studies to highlight consistencies and divergences in results
3. Identifying knowledge gaps to propose areas for future research.

Quality assessment

Although a formal systematic review was not conducted, efforts were made to ensure methodological rigor by prioritizing peer-reviewed studies with transparent methodology, adequate sample descriptions, and clearly reported outcomes, and by excluding sources with potential bias.

This approach enables a comprehensive yet flexible examination of the literature, offering critical insights into the topic while identifying gaps and potential future directions.

RESULTS

The integration of AI into simulation-based medical training has led to significant advancements across multiple healthcare disciplines. AI-driven simulation enhances clinical skills, decision-making, and personalized learning, offering innovative training approaches tailored to the needs of medical learners. Based on a thematic synthesis of the literature, six key domains of AI applications in simulation training have been identified.

AI-driven communication and interpersonal skills training

AI-powered virtual patients and natural language processing systems have transformed communication training in medical education by providing interactive, real-time feedback. These systems simulate diverse patient interactions, helping trainees refine diagnostic questioning, counseling, and interpersonal skills.[14,15] AI-generated standardized patient dialogues are particularly useful for prenatal counseling, breaking bad news, and patient education.[3]

Moreover, AI-driven conversational agents enhance patient-doctor communication training by mimicking complex emotional responses, enabling medical students to practice empathetic communication in a controlled, iterative environment. This is particularly valuable in training healthcare professionals to navigate sensitive discussions such as end-of-life care, informed consent, and cultural competency in healthcare delivery.[16]

AI in procedural and surgical simulation training

AI-enhanced surgical simulators integrate virtual reality,

augmented reality, and robotic-assisted technologies to improve procedural accuracy and surgical competency. AI-powered robotic surgery training platforms, such as the Da Vinci surgical system, provide real-time feedback, assisting trainees in refining their motor skills and decision-making abilities.[17]

Furthermore, AI-driven tele-surgical training offers remote mentorship and skill assessment, particularly benefiting medical learners in resource-limited settings by facilitating access to global surgical expertise.[18,19] Several studies have demonstrated that AI-enhanced laparoscopic and microsurgical simulations significantly improve procedural confidence, reduce operative errors, and enhance skill retention among trainees.[20,21]

AI-based ultrasound guidance systems are also being integrated into regional anesthesia training, assisting clinicians in needle placement and reducing the likelihood of complications.[22]

AI in dental and endodontic training

In dental education, AI has been applied in radiographic interpretation, treatment planning, and skill assessment, improving students' diagnostic accuracy and decision-making abilities.[8] AI-driven radiological image analysis tools support dental trainees in differentiating complex dental pathologies, improving patient safety by reducing misdiagnosis rates.[23]

In addition, AI-based haptic simulation training is being explored to enhance manual dexterity and fine motor control in dental procedures, particularly for endodontic and restorative procedures. AI-powered feedback mechanisms help trainees adjust their techniques in real-time, leading to greater precision in operative dentistry.

AI-generated imaging for medical training

AI-generated radiological images have revolutionized medical training by providing a diverse range of pathologies that can be used for diagnostic practice. AI-generated mammographic datasets and synthetic chest X-rays are now being used to enhance radiology training programs, enabling students to improve diagnostic accuracy and case interpretation skills.[24]

Similarly, AI-assisted osseous biopsy simulations are being integrated into orthopedic and pathology training, enhancing precision in bone tumor diagnosis and guided biopsies.[25] AI-driven pathology simulation models allow learners to practice recognizing microscopic patterns in tissue samples, improving histopathological diagnosis.

AI in clinical decision-support training

AI-based clinical decision-support systems enhance medical trainees' ability to analyze complex patient cases, refine diagnostic reasoning, and optimize treatment planning.[26] These systems provide data-driven recommendations, helping trainees navigate clinical uncertainty and integrate evidence-based decision-making into their practice.

AI-driven neurological and oncological training platforms allow students to simulate real-world patient management scenarios, improving critical thinking and decision-making in high-risk specialties such as neurosurgery and oncology.[27]

DISCUSSION

The integration of AI into simulation-based medical training has transformed traditional educational paradigms by providing adaptive, data-driven learning environments. AI-driven simulations offer personalized skill development, real-time feedback, and enhanced procedural accuracy, addressing key limitations of conventional training methods. However, despite these advancements, several challenges must be considered, including ethical concerns, technological constraints, and accessibility barriers. This section explores AI's role as a complementary tool in medical training, examines regulatory and ethical challenges, and discusses strategies for optimizing AI's integration into medical education.

AI as an augmentative tool in simulation training

The integration of AI into medical simulation training has introduced novel, data-driven educational models that enhance learning efficiency, accuracy, and adaptability. However, AI-driven tools should be viewed as complementary rather than replacements for traditional medical education methodologies. AI-powered virtual patients and conversational AI models, for instance, offer structured communication training but cannot fully replicate the nuances of human interaction, particularly in complex emotional exchanges.[15,28,29]

Similarly, while AI-driven surgical simulation significantly enhances technical skills, tactile feedback and real patient exposure remain essential for mastering procedural competence.[17] AI should therefore be integrated into hybrid learning models, combining simulation with bedside patient encounters for a more comprehensive training approach.

Ethical and regulatory challenges

Despite AI's educational benefits, several ethical and regu-

latory concerns remain. One of the major concerns is algorithmic bias, which can result from AI models being trained on non-representative datasets, leading to disparities in training outcomes.[30] In addition, AI-driven decision-support tools must be validated rigorously to ensure their accuracy, reliability, and clinical applicability.[31,32]

Bridging the digital divide

The high cost of AI-driven simulation tools, hardware requirements, and limited access to AI infrastructure pose barriers to widespread adoption, particularly in low-resource settings.[33] Expanding access to open-source AI training models and promoting AI-driven cloud-based simulation platforms could help democratize medical training.[34]

Limitations

This narrative review has several limitations. The included studies vary considerably in design, outcome measures, and reporting quality, which limits the ability to synthesize findings and draw generalizable conclusions. In addition, some studies lacked sufficient detail regarding sample characteristics, evaluation procedures, or AI model performance, reducing the clarity and comparability of the evidence. Finally, as this review is not systematic, the possibility of publication bias and the exclusion of non-peer-reviewed sources should be acknowledged.

Future directions for AI in medical simulation training

The future directions identified in this review were derived directly from the gaps observed in the existing literature. To fully harness AI's potential in medical education, future research should focus on:

- Standardization and validation: Establishing rigorous validation frameworks for AI-based training tools and conducting large-scale randomized controlled trials to assess effectiveness[35]
- Interdisciplinary collaboration: Enhancing cooperation among medical educators, AI developers, and policymakers to bridge the gap between AI advancements and real-world clinical training needs
- Ethical AI ımplementation: Developing clear ethical guidelines for AI use in medical training, ensuring accountability, transparency, and bias mitigation. Institutional review boards should oversee AI-driven training programs
- Curriculum ıntegration: Embedding AI-enhanced simulation training into standardized medical curricula, incorporating it into competency-based assessment models to ensure accessibility and effectiveness
- Longitudinal studies: Conducting long-term research to evaluate AI's impact on skill retention, clinical decision-making, and patient safety outcomes.[36]

CONCLUSION

AI-driven simulation training is transforming medical education by offering personalized, data-driven learning experiences. By integrating machine learning, virtual patients, and robotics, AI enhances clinical competency, procedural accuracy, and decision-making. Despite its potential, challenges such as cost, data security, and ethical concerns must be addressed for widespread adoption. Interdisciplinary collaboration and ongoing research are essential to optimize AI's integration into medical training. Establishing robust ethical guidelines and validating AI-based training models will ensure equitable and effective implementation. **Moreover, the adaptability of AI-driven simulation approaches suggests potential value for family medicine and primary care training, where scalable and standardized educational tools are increasingly needed.** With continued advancements, AI has the potential to improve medical education, enhance skill development, and ultimately contribute to better patient safety.

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Evaluation of Rope Jumping and Strength Training in Children with Low Vision

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ABSTRACT

Objectives: The aim of the study was to investigate the effect of rope jumping and strengthening training on muscular and aerobic fitness in children with low vision.

Methods: Nineteen children with low vision aged 10–14 years were included in the study. The children were randomly divided into two groups: The training group with 9 children (47.3%) and the control group with 10 children (52.6%). Sit-up test, modified push-up test, and one-mile run/walk test were used for the evaluation. Training group received rope jumping and strengthening training. The training was conducted in 45-min sessions, twice a week, for 8 weeks. The control group did not participate in any exercise program.

Results: At the end of 8 weeks, the training group showed a significant improvement in the sit-up test ($p<0.001$) and one-mile run/walk test ($p=0.017$), but there was no significant difference in the modified push-up test ($p=0.299$). In the control group, there was no significant difference in the sit-up test ($p=0.168$), modified push-up test ($p=0.864$), and one-mile run/walk test ($p=0.467$). When the post-training values between groups were compared, there was a difference in favor training group for sit-up test ($p=0.039$) and the one-mile run/walk test ($p=0.044$).

Conclusion: Exercise training consisted of jumping and strengthening exercises, significantly improved muscular strength and aerobic capacity in children with low vision.

Keywords: Aerobic capacity, child, exercise training, low vision, muscular strength

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INTRODUCTION

In children, poor vision means impaired visual performance as a result of impaired visual acuity and contrast sensitivity, visual field defects, and other related dysfunctions.[1,2] Low vision is defined as a level of vision when the person cannot perform visual activities with standard glasses or contact lenses.[3]

Visual perception provides a stimulus for a child to move and a feedback for movement correction and development. Therefore, low visual perception affects the child's motor development organization.[4] Previous studies have reported that children with low vision have poorer motor skills than sighted children.[5,6] Insufficient motor competence may be caused by re-

duced physical activity participation in visually impaired children.[7]

Visually impaired children have a more sedentary lifestyle than sighted children. The level of physical fitness and exercise tolerance in visually impaired children is lower than that of sighted children.[8-10] A study by Hopkins et al.[11] found that children with visual impairments had lower maximal oxygen consumption and aerobic capacity compared to healthy children.[11] A visually impaired child needs activities such as cooperation, competition, and team play as sighted children. Participation in physical activity helps with personality development, confidence, and independence. Increased participation in physical activity is important for the motor development and physical fitness of visually impaired children.[12,13] In the literature, studies on physical activity in visually impaired children mostly focus on general physical fitness, balance, or motor skills, while findings on specific and applicable training models that simultaneously target aerobic capacity and muscle strength are limited. This study contributes to the literature by examining the effects of a structured exercise program combining rope jumping and strengthening training on muscle strength and aerobic capacity in visually impaired children, making it one of the few studies in this area. Furthermore, the evaluation of a low-cost, accessible, and easily implementable activity, such as rope skipping in conjunction with a strength training program adapted for visually impaired children enhances the practical applicability and clinical significance of the study. In this regard, the study provides an evidence-based approach for exercise prescriptions, rehabilitation programs, and school-based physical activity interventions designed for visually impaired children.

This study aimed to investigate the effect of rope jumping and strengthening training on muscular strength and aerobic capacity in children with low vision.

METHODS

The study was conducted at a public school for visually impaired children. Nineteen visually impaired children participated in the study, including 11 girls (57.9%) and 8 boys (42.1%). The children were randomly divided into two groups: The training group with 9 children (47.3%) and the control group with 10 children (52.6%). Randomization was done with the Statistical Package for Social Sciences (SPSS) (SPSS Inc., Chicago, IL, USA) program for group allocation. The inclusion criteria were children aged 8–15 years who could walk independently, had low vision, and had no comorbidities. The exclusion criteria were a diagnosis of cardiac disease or the presence of hearing or intellectual disabilities.

Ethical approval for this study was obtained from the local ethics committee (Date: May 16, 2017; number: 07). Written informed consent was obtained from the parents or legal guardians of all children. The study is conducted according to Declaration of Helsinki.

Demographic data of the participants were recorded before the evaluations. All assessment tests were performed at baseline and at the end of the 8th week. Standardized test protocols were used in the evaluation. The tests were performed in the same conditions and by the same experienced physiotherapist. In the evaluation, tests that have been shown to be valid in the child population, are easy to administer, reliable, and do not require special equipment were preferred. The abdominal muscle strength and endurance of the participants were evaluated by sit-up test, upper body strength and endurance by the modified push-up test, cardiorespiratory capacity by one-mile run/walk test.

Sit-up test

The test was used to assess the strength and endurance of abdominal muscles. Participants were in the supine position for evaluation, knees bent, hands on the side, and the soles of the feet on the ground. When the participants lay down on the ground, their shoulders touched the ground and elbows touched their knees. Participants started to perform sit-ups with the "Start" command. The number of sit-ups that the participant could repeat within 30 s was recorded.[14]

Modified push-up test

This assessment was used to measure the upper-body strength and endurance of the participants. The test began with the participants in the prone position, arms extended to the sides at 90°, one leg placed over the other, and knees resting on the ground. The child was asked to push his elbows up until he reached full extension, then to return to the initial position. This movement was considered one push-up, and participants began performing push-ups when given the "Start" command. The number of push-ups completed within 30 s was recorded.[15]

One-mile run/walk test

The test was used for assessing aerobic capacity. In the test, the children were asked to complete one mile (1609 m) by running or walking. Pulse measurements of each of the children were performed before and after running. The time participants completed the one-mile distance was measured with a stopwatch.[16]

Exercise training

The training was conducted in 45-min sessions, twice a week, for 8 weeks. Training session included warm-up (10 min), jumping and strengthening exercises (30 min), and cool down (5 min). The exercise program consisted of the following exercises:

- 10-min walking for warm-up
- Sit-up exercise (10 times/3 sets)
- Push-up exercise (10 times/3 sets)
- Bridge exercise (10 times/3 sets)
- Upper extremity strengthening with dumbbells (10 times/3 sets)
- Lower extremity strengthening with a sandbag (10 times/3 sets)
- Jump rope training (25 times ×4 sets)
- 5 min walking for cool down.

At least 1 min rest intervals between sets were given according to the tolerance of the children. In exercise training, the number of sets and the number of jumping rope was determined according to the child's fatigue.

Participants in the control group did not perform any exercise program or physical activity.

The data obtained were evaluated with the SPSS program. Continuous variables were given as mean±standard deviation, categorical variables as numbers and percentages. Kolmogorov–Smirnov method was used to determine whether the data had a normal distribution. The Independent-Samples t-test was used to compare demographic data between groups, and the Paired-Sample t-test was used to compare before and after training data within groups. Analysis of covariance test was used to compare for post-training values of the groups, with baseline values entered as covariates.

RESULTS

Demographic data are shown in Table 1. There was no difference between the training and control groups in demographic data, baseline sit-up test, modified push-up test, and one-mile run/walk test values (p>0.05) (Table 1).

At the end of 8 weeks, the training group showed a significant improvement in the sit-up test (p<0.001) and one-mile run/walk test (p=0.017), but there was no significant difference in the modified push-up test (p=0.299). In the control group, there was no significant difference in the sit-up test (p=0.168), modified push-up test (p=0.864), and one-mile run/walk test (p=0.467) (Table 2).

In comparison of the post-training values of the groups, there was a difference in favor of training group for the sit-up test (p=0.039) and the one-mile run/walk test (p=0.044) (Table 3).

DISCUSSION

In the present study, the effect of rope jumping and strengthening training on muscular and aerobic fitness in low vision children was examined. The results of the study were 8-week exercise training consisted of rope jumping and strengthening exercises that improved muscular strength and aerobic capacity in children with low vision.

Large muscle development is important for the independent movement skills of children with visual impairment.

Table 1. Comparison of demographic characteristics of groups

Variable	Training group (n=9)	Control group (n=10)	Z	p*
	Mean±SD	Mean±SD		
Age (years)	12.0±1.1	11.6±0.8	−0.603	0.546
Height (cm)	149.7±11.5	149.7±13.9	−0.491	0.624
Weight (kg)	45.4±9.9	44.8±18.0	−0.780	0.435
BMI (kg/m^2)	20.4±5.1	19.5±6.2	−0.816	0.414

SD: Standard deviation, BMI: Body mass index, *Independent-samples t-test

Table 2. Comparison of sit-up test, push-up test and one-mile run/walk test values in groups before and after training

Variable	Training group (n=9)		p*	Control group (n=10)		p*
	Pre	Post		Pre	Post	
	$\bar{X}$ Mean±SD	$\bar{X}$ Mean±SD		$\bar{X}$ Mean±SD	$\bar{X}$ Mean±SD	
Sit-up test	15.6±3.5	18.0±3.5	**<0.001**	15.3±2.9	16.1±3.1	0.168
Modified push-up test	17.8±2.2	17.1±3.1	0.299	16.4±3.7	16.3±3.1	0.864
One-mile run/walk test	14.8±2.3	14.1±2.4	**0.017**	16.5±3.4	16.4±3.3	0.467

SD: Standard deviation, *Paired-sample T-test

Table 3. Compare for post-training values of the groups

Variable	Training group (n=9)	Control group (n=10)	p*
	$\bar{X}$ Mean±SD	$\bar{X}$ Mean±SD	
Sit-up test	18.0±3.5	16.1±3.1	**0.039**
Modified push-up test	17.1±3.1	16.3±3.1	0.686
One-mile run/walk test	14.1±2.4	16.4±3.3	**0.044**

SD: Standard deviation, Analysis of covariance test

First movement experiences, such as independent walking, facilitate the development of muscular endurance, strength, and balance. All of these elements allow the child to control their body with safer, more competent, and more graceful movements.[6,17,18] In most children with visual impairment, sensory-motor development may be insufficient due to the lack of movement experience due to visual impairment. This retardation can significantly affect independent movement performance.[5,6,19,20]

Taskın et al.[20] reported that children with low vision in the 6–15 age group reported that the lack of visual perception negatively affects gross and fine motor skills. Uysal and Düger and Bouchard and Tetreault reported similar findings for children aged range 7–14 years.[5,6]

Developing the motor performance of visually impaired children is very important. Aki et al.[21] implemented a motor training program for children with low vision, including activities for balance, strength, body coordination, upper extremity coordination, visual-motor control, and manual skills. Significant improvement was found in all parameters.

There was a one study in the literature, examined the efficacy of exercise intervention on physical fitness in with an age range of 15–17, children with visually impaired. In the study by Chen and Lin,[22] the effectiveness of rope jumping exercises on body mass index, sit and reach, sit-up, and progressive aerobic cardiovascular endurance run tests was examined. The authors concluded that rope jumping exercises significantly improved aerobic capacity and flexibility. The results of their studies were similar to our results in terms of aerobic capacity. However, our finding was different for sit-up test results. We found that both aerobic capacity and abdominal strength improved in our sample. We thought that the reason for the different findings might be adding strengthening exercises to rope jumping.

Moderate aerobic exercises are recommended by experts for children and adolescents. In the 1970s and 1980s, strengthening exercises were thought to be particularly harmful to adolescents; however, strong evidence has been put forward that this is merely an illusion devoid of evidence. More recently, the idea that strengthening exercises are beneficial for young people between the ages of 12 and 15 has been increasingly adopted. Therefore, both aerobic and strength training were applied in a combined manner.[23,24]

The limitation of the study was that the number of participants was low due to the low number of students in the visually impaired school.

CONCLUSION

Rope jumping and strengthening training had a positive effect on muscular strength and aerobic capacity in children with low vision. In light of these results, a combined aerobic and strength training is beneficial for the development of physical fitness in low-vision children. We recommend rope jumping and strengthening exercise training to improve muscular strength and aerobic capacities of children with low vision.

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Readability, Content Quality, and Reliability of Turkish Websites on Diabetes Mellitus

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ABSTRACT

Objectives: The aim was to evaluate the knowledge content, readability level, reliability, and quality levels of Turkish websites prepared about diabetes.

Methods: The Turkish words "sugar disease" were searched for using the Google (https://www.google.com.tr) search engine. Ateşman and Bezirci-Yılmaz readability values of the texts included in the study were calculated. The reliability of the content was evaluated using the Quality Criteria for Consumer Health Information (DISCERN) scale, based on the diabetes mellitus (DM) diagnosis and treatment guidelines (2022) published by the Turkish Endocrinology and Metabolism Association, while the writing quality and reliability of the text were assessed using the Journal of the American Medical Association (JAMA) score.

Results: Of the 111 Turkish websites included in the study, 89 were prepared by health professionals (80.2%) (Group 1) and 22 were prepared by others (19.8%) (Group 2). For all websites, the mean value for readability level was 50.2±8.1 according to Ateşman and 12.9±2.5 according to Bezirci-Yılmaz. There was no statistically significant difference between Group 1 and Group 2 in terms of Ateşman and Bezirci-Yılmaz readability levels (p=0.249, p=0.207, respectively). For all websites, the median DISCERN scale scores were 31 (17–68), with a mean JAMA score of 1 (0–3). The DISCERN scale scores and JAMA scores were statistically significantly higher for websites in Group 1 compared to websites in Group 2 (p=0.001, p=0.014, respectively).

Conclusion: Turkish-language internet texts on DM demonstrated poor readability, with difficult and university-level readability according to the Ateşman and Bezirci–Yılmaz indices, respectively, and were found to have inadequate content quality and low reliability based on the DISCERN scale and JAMA score.

Keywords: Diabetes, diabetes mellitus, internet, quality, readability, reliability

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INTRODUCTION

Diabetes mellitus (DM) is known to the public in Turkey as "sugar disease."[1] Emerging as a result of insulin release and/or defects, it is a chronic metabolic disease causing disruption of carbohydrate, protein, and fat metabolism.[2] It is included in the top four non-infectious diseases causing mortality.[3] According to 2021 International Diabetes Federation (IDF) data, there are 537 million individuals with diabetes diagnosis worldwide and it is estimated that 6.7 million individuals aged 20–79 years die due to diabetes-related causes. Again, according to 2021 IDF data, the diabetes prevalence in Türkiye is 14.5% and it was reported that 83,221 individuals with diabetes aged 20–79 years died due to diabetes-related causes.[2] According to the TURDEP-II study data in our country, 42% of the adult population have diabetes or prediabetes diagnosis with increases observed in the number of diabetes cases.[3]

The internet appears to be a practical, easy, and cheap method for acquiring information for the curious. However, there are differences in the readability and comprehensibility levels of the information. It is important that accessible information should be accurate and current, in addition to being appropriate for the general literacy level of society to be comprehensible. Readability is defined as texts being "easy or difficult to understand" by readers and is an objectively measurable concept.[4] The number of syllables in words, sentence length, and number of words with multiple meanings are among the factors affecting readability level.[5] Although there are several formulas to measure readability level, there is research revealing that these formulas, which were not designed for the Turkish language, are inadequate to measure the readability levels of Turkish texts.[6] To measure the readability levels of Turkish texts, the Ateşman readability formula[7] and Bezirci-Yılmaz readability formula[8] were developed.

In Türkiye, the proportion of those aged 25 and over with associate degree, undergraduate degree, master's degree, and doctoral degree in 2008 was 9.8%, while by 2023, this proportion was 24.6%. In 2008, the proportion of those graduating with secondary education and higher education levels was 26.5%, while by 2023, this proportion rose to 48.3%. The Turkish Statistical Institute reported that the mean education duration of the population aged 25 years and older was 9.3 years in 2023. This proportion was reported to be 8.5 years for women and 10.0 years for men.[9]

In our study, the aim was to assess Turkish internet websites containing information prepared about DM, with investigations according to the Ateşman and Bezirci-Yılmaz readability formulas for readability levels, DM Diagnosis and Treatment Guidelines-2022 (TEMD-DM-2022) published by the Turkish Endocrinology and Metabolism Association for reliability of site content, and the Quality Criteria for Consumer Health Information (DISCERN) and *Journal of the American Medical Association* (JAMA) scores for quality and reliability.[3]

METHODS

Our study is cross-sectional research. As DM is known as "sugar disease" by the Turkish public, in May 2024, the search was performed by writing "sugar disease" into the Google (https://www.google.com.tr) search engine. The internet sites on the first 15 pages were evaluated. Commercial blog sites, sites containing ads, sites with only pictures or videos, chat sites, forum sites, sites with magazine content, and sites with <10 sentences were excluded from the assessment. The information texts on sites included in the research were transferred to the Microsoft Word program with the author information, educational titles, site URL, and links removed so as not to affect the readability evaluation results. The tests were transferred to a computer program, and the Ateşman and Bezirci-Yılmaz readability values, number of words with a mean of 4 syllables or more, and mean number of syllables per word were calculated. The internet sites included in the study were divided into two groups according to the institution and organization preparing the website. Sites prepared by public institutions, hospitals, experts on the topic, foundations, and associations were included in the first group, while all other sites were included in the second group.

The DISCERN scale and the JAMA score were developed with the aim of assessing the quality and reliability of internet pages. The DISCERN scale was designed to assess the reliability of written information.[10] The JAMA score was developed to assess the quality and reliability of writing with assessments such as author information, citation numbers, and level of being up-to-date for the text.[11]

Assessment of information content of text

The content of the text was evaluated in terms of containing current information or not according to TEMD-DM-2022 for information about the definition of DM, diagnostic criteria, classification, place of the oral glucose tolerance test (OGTT) in DM diagnosis, lifestyle changes and exercise for treatment, use of oral antidiabetic drugs (OAD), use of insulin, surgical treatment, and complications.[3] The information content was evaluated by one researcher (A.Y.).

Assessment of reliability and quality of text

Quality criteria for consumer health information (DISCERN) scale: The DISCERN scale was developed by Charnock et al.[12] and translated to Turkish by Gökdoğan[10] (Table 1). It was created to evaluate the adequacy and quality of text. It comprises a total of 16 questions. The first section contains 8 questions about reliability and dependability, while the second section comprises 7 questions about the adequacy of treatment choices. The final question is answered to evaluate general quality including intuitive opinions. Total scores are given for 15 questions. Each question is scored from 1 to 5 from no to yes. If the answer is definitely yes, 5 points are given; if it is definitely no, 1 point is given, with points from 2 to 4 given according to responding to the relevant question. Total scores from 63 to 75 are classified as "perfect," from 51 to 62 as "good," from 39 to 50 as "moderate," from 28 to 38 as "inadequate," and 15–27 as "very inadequate."[13] DISCERN scale rating was performed by one researcher (A.Y.) independently.

JAMA score: The JAMA score is an international score used to evaluate the reliability and quality of information on the internet.[11] A total of 4 elements of author information, citations (reference and copyright information), transparency (sponsors, ads, and conflict of interest), and currency are evaluated. Each of these elements is given 1 point if present, 0 if not. Total scores vary from 0 to 4. If scores are ≥3, "high reliability" is identified; if scores are ≤2, "low reliability" is identified. The JAMA score was examined by one researcher (A.Y.) independently.

Assessment of text readability

Ateşman readability formula: This was developed by Ender Ateşman in 1977. It is the Turkish adaptation of the Flesch Ease of Reading formula, based on word and sentence lengths. According to the Ateşman formula, the readability level of a text is "very easy" if scores are 90–100, "easy" from 70 to 89, "moderate" from 50 to 69, "difficult" from 30 to 49, and "very difficult" from 1 to 29.[7] The Ateşman readability formula was evaluated by one researcher (A.Y.).

Readability level points=198.825–40.175 × (Total syllables/total words)–2.610 × (Total words/total sentences).

Bezirci-Yılmaz readability formula: The Bezirci-Yılmaz readability formula was created based on the sentence length and number of syllables in a text. It was developed in 2010 based on the statistical features of the Turkish language.[8] According to this formula, higher numbers of words in sentences, higher numbers of syllables in words, and sentence length affect the readability of a text. Increases in the length of sentences in a text or number of syllables in words reduce the readability of the text. The Bezirci-Yılmaz readability formula is given below. The Bezirci-Yılmaz readability formula was evaluated by one researcher (A.Y.).

$$NRV=\sqrt{MWC}\times((H3\times0.84)+(H4\times1.5)+(H5\times3.5)+(H6\times26.25))$$

(NRV: New readability value, MWC: Mean word count, H3: Mean number of 3-syllable words, H4: Mean number of 4-syllable words, H5: Mean number of 5-syllable words, H6: Mean number of 6-syllable or longer words).

The result obtained from the formula is explained according to the year level of the text based on the educational system in our country. The education system includes years 1–8 as "primary education," years 9–12 as "secondary education (high school)," years 12–16 as "undergraduate," and years 16 or more as "academic education level." Assessments according to the Ateşman and Bezirci-Yılmaz formulas were performed by A.Y.

Table 1. Quality criteria for consumer health information scale survey questions

Is this website a reliable source of information?
Are these objectives attainable?
Is the website relevant to the topic?
Are the sources used in preparing this website clearly stated?
Is the date of the information reported or used on this website clearly indicated?
Are the pieces of information presented on this website consistent and unbiased?
Does the website provide details regarding additional or supporting sources of information?
Does the website acknowledge any areas of uncertainty?
Does it describe how each treatment is carried out?
Does it describe the benefits of each treatment?
Does it describe the risks of each treatment?
Does it describe what would happen if no treatment were applied?
Does it explain how the treatment options might affect quality of life?
Does it state that there may be more than one possible treatment option?
Does it provide support for the patient in making a decision?

Analysis of data

Descriptive statistics for categorical data included in the study are shown as frequency and percentage values, while numerical data are shown as mean and standard deviation. The Shapiro–Wilk and Kolmogorov–Smirnov tests were used to assess whether groups had normal distribution or not. Comparison of numerical data between independent groups in the study used the independent samples t-test for data with equal variance and normal distribution and the Welch t-test for data without equal variance. For data without normal distribution, the Mann–Whitney U test was used. To compare categorical data, the Chi-square test or Fisher's exact Chi-square test was used according to the expected value. All statistical analyses were two-tailed, with 5% significance limit and 95% confidence interval. Analysis of data used the Statistical Package for the Social Sciences® 25.00 (IBM Inc., USA) software.

Ethics committee decision

The study was approved by KTO Karatay University Faculty of Medicine Non-Drug or Medical Device Ethics Committee (April 25, 2024, decision no: 2024/019). The study is conducted according to Declaration of Helsinki.

RESULTS

Of the 151 sites investigated, the study included a total of 111 sites meeting the inclusion criteria. Of the sites, 89 were prepared by health professionals (80.2%) (Group 1) and 22 were Turkish internet sites prepared by others (19.8%) (Group 2).

Among the sites, 86 included information about diabetes definition (77.5%), 47 about diabetes diagnostic criteria (42.3%), 70 about diabetes classification (64.9%), 40 about OGTT (36.0%), 76 about lifestyle changes (68.5%), 52 about OAD (46.8%), 58 about insulin treatment (52.3%), 25 about surgical treatment (22.5%), and 56 about diabetes complications (50.5%).

The comparison of readability parameters, DISCERN scale scores, and JAMA scores in the study groups is shown in Table 2.

The comparison of readability intervals according to Ateşman, JAMA, and DISCERN classifications in the study groups is shown in Table 3.

DISCUSSION

DM is increasing every day.[3] Around the world, the incidence of diabetes and the popularization of internet use to acquire information have increased the number of people using the internet.

In general, health literacy is defined as a concept dependent on literacy skills that encompass individuals' knowledge and ability to access, comprehend, evaluate, and apply health information necessary to make informed decisions and judgments regarding disease prevention and health promotion.[14] In this context, texts containing in-

Table 2. Comparison of readability parameters, DISCERN scale scores, and JAMA scores for the study groups

	All sites	Group 1 (Health Professionals)	Group 2 (Others)	p
Ateşman* (mean±SD)	50.2±8.1	50.6±7.6	48.4±9.9	0.249
Bezirci-Yılmaz* (mean±SD)	12.9±2.5	12.8±2.4	13.5±3.0	0.207
Mean number of words with four or more syllables per sentence* (mean±SD)	3.9±0.9	3.8±0.8	4.1±1.1	0.208
Mean number of syllables per word* (mean±SD)	2.9±0.4	2.9±0.4	2.8±0.1	0.770
DISCERN scale score† (median [min-max])	31 (17–68)	33 (17–68)	25 (17–45)	0.001
JAMA score† (median [min-max])	1 (0–3)	1 (0–3)	1 (0–2)	0.014

*Independent two-samples t-test, †Mann–Whitney U test, DISCERN scale: Quality criteria for consumer health information scale, JAMA score: *Journal of the American Medical Association* score, SD: standard deviation

Table 3. Comparison of study groups according to Ateşman readability intervals, JAMA, and DISCERN classifications

	All sites n=111 (100%)	Group 1 (Health professional cites) n=89 (80.2%)	Group 2 (Other cites) n=22 (19.8%)	p
DISCERN classification*				
Perfect+Good	84 (75.7)	63 (70.8)	21 (95.5)	0.013
Moderate+Inadequate+Very Inadequate	27 (24.3)	26 (29.2)	1 (4.5)	
JAMA classification*				
High reliability	103 (92.8)	81 (91.0)	22 (100.0)	0.353
Low reliability	8 (7.2)	8 (9.0)	0 (0.0)	
Ateşman readability intervals†				
Difficult	53 (47.7)	41 (46.1)	12 (54.5)	0.476
Moderate+Easy	58 (52.3)	48 (53.9)	10 (45.5)	

*Fisher's exact Chi-square test, †Chi-square test, DISCERN scale: Quality criteria for consumer health information scale, JAMA score: *Journal of the American Medical Association* score, n: Frequency, %: Percentage

formation about diabetes should not only have an appropriate level of readability but also include comprehensive content regarding the importance and prevalence of diabetes, preventive strategies, as well as diagnostic and treatment methods.

In America, the readability of texts below 6th grade level was found to be easy, with the readability of texts from 7th to 9th grade level at moderate level and readability of texts above 9th grade level was found to be difficult.[15] According to the study by Bezirci-Yılmaz, which evaluated data from Turkey, a classification similar to that used in the United States was identified: Texts at the 1st–8th grade level correspond to "primary education," those at the 9th–12th grade level to "secondary education (high school)," those at the 12th–16th grade level to "undergraduate," and those above the 16th grade level to "academic" level.[8]

Studies by Solak et al.,[16] Eryılmaz et al.,[17] Solak,[18] and Yılmaz et al.[19] found that texts were difficult according to Ateşman and undergraduate according to Bezirci-Yılmaz and concluded that these texts were difficult to understand. In our study, the results were consistent with the literature, with texts classified as intermediate according to the Ateşman formula and at the undergraduate level according to the Bezirci–Yılmaz formula.

When studies evaluating the quality and reliability of website information using the DISCERN scale and JAMA score are examined, Ng et al.[20] found that the DISCERN scores were at a good level. Yurdakul et al.[21] found that the JAMA score in their study was at a highly reliable level. In contrast to these studies, Yılmaz et al.[19] found that Turkish websites did not present information about osteoporosis with adequate level and quality. The study by Yılmaz et al.[22] concluded that the JAMA score was at low reliability level, while the DISCERN score was inadequate. In our study, similar to the literature, there was low reliability level, with most sites not found to include author and date/current information. Interrogation about treatment choices, especially noted by the DISCERN scale, found that Turkish internet sites had "inadequate" information content and quality due to not sufficiently including treatment choices. In addition, when evaluated according to the DISCERN and JAMA classifications, our study found that websites rated as "excellent" on the DISCERN scale showed a significant difference between groups compared to others. Therefore, we believe that websites created by healthcare professionals may be more reliable in terms of information quality. We believe that our results are important as our study is the first to comprehensively assess the written texts of Turkish websites related to DM.

Internet users using search engines were observed to generally click on the top 20 results on the first two pages.[23] In our study, the majority of sites on the first 15 pages were in Group 1 (80.2%). We believe that the heterogeneous distribution between the groups occurred due to internet users thinking that information offered by hospitals and health employees is higher quality and more reliable when searching for information related to health.

There are some limitations to our study. As discussed above, there is no definite method for "understandability" in the readability formulas. The cross-sectional nature of the study, encompassing a certain time period, different top results being given with use of search engines by different people, the treatment focus of the DISCERN scale, the lack of full reflection of accuracy of content in the JAMA score, the subjective assessments with the JAMA score and DISCERN scale, and the strict inclusion and exclusion criteria, which may limit the generalizability of the findings, all comprise the limitations of our study.

CONCLUSION

Our findings indicate that diabetes-related texts on Turkish-language internet sites have very low readability and generally fail to provide adequate information on diabetes-related risks, complications, diagnostic processes, and treatment options. These results highlight the need for health information policies and practical guidelines that ensure online content is written at a level accessible to the general population, thereby supporting informed decision-making and public health literacy.

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Perceived Social Support and its Determinants among Individuals with Substance Use Disorder: A Community-Based Cross-Sectional Study

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ABSTRACT

Objectives: This study aims to examine the perceived social support levels of individuals with substance use disorders and to investigate the relationship between perceived social support and their sociodemographic and substance use characteristics.

Methods: This cross-sectional study was conducted with 75 participants enrolled in a substance addiction rehabilitation program in Burdur, Türkiye. Data were collected using a researcher-developed sociodemographic and substance use characteristics form and the multidimensional scale of perceived social support (MSPSS). Statistical analyses included descriptive statistics, independent samples t-tests, and forward linear regression.

Results: The mean total MSPSS score was 46.7±14.0, with family, friends, and significant other subscale scores of 15.3±6.1, 14.5±5.1, and 16.8±7.3, respectively. Perceived social support was significantly lower among individuals with insufficient income (p=0.042), multiple substance use (p=0.020), and those living alone (p=0.002). Regression analysis identified living alone, low income, and multiple substance use as significant negative predictors of perceived social support (p=0.001, p=0.008, and p=0.011, respectively).

Conclusion: Perceived social support among individuals with substance use disorders is influenced by socioeconomic and living conditions. Enhancing employment opportunities, promoting family involvement, and addressing polysubstance use in rehabilitation programs may strengthen social support networks and contribute to better treatment outcomes.

Keywords: Perceived social support, sociodemographic factors, substance use disorders

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INTRODUCTION

Substance addiction is one of the leading public health problems affecting societies worldwide in terms of biological, psychological, social, and economic dimensions.[1] In parallel with its expanding global burden, substance addiction has been defined as a chronic disease with extremely high relapse rates ranging from 56.8% to 81.8%.[2,3] Consistent with this chronic and relapsing nature, the United Nations' 2023 World Drug Report, drug use has increased by 23% in the past 10 years, and in 2021, one in every 17 people aged 15–64 worldwide used drugs.[4] Similarly, according to a research report published by the European Monitoring Centre for Drugs and Drug Addiction, it is estimated that approximately 83 million adults (aged 15–64) have used illicit drugs at least once in their lifetime.[5] The increasing prevalence of substance use and disorder globally poses a significant health crisis threat in every region of the world.

[6] Increasing substance use in the world and the resulting substance-related disorders cause increasingly widespread medical and psychosocial problems in society. In the advanced stages of substance addiction, the person's family, environment, social life, and functionality deteriorate. Because addiction disrupts the individual's biopsychosocial integrity and causes the person to harm himself, his family, and society.[7,8] Social support acts as a buffer between the person and substance use in recovering from addiction, restructuring his relations with society, and preventing, treating, and rehabilitating addiction.[9]

Social support is the perception or experience of being loved, respected, valued by others, and being part of a social network.[10] Social support can be provided by a spouse, relatives, friends, and even a pet.[11] In other words, social support is a powerful resource that individuals are aware of in terms of preventing, solving, and intervening in their problems and protecting their mental health.[12] There are two types of social support mentioned in the literature: Provided and perceived. Perceived social support is defined as the subjective feeling of support and is stated to have a greater effect on a person's psychological health than provided social support.[13] Perceived social support refers to how individuals perceive their friends and family members to provide functional and general support in times of need.[14] There are many studies in the literature supporting the beneficial effect of social support on various negative health conditions, including substance addiction.[15-17]

Social support is very important for reducing substance use behavior and treatment motivation in addicted individuals. Social support from networks outside the family, such as friends, peers, and self-help groups, is a resource that helps addicts cope with emotional consequences as well as maintaining remission.[18,19] In a study conducted by Saleem et al.[20] with drug addicts, it was determined that perceived social support reduced individuals' substance use behavior. The perceptibility of social support systems is as important as the presence of social support in treating addiction.[14] Studies have shown that perceived social support can protect individuals from the negative effects of stress on physical and mental health and can also enable the development of stronger coping mechanisms and reduce relapse.[21,22]

The aim of this study was to measure the level of perceived social support in individuals who use substances and to examine the relationship between perceived social support and the sociodemographic characteristics and substance use characteristics of individuals.

METHODS

Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Mehmet Akif Ersoy University (No: GO2020/243, Date: 02/09/2020). In addition, permission to conduct the study was granted by the Burdur Provincial Health Directorate. The study is conducted according to Declaration of Helsinki.

This cross-sectional study was conducted within the scope of the substance addiction rehabilitation program implemented in Burdur, Türkiye. The study population consisted of 75 individuals diagnosed with substance use disorder who participated in the rehabilitation program between 2020 and 2021. Inclusion criteria were being enrolled in the program during the study period, having a diagnosis of substance use disorder, being aged 18 years or older, and agreeing to participate in the study. Individuals who did not consent to participate or who had incomplete questionnaire data were excluded. Since the entire accessible population was included, no sampling method was applied.

Data were collected using a structured questionnaire consisting of two sections: (1) A sociodemographic and substance use characteristics form developed by the researchers and (2) the multidimensional scale of perceived social support (MSPSS). The MSPSS was originally developed by Zimet et al.[23] and validated in Turkish by Eker and Arkar.[24] The scale comprises 12 items and uses a 7-point Likert-type format (1 = very strongly disagree and 7 = very strongly agree). It includes three subscales that measure perceived support from family (items 3, 4, 8, and 11), friends (items 6, 7, 9, and 12), and a significant other (items 1, 2, 5, and 10). Subscale scores range from 4 to 28, and the total score ranges from 12 to 84, with higher scores indicating greater perceived social support.[23,24]

Data collection was conducted through face-to-face interviews after participants were informed about the study and provided verbal consent. The data of 75 participants who fully completed the questionnaire were included in the analysis.

All statistical analyses were performed using IBM Statistical Package for the Social Sciences Statistics version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics such as frequency, percentage, mean, standard deviation, minimum, and maximum values were used to summarize the data. Independent samples t-test was employed to assess group differences. In addition, a forward linear regression analysis was conducted to identify the predictors of perceived social support. Statistical significance was accepted at $p<0.05$.

RESULTS

The mean age of substance addicts was 29.5±6.6 (min. 14-max. 51) and 73 (97.3%) of them were male. The mean scale score within the scope of MSPSS was determined as 46.7±14.0 (min 17–max 68). The mean scores of the MSPSS subscales of family, friend, and special person support were found to be 15.3±6.1 (min 5–max 27), friend 14.5±5.1 (min 4–max 24), and special person 16.8±7.3 (min 6–max 51), respectively. The distribution of the sociodemographic and substance use characteristics of substance addicts on the mean MSPSS scores is shown in Table 1.

As a result of the analysis, it was seen that income status (p=0.042), marital status (p=0.019), substance use characteristics (p=0.020), previous counseling status (p=0.027), and who they live with (p=0.002) created a statistically significant difference in MSPSS score averages. Independent variables with statistically significant differences were included in linear logistic regression analysis (Table 2).

According to the results of logistic regression analysis, insufficient income (p=0.001), multiple substance use (p=0.008), and living alone (p=0.011) were identified as factors that reduced the perception of social support.

Table 1. Distribution of sociodemographic and substance use characteristics of substance addicts based on MSPSS mean scores

	n	%	Mean±SD	Test value	p
Age					
30 years and below	46	61.3	44.6±14.1	2.469	0.120*
Above 30 years	29	38.7	49.8±13.4		
Gender					
Male	73	97.3	49.5±7.7	0.084	0.773*
Female	2	2.7	46.5±14.1		
Occupation					
Unskilled worker	44	58.7	47.5±13.7	0.472	0.494*
Skilled worker	32	41.3	45.3±14.5		
Employment status					
Employed	32	42.7	48.2±14.5	0.749	0.390*
Unemployed	43	57.3	45.4±13.6		
Income status					
Insufficient	57	76.0	44.8±13.4	4.298	**0.042***
Sufficient	18	24.0	52.5±14.6		
Educational attainment					
Below high school	59	78.7	46.4±12.9	0.044	0.834*
High school and above	16	21.3	47.3±18.0		
Marital status					
Married	20	26.7	52.9±10.3	5.756	**0.019***
Single/Divorced	55	73.3	44.3±14.5		
Children					
No	52	69.3	45.8±14.7	0.613	0.436*
Yes	23	30.7	48.5±12.3		
Place of residence					
Urban/district	64	85.3	45.6±14.1	2.170	0.145*
Village	11	14.7	52.3±12.6		
Substance use type					
Multiple substance abuse	29	38.7	41.9±14.0	5.699	**0.020***
Single substance abuse	46	61.3	49.6±13.3		

Table 1. Continue

	n	%	Mean±SD	Test value	p
Duration of substance abuse					
10 years and below	38	50.7	46.3±14.9	0.031	0.860*
Above 10 years	37	49.3	46.9±13.1		
Onset of substance abuse					
Below 18 years	39	52.0	45.0±14.8	1.095	0.299*
18 years and above	36	48.0	48.4±13.1		
Previous treatment for substance abuse					
No	56	74.7	45.2±13.8	2.250	0.138*
Yes	19	25.3	50.7±14.0		
Previous counseling for substance abuse					
No	61	81.3	44.9±13.9	5.079	**0.027***
Yes	14	18.7	54.0±12.3		
Cohabitant					
Single	6	8.0	30.1±5.1	10.119	**0.002***
Family/friends	69	92.0	48.0±13.6		
Total	75	100.0	46.6±14.0		

SD: Standard deviation,*Independent samples t-test, MSPSS: Multidimensional scale of perceived social support

Table 2. Forward linear regression analysis results

Independent variable	B	SE	Beta	t	p*
Who lives with	17.993	5.288	0.350	3.402	0.001
Substance use characteristics	1.015	0.371	0.284	2.737	0.008
Income status	5.926	2.262	0.272	2.620	0.011

SE: Standard error.*Forward linear regression analysis

DISCUSSION

The findings of this study, which was conducted to examine the relationship between perceived social support and demographic characteristics of individuals with substance use disorder, are discussed in the light of the literature. It was determined that the scores of the substance addicted individuals participating in the study from the Multidimensional Perceived Social Support Scale subscales were family 15.3±6.1 (min 5–max 27), friend 14.5±5.1 (min 4–max 24), special person 16.8±7.3 (min 6–max 51), respectively. When the lowest and highest scores that can be obtained from the scale are considered, it is possible to say that the average social support scores of the individuals are below the median value. In the study conducted by Avşar et al.[25], which examined the perceived social support of substance addicted individuals from their families, it was determined that the perceived social support of the participants was less than the scale median value. There are studies in the literature that have determined a negative significant relationship between perceived social support and substance use.[25-29] In this context, our study is compatible with the literature in terms of the distribution of scores of the subscales.

In our study, insufficient income, multiple substance use, and living alone were identified as factors that reduce perceived social support. According to the findings of our study, the presence of polysubstance use (PSU) reduces the perceived social support of substance addicts. The perception of social support was found to be 2.6 times higher in addicts who did not use polysubstances. Although PSU concerns approximately 10% of addicts, it is an important problem that is often overlooked in field studies.[30] The use of more than one substance sequentially or simultaneously by an addict is called polysubstance use. PSU causes many

negative outcomes such as non-compliance with treatment, high risk of relapse, and death.[31] In line with our research findings in the literature, it has been reported that individuals with polysubstance use have less perceived social support.[32,33] In a study conducted by Appiah et al.[34], it was stated that the addition of social support networks to the treatment of addicts with PSU increases the success of treatment and that addicts see the support they receive from their family and friends as an invaluable resource that facilitates their recovery. The literature and our study data show the necessity of using social support systems in combating polysubstance use, which is a significant obstacle to treatment.

Another factor affecting the perception of social support of substance addicts is insufficient income. In our study, it was observed that perceived social support was 2.7 times higher among addicts who defined their income as sufficient. The positive relationship between income status and social support is supported by the literature, and it is reported that there is less contact with friends and social support satisfaction is low in low-income groups.[35,36] In the study of Avşar et al.[25], a statistically significant relationship was found between the employment status of addicts and their perception of social support. In the study conducted by Yilmaz et al.[37] with individuals who are heroin addicts, it was determined that the unemployed and those whose income is less than their expenses are at risk in terms of social support.

Having a job is an important part of social life, and in addition to structuring time, it provides economic security, identity, and social participation opportunities.[37] Studies have shown that the perception of social support is low in individuals who are not employed and that this situation causes physical, psychological, and functional problems.[38,39] Substance addiction is also among these mental disorders. It is known that unemployment is common among substance addicts or that the unemployed are more addicted.[40] Although many addicts want to work and the positive effects of working in a job on physical and mental health are known, this is not possible because they are in the most difficult group to employ among the disabled, or they are employed in low-income and unpreferred jobs.[41] Similar to the general population, it was determined that the perception of social support was low among the addicts in our study who had low income.

In our study, it was observed that the perception of social support was 3.4 times higher in those living with family or friends than in those living alone. It is known that social isolation and loneliness are risk factors for the development of addiction.[42] Addiction is called a family disease because it occurs in the family, harms the family, can cause active addiction or its maintenance, and can be a potential source of treatment and recovery.[7,8] In this study, it was thought that families or people they live with, who constitute a potential source of recovery and treatment, also increase the perception of social support in addicts. In the literature, it has been reported that positive family relationships have a protective role in the development of addiction as well as a positive contribution to treatment success.[43] On the other hand, contrary to our study findings, in a study conducted with substance addicts, it was reported that those living with their families had lower perception of social support compared to those living with friends and alone.[25]

The most important limitation of this study is that it is not representative of all addicts because it was conducted among addicts who applied within the scope of the program. Another limitation is that almost all of the participants are male. It cannot provide information about female addicts. Therefore, it is recommended that studies should be conducted with a sample that will represent all addicts in future studies and that female addicts should be included in the studies. This study was conducted using a cross-sectional method. It is thought that if future studies are conducted using a longitudinal method and the application is made to addicted individuals before and after receiving any treatment, more functional findings can be obtained in the study. Taken together, these limitations indicate the need for future studies to employ more representative and gender-balanced samples and to utilize longitudinal designs to obtain more comprehensive and generalizable findings.

CONCLUSION

As a result, social support mechanisms should be used effectively in interventions targeting addicted individuals. Because in cases where the perception of social support is insufficient in individuals receiving addiction treatment, adaptation problems, abandonment of treatment, or negative situations are experienced during treatment.[44,45] Polysubstance use, living alone, and insufficient income have been identified as factors that reduce the perception of social support. In this context, placement of addicts in a job during their rehabilitation process is an important parameter in terms of creating a new environment, earning an income that will meet their needs, adapting to treatment, and providing social support. The study results show that the social aspect of addiction treatment should be planned to include employment, programs should be implemented to provide vocational skills, and the elimination of polysubstance use should be prioritized in medical treatments.

Considering that addiction is a family disease, it is recommended that the relatives of the addicted individual should also be included in treatment programs. Psychoeducation and skills training should be provided to addicted relatives to increase the social support perceived by addicts and to help the addicts cope effectively.

Disclosures

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Conflict of Interest: None declared.

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Ethics Committee Approval: Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Mehmet Akif Ersoy University (No: GO2020/243, Date: 02/09/2020). In addition, permission to conduct the study was granted by the Burdur Provincial Health Directorate.

Authorship Contributions: Concept – S.S., O.K.; Design – S.S., O.K.; Supervision – S.S.; Materials – S.S., Ö.K.; Data collection &/or processing – S.S., O.K.; Analysis and/or interpretation – S.S.; Literature search – S.S., O.K.; Writing – S.S., O.K.; Critical review – S.S., O.K.

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Breast Cancer Knowledge and Awareness among Women in Two Socioeconomically Distinct Districts of Ankara

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ABSTRACT

Objectives: This study aimed to evaluate the relationship between social determinants of health and women's knowledge and awareness levels regarding breast cancer in two districts of Ankara with distinct socioeconomic profiles.

Methods: A cross-sectional study was conducted among 368 women aged 30–70 years who applied to Cancer Early Diagnosis, Screening, and Training Centers (KETEM) in Çayyolu (high socioeconomic level) and Mamak (middle socioeconomic level). Data were collected using a sociodemographic questionnaire and the breast cancer awareness scale. The scale demonstrated good to excellent reliability (Cronbach's α=0.774–0.973; overall α=0.890), and construct validity was supported by exploratory factor analysis and confirmatory factor analysis with acceptable model fit indices. Statistical analyses included Independent Sample t-tests, analysis of variance, and Pearson correlation.

Results: Women attending the Çayyolu KETEM had significantly higher scores than those attending the Mamak KETEM in the sub-dimensions of Knowledge of Risk Factors (2.26±0.56 vs. 1.94±0.56), Knowledge of signs and symptoms (2.66±0.57 vs. 2.13±0.81), attitudes toward breast cancer prevention (3.90±0.93 vs. 3.47±1.25), and health behaviors related to breast cancer awareness (3.12±1.10 vs. 2.59±0.97) (all p=0.001), while no significant difference was observed in the Barriers to Screening sub-dimension (p>0.05). Education level, marital status, employment, income, and family health background were significantly associated with awareness levels. Women who had received education on breast cancer screening and those who had undergone breast ultrasound exhibited higher awareness scores.

Conclusion: The findings indicate that social determinants such as education, income, and access to health services significantly influence breast cancer awareness. These results underscore the critical role of primary healthcare and public health services, particularly family health centers and community-based screening units, in delivering targeted, culturally adapted breast cancer awareness and screening programs, especially in socioeconomically disadvantaged regions.

Keywords: Attitudes, breast neoplasms, health knowledge, practice, social determinants of health, socioeconomic factors, women's health

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INTRODUCTION

Cancer is a group of diseases characterized by the uncontrolled proliferation and spread of cells resulting from disruptions in cellular proliferation and differentiation mechanisms, leading to invasion of surrounding tissues and metastasis to distant organs.[1] Breast cancer, which develops through the malignant transformation of epithelial cells in the breast tissue, is one of the most common types of cancer among women.[2] Both in Türkiye and worldwide, breast cancer is the most frequently diagnosed cancer among women and remains one of the leading causes threatening women's health.[3]

The incidence and mortality rates of breast cancer are directly associated with a country's income level and socioeconomic development.[4] The positive impact of development level on breast cancer survival is primarily attributed to improved access to early diagnosis and treatment services. Although complete prevention of the disease is not always possible, early detection significantly reduces morbidity and mortality, thereby improving treatment success and life expectancy. Therefore, focusing on early diagnosis and treatment of breast cancer is of vital importance.[5] Regular mammography screenings, breast self-examinations (BSE), and clinical breast examinations are essential methods for early detection of breast cancer.[6]

Early detection remains one of the most critical factors that improves the prognosis of breast cancer; however, its effectiveness depends largely on individuals' levels of knowledge and awareness regarding the disease. Primary care and family medicine services play a pivotal role in this process, as they constitute the first point of contact for preventive counseling and timely referral. Strengthening first-step healthcare in routine breast cancer education can substantially increase women's screening participation, especially in socioeconomically disadvantaged communities.[7-10] In the literature, knowledge and awareness of breast cancer have been reported to be associated with various social determinants of health, such as age, income level, educational attainment, as well as geographic disparities and access to healthcare services.[11-18] However, most of these studies have assessed breast cancer knowledge and awareness with a limited set of social determinants.

Accordingly, the present study aimed to evaluate the knowledge and awareness levels of women receiving services from Cancer Early Diagnosis, Screening, and Training Centers (KETEM) located in two districts of Ankara – Çayyolu and Mamak – representing different socioeconomic levels, in relation to social determinants of health. Based on the Socioeconomic Development Ranking of Districts (SEGE) conducted by the Ministry of Industry and Technology of the Republic of Türkiye, which compares districts based on multidimensional indicators such as education, health, employment, income, and living conditions, Çankaya district ranks first among 25 districts in Ankara in terms of socioeconomic development, whereas Mamak ranks ninth.[19]

METHODS

This cross-sectional study included women aged 30–70 years who applied to KETEM, located in the Çayyolu neighborhood of Çankaya District and the Mamak Central neighborhood of Mamak District in Ankara Province. The necessary ethics committee approval and institutional permissions were obtained from the Ankara Yıldırım Beyazır University before conducting the study. The study is conducted according to Declaration of Helsinki. Participants were required to have no prior diagnosis of breast cancer and to be physically and mentally capable of completing the survey.

According to the Health Statistics Yearbook of Türkiye, 2023, the proportion of women performing BSE at least once every three months was reported as 29.8%, and those undergoing mammography at least once every three years was 19.8%.[3] The higher of these rates, the BSE rate, was used for sample size estimation. Using a 95% confidence interval (Z=1.96) and a 5% margin of error (d=0.05), with the event probability (p=0.298) and non-event probability (q=0.702), the minimum sample size was calculated as 322 participants.[20] Accordingly, data were collected from 210 voluntary women at Mamak KETEM and 158 women at Çayyolu KETEM, yielding a final sample of 368 participants.

The questionnaire consisted of two sections. The first section included 21 questions assessing sociodemographic characteristics, health service utilization, health status, history of cancer, and social determinants related to breast cancer awareness.[17,19,21] The second section comprised the breast cancer awareness scale (BCAS), developed by Rakkapao et al.[21] and adapted into Turkish by Altuntuğ et al.[22] The scale includes 35 items grouped under five subdimensions: Knowledge of risk factors for breast cancer (KRF; 9 items), knowledge of signs and symptoms (KSS; 8 items), attitudes toward breast cancer prevention (ABCP; 6 items), barriers to screening (BS; 4 items), and health behaviors related to breast cancer awareness (BCF; 8 items).

A Cronbach's alpha coefficient of 0.70 or higher indicates acceptable internal consistency for a scale.[20] The reliability coefficients were found as follows: KRF=0.895, KSS=0.973, ABCP=0.954, BS=0.774, BCF=0.789, and the overall scale=0.890, demonstrating that both the total scale and

its subdimensions were within the reliable or highly reliable range. Construct validity was assessed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The EFA initially included all 35 items as in the original version; however, four items belonging to the BCF subdimension (Items BCF5, BCF6, BCF7, and BCF8) were excluded due to factor loadings below 0.30 and cross-loading patterns that weakened the conceptual clarity of the factor. After removal of these items, the revised 31-item version retained the original five-factor structure, with eigenvalues >1 and factor loadings above 0.30. The Kaiser–Meyer–Olkin (KMO) measure verified sampling adequacy (KMO=0.909>0.60), and Bartlett's test of Sphericity confirmed suitability for factor analysis (χ^2=10013.184; P≤0.001).

The CFA conducted with the refined 31-item structure demonstrated good/acceptable model fit (χ^2 [421]=961.766, p<0.001; minimum discrepancy/degrees of freedom=2.284; comparative fit index=0.945; Tucker-Lewis index=0.939; normed fit index=0.907; root mean square error of approximation=0.059), supporting the validity of the final model.

Ethical approval for the study was obtained from the Institutional Ethics Committee, and official permissions were granted by the relevant authorities before data collection. Data were collected through face-to-face interviews between November 2024 and February 2025. Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Normality was assessed using skewness and kurtosis coefficients, which are more appropriate for large samples. All BCAS subdimension scores showed acceptable normality, with skewness values ranging from –0.92 to +0.12 and kurtosis values ranging from –1.11 to +0.13, all within the commonly accepted ±1.5 interval. Therefore, the distributions were considered suitable for parametric analyses. To determine whether BCAS subdimension scores differed according to sociodemographic characteristics, independent samples t-tests were used for two-group comparisons and analysis of variance (ANOVA) for comparisons among more than two groups. Bonferroni *post hoc* tests were applied to identify the source of significant differences found by ANOVA. Relationships among BCAS subdimensions were examined using Pearson's correlation analysis. The study was designed and reported in accordance with the ICMJE and STROBE guidelines for observational studies. All statistical analyses were performed using IBM the Statistical Package for the Social Sciences Statistics, and a significance level of p<0.05 was adopted.

RESULTS

Table 1 presents the results of participants' responses regarding their individual characteristics and social determi-

Table 1. Descriptive characteristics of participants by district

Determinants	Mamak n (%)	Çayyolu n (%)
Age		
≤39	50 (23.8)	38 (24.1)
40–45	71 (33.8)	46 (29.1)
46–50	44 (21.0)	34 (21.5)
≥51	45 (21.4)	40 (25.3)
Education level		
Primary	81 (38.6)	24 (15.2)
Secondary	78 (37.1)	21 (13.3)
Associate/Bachelor and above	51 (24.3)	113 (71.5)
Marital status		
Married	183 (87.1)	111 (70.3)
Single/Divorced/Widowed	27 (12.9)	47 (29.7)
Number of children		
None	20 (9.5)	47 (29.7)
1	26 (12.4)	30 (19.0)
2	102 (48.6)	61 (38.6)
3	42 (20.0)	13 (8.2)
≥4	20 (9.5)	7 (4.4)
Employment status		
Retired	13 (6.2)	14 (8.9)
Not employed/Household work	129 (61.4)	42 (26.6)
Employed	68 (32.4)	102 (64.6)
Health worker in family		
Yes	50 (23.8)	52 (32.9)
No	160 (76.2)	106 (67.1)
Household income		
Income<expenses	81 (38.6)	28 (17.7)
Income>expenses	13 (6.2)	39 (24.7)
Income=expenses	116 (55.2)	91 (57.6)
Household size		
1 person	8 (3.8)	21 (13.3)
2 persons	13 (6.2)	34 (21.5)
3 persons	42 (20.0)	42 (26.6)
4 persons	91 (43.3)	48 (30.4)
≥5 persons	56 (26.7)	13 (8.2)
Home ownership		
Owned	160 (76.2)	118 (74.7)
Rented	50 (23.8)	40 (25.3)

Table 1. Continue

Determinants	Mamak n (%)	Çayyolu n (%)
Most frequently used healthcare type		
Public hospital	163 (77.6)	96 (60.8)
Private hospital/poly-clinic	9 (4.3)	49 (31.0)
University hospital	38 (18.1)	13 (8.2)
Unmet healthcare need (cost)		
Yes	83 (39.5)	44 (27.8)
No	127 (60.5)	114 (72.2)
Unmet healthcare need (access)		
Yes	60 (28.6)	39 (24.7)
No	150 (71.4)	119 (75.3)
Balanced diet		
Yes	128 (61.0)	131 (82.9)
No	82 (39.0)	27 (17.1)
Smoking status		
Quit	18 (8.6)	31 (19.6)
Never	112 (53.3)	85 (53.8)
Current	80 (38.1)	42 (26.6)
Alcohol use		
Quit	4 (1.9)	13 (8.2)
Never	179 (85.2)	91 (57.6)
Current	27 (12.9)	54 (34.2)
Chronic disease		
Yes	73 (34.8)	48 (30.4)
No	137 (65.2)	110 (69.6)
Family history of cancer		
Yes	78 (37.1)	54 (34.2)
No	132 (62.9)	104 (65.8)
Family history of breast cancer		
Yes	35 (16.7)	27 (17.1)
No	175 (83.3)	131 (82.9)
Breast ultrasound (ever)		
Yes	92 (43.8)	86 (54.4)
No	118 (56.2)	72 (45.6)
Breast ultrasound frequency		
Never	119 (56.7)	71 (44.9)
Annually	22 (10.5)	25 (15.8)
Every two years	25 (11.9)	20 (12.7)
Irregular	44 (21.0)	42 (26.6)
Education on breast cancer screening		
Yes	79 (37.6)	84 (53.2)
No	131 (62.4)	74 (46.8)
Total	210 (100.0)	158 (100.0)

Table 2. BCAS subdimension scores by district (ındependent samples t-test)

BCAS subdimension	District	Mean	SD	t	p
KRF	Mamak	1.94	0.56	−5.45	0.001
	Çayyolu	2.26	0.56		
KSS	Mamak	2.13	0.81	−6.97	0.001
	Çayyolu	2.66	0.57		
ABCP	Mamak	3.47	1.25	−3.66	0.001
	Çayyolu	3.90	0.93		
BS	Mamak	3.61	0.99	−1.65	0.099
	Çayyolu	3.78	0.89		
BCF	Mamak	2.59	0.97	−4.89	0.001
	Çayyolu	3.12	1.10		

BCAS: Breast cancer awareness scale, KRF: Knowledge of risk factors, KSS: Knowledge of signs and symptoms, ABCP: Attitudes toward breast cancer prevention, BS: Barriers to screening, BCF: Breast Cancer Awareness

The relationships among the BCAS subdimensions were evaluated using correlation analysis, and the results are presented in Table 4. According to these findings, a strong and statistically significant positive correlation was found between KRF and KSS ($r=0.652$, $p<0.01$). Weak to very weak but significant positive correlations were observed between KRF and ABCP ($r=0.165$, $p<0.01$) and between KRF and BCF ($r=0.216$, $p<0.01$). Similarly, KSS showed weak to very weak positive correlations with ABCP ($r=0.205$, $p<0.01$) and BCF ($r=0.178$, $p<0.01$). A weak positive correlation was also identified between BS and BCF ($r=0.320$, $p<0.01$). No statistically significant correlations were found among the other pairs of subdimensions ($p>0.05$).

DISCUSSION

This study evaluated the relationship between social determinants of health and breast cancer knowledge and awareness among women living in two districts of Ankara with distinct socioeconomic profiles. The findings indicated significant differences in breast cancer knowledge and awareness according to social determinants of health. Women residing in Çayyolu scored significantly higher than those in Mamak across the KRF, KSS, ABCP, and BCF subdimensions, reflecting the positive influence of higher socioeconomic status on access to information, health literacy, and preventive health behaviors. These results are consistent with the findings reported in the literature. Üçüncü et al.[16]

Table 3. Differences in BCAS subdimensions by social determinants (t-test/ANOVA)

Determinants	KRF	KSS	ABCP	BS	BCF
Education level	Associate/Bachelor+>Primary*	Associate/Bachelor+>Secondary>Primary*	Associate/Bachelor+>Primary*	—	Associate/Bachelor+>Primary*
Marital status	Single/Divorced/Widowed>Married*	Single/Divorced/Widowed>Married*	—	—	—
Number of children	—	1>3*	None>≥4*	—	None>2>3>≥4*
Employment status	Employed>Not employed//Household work*	Employed>Not employed//Household work*	Employed>Not employed//Household work*	—	Employed>Not employed//Household work*
Health worker in family	Yes>No*	Yes>No*	—	—	Yes>No*
Household income	—	—	—	Income=Expenses>Income<Expenses*	Income>Expenses>Income<Expenses*
Household size	—	—	—	—	2 persons>≥5*
Home ownership	—	—	—	—	Owned>Rented*
Smoking status	Current<Quit/Never*	—	—	—	—
Unmet need (cost)	—	—	Yes<No*	Yes<No*	—
Unmet need (access)	—	—	—	Yes<No*	—
Balanced diet	—	—	—	—	Yes>No*
Chronic disease	—	—	—	—	No>Yes*
Breast ultrasound (ever)	Yes>No*	Yes>No*	—	Yes>No*	Yes>No*
Education on breast cancer screening	Yes>No*	Yes>No*	Yes>No*	Yes>No*	Yes>No*

*p<0.05; "—" = not significant; ">" indicates higher mean score. BCAS: Breast cancer awareness scale, ANOVA: Analysis of variance, KRF: Knowledge of risk factors, KSS: Knowledge of signs and symptoms, ABCP: Attitudes toward breast cancer prevention, BS: Barriers to screening, BCF: Breast Cancer Awareness

Table 4. Correlations among BCAS subdimensions (Pearson)

	KRF	KSS	ABCP	BS	BCF
KRF	1				
KSS	0.652**	1			
ABCP	0.165**	0.205**	1		
BS	0.037	0.074	−0.067	1	
BCF	0.216**	0.178**	0.020	0.320**	1

**p<0.01; *p<0.05. BCAS: Breast cancer awareness scale, KRF: Knowledge of risk factors, KSS: Knowledge of signs and symptoms, ABCP: Attitudes toward breast cancer prevention, BS: Barriers to screening, BCF: Breast Cancer Awareness

also reported that women living in urban areas with higher education and income levels had significantly greater awareness and more regular participation in early detection practices. Similarly, Kim and Kang found that women with higher income and education levels were significantly more likely to participate in national cancer screening programs, whereas screening access was limited among lower socioeconomic groups.[23]

Sociodemographic variables such as education, marital status, income, and employment status were significantly associated with awareness levels, indicating that awareness is influenced not only by individual knowledge but also by social environment and living conditions. Within Marmot's framework of social determinants, education and economic status shape individuals' health behaviors.[24] In line with this, Jensen et al.[13] reported that in West Texas, women with lower income and without health insurance had lower screening rates and higher rates of late-stage diagnosis. Similarly, Lee et al.[8] and Kolahdooz et al.[25] found that women with higher income and educational attain-

ment were more likely to participate in mammography screening and to engage in early detection behaviors. In this study, awareness levels were higher among single and employed women, suggesting that social participation and individual health responsibility are positively associated with knowledge and awareness. Ghanbari et al.[7] similarly reported that social support and financial independence enhanced screening behaviors, while awareness was weaker among low-income and housewife groups. Conversely, lower awareness levels observed among women with three or more children may be explained by both the financial burden and time constraints limiting healthcare engagement. These results are consistent with the findings of Rezaeimanesh et al.[15], who reported that socioeconomic status and living conditions influence mammography behavior.

However, it should also be acknowledged that the relationship between socioeconomic status and breast cancer awareness is not unidirectional. Several studies have reported that even among women with higher education or income levels, screening participation may remain suboptimal due to perceived invulnerability, competing life responsibilities, cultural attitudes, or low perceived risk.[17,26] For instance, some research has shown that socioeconomic advantage does not always translate into preventive health behaviors, and structural barriers can persist across all socioeconomic groups.[27] These findings suggest that while socioeconomic resources facilitate awareness, individual perceptions, cultural norms, and health system barriers may moderate this relationship.

Higher awareness scores among women who had undergone breast ultrasound and participated in educational programs indicate that increased knowledge translates into behavioral change. Açıkgöz et al.[6] demonstrated that structured education programs improved screening behaviors, while Tahergorabi et al.[12] showed that knowledge levels significantly predicted both mammography and clinical breast examination practices. These findings support the notion that educational interventions are effective not only for improving knowledge but also for promoting behavioral outcomes. However, the absence of a significant difference between the two groups in the BS subdimension suggests that increased knowledge does not necessarily result in behavioral change. Similarly, Miller et al.[14] noted that women facing adverse social determinants – such as limited transportation, social isolation, and financial stress – had significantly lower mammography participation rates. This finding highlights that behavioral change requires addressing environmental and psychological barriers in addition to cognitive knowledge.

The strong positive correlation between KRF and KSS observed in this study demonstrates that the components of knowledge and awareness complement one another. Seyedkanani et al.[10] also reported that women with higher risk awareness were nearly twice as likely to recognize early symptoms, underscoring the importance of integrating comprehensive knowledge. Mohammadnabizadeh et al.[9] further indicated that lifestyle factors such as non-smoking, physical activity, and healthy nutrition strongly predict mammography participation, emphasizing the need to address healthy lifestyle behaviors in conjunction with awareness programs. The lower awareness scores among smokers and women with chronic illnesses in the present study directly support this relationship.

This study has several limitations. First, although statistically significant associations were observed, the cross-sectional design allows only the identification of relationships rather than causal effects. In other words, temporal ordering cannot be established, and statistically significant findings should not be interpreted as evidence of causation. Second, the sampling strategy relied on voluntary participation among women who applied to KETEM services, which may introduce selection bias, as women who actively seek preventive care may differ from those who do not. Third, the study relied on self-reported data for variables such as health behaviors and previous screening practices, which may be subject to recall bias and social desirability bias. Fourth, although the BCAS has established validity, the exclusion of four items during the EFA process and the cultural context of the population may have influenced the measurement structure. Fifth, the unequal number of participants between the two districts reflects natural utilization patterns of KETEM services and may have affected subgroup comparisons despite the use of robust statistical methods. Finally, the study was conducted in only two districts of Ankara, limiting the generalizability of the findings to other regions with different sociodemographic or cultural characteristics. Nonetheless, the findings contribute valuable descriptive insights to the existing literature on breast cancer awareness in Türkiye.

CONCLUSION

This study demonstrates that social determinants of health are significantly associated with women's knowledge and awareness levels regarding breast cancer. Socioeconomic factors such as education, income, and employment status, along with health status and access to healthcare services, are key determinants of awareness. The higher awareness levels observed among women who received information and screening education highlight the effectiveness of ed-

ucational interventions. However, the persisting inadequacy in early detection behaviors suggests that psychosocial and cultural factors also play a crucial role in transforming knowledge into practice.

The findings indicate that developing accessible, sustainable, and culturally tailored awareness programs for women living in socioeconomically disadvantaged regions should be among the primary objectives of national health policies for combating breast cancer in Türkiye. In this context, primary healthcare services and family medicine play a pivotal role, as they constitute the first point of contact for preventive counseling, early detection guidance, and referral. Strengthening the integration between KETEM and family medicine units can enhance community-based outreach and facilitate equitable access to screening services. Furthermore, it is recommended that the planning of KETEM services consider not only population density but also socioeconomic status. Future research should employ longitudinal study designs to examine the causal relationships between social determinants and breast cancer awareness and to evaluate the effectiveness of intervention programs aimed at improving awareness levels.

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Case Report

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Plethora of Characteristic Findings in Osteopetrosis: A Case Report

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ABSTRACT

Osteopetrosis, a rare genetic disorder, presents in two major forms: Autosomal recessive and autosomal dominant osteopetrosis. This disorder is characterized by loss of osteoclastic activity, which results in increased bone density. In this case, an 8-month-old female presented with acute respiratory distress, hepatosplenomegaly, anemia, and frontal bossing. Diagnosis was established based on characteristic radiological findings, including the classic "bone-in-bone" appearance. In infants presenting with anemia and hepatosplenomegaly, osteopetrosis should be considered a differential diagnosis. Early diagnosis through genetic typing and treatment with hematopoietic stem cell transplantation may prevent life-threatening complications.

Keywords: Bone-in-bone, hepatosplenomegaly, osteopetrosis

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INTRODUCTION

Osteopetrosis is a rare genetic disorder of defective osteoclastic activity, in which impaired bone resorption results in increased bone density. It is more common in consanguineous populations of Turkey, India, and Pakistan.[1]

There are two primary forms. Autosomal recessive osteopetrosis (ARO), the more severe variant, has an incidence of ~1/250,000 births and presents in infancy with macrocephaly, hepatosplenomegaly, and cranial neuropathies.[2] Radiological findings reveal a characteristic "bone-within-bone" appearance. Without intervention, bone marrow failure ensues, resulting in a mortality rate of ~70% by the age of 6 years.[3]

Autosomal dominant osteopetrosis (ADO) is a milder form with an incidence of ~1/20,000 births.[2] It typically presents with multiple fractures caused by brittle bones. X-ray findings show a "sandwich" bone appearance and an Erlenmeyer flask deformity.

ARO is caused by biallelic mutations, with the majority having mutations in the *TCIRG1* gene. Other mutations include genes such as *CLCN7, TNFSF11* (RANKL).[2] Hematopoietic stem cell transplantation (HSCT) is the only definitive treatment, and supportive management is required to prolong survival.

CASE REPORT

An 8-month-old female presented to the emergency department with acute respiratory distress. Her parents also complained of progressive abdominal distension, which started at around 1 month of age.

On examination, the patient had pallor, frontal bossing, a bulging anterior fontanelle, hypertelorism, and micrognathia. Her anthropometric measurements suggested impaired bone growth. The liver was enlarged, 6 cm below the right costal margin. The spleen was also enlarged, measuring 4 cm below the left costal margin.

Total blood count showed hemoglobin=10.6 g/dL, total leukocyte count=33.3×10^9/L, neutrophils=8.03×10^9/L, lymphocytes=14.99×10^9/L, hematocrit=33.2%, and mean corpuscular volume=80.8 fL (Table 1). Peripheral blood smear showed a dimorphic picture: Normochromic, normocytic, and microcytic, hypochromic red blood cells. Serum electrolytes showed decreased phosphate levels: 3.2 mg/dL (4.3–9.3 mg/dL).

X-ray showed a generalized increase in bone density and loss of corticomedullary differentiation. Widening of metaphyseal ends and metaphyseal lucent bands were noted in the bilateral femur, proximal tibia, and fibula. The ribs also showed increased density (Fig. 1). The spine showed radiopacity with a characteristic "bone-in-bone" appearance (Fig. 2). A bone marrow biopsy was attempted but was unsuccessful.

Differential diagnoses included storage disorders, TORCH infections, and malignancies. However, based on characteristic radiographic findings and peripheral smear, our case was accepted as ARO.

Symptomatic treatment, i.e., intravenous antibiotics, was given, and improvement was seen within 72 h. Follow-up in 2 weeks was advised, and the patient was enlisted as a bone marrow recipient.

DISCUSSION

Our patient presented with ARO, the most clinically severe form.[1] Radiological findings, particularly the "bone-in-bone" appearance, were crucial for diagnosis in the absence of a successful bone marrow biopsy. This underscores the importance of skeletal surveys in evaluating suspected cases in resource-limited areas. Furthermore, advanced ra-

Table 1. Complete blood count parameters in a 6–23-month-old female.

Component	Patient value	Reference range	Unit
Hemoglobin	10.6	10.2–12.7	g/dL
Total Leucocyte Count	33.3	6.5-13.0	×10^9/L
Neutrophils	8.03	1.27– 7.18	×10^9/L
Lymphocytes	14.99	1.52-8.09	×10^9/L
Hematocrit	33.2	30.9-37.9	%
MCV	80.8	71.3– 82.6	fL

Hb: hemoglobin; TLC: total leucocyte count; Hct: hematocrit; MCV: mean corpuscular volume; MCHC: mean corpuscular hemoglobin concentration.

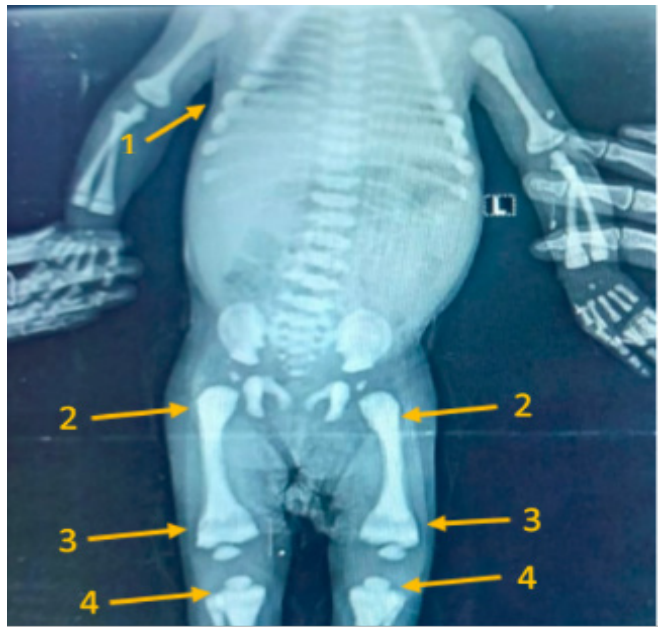


Figure 1. Ribs showing increased density (1), bilateral femur and proximal tibia also showing increased bone density (2) with alternating radiolucent metaphyseal bands (3,4).



Figure 2. Lateral view spine demonstrating the classic 'bone-in-bone' appearance.

diological techniques such as computed tomography and magnetic resonance imaging could be significant in detecting neurological complications before clinical symptoms such as blindness or facial palsy emerge.[4] Increased bone density in osteopetrosis disrupts normal medullary hematopoiesis, leading to pancytopenia and increased susceptibility to infections. In our case, the infant presented with bronchopneumonia. The eventual decreased blood cell formation results in extramedullary hematopoiesis manifesting as hepatosplenomegaly and frontal bossing.

Defective longitudinal bone growth has also been observed in other cases of osteopetrosis.[5] In addition, hypophosphatemia precedes hypocalcemia, also seen in our patient.[6] Hypophosphatemia causes decreased 2,3-diphosphoglycerate levels, depleting adenosine triphosphate stores and impairing oxygen delivery. This causes hemolysis, reduced platelet hemostatic function, and phagocytic activity of leukocytes, resulting in hematopoietic insufficiency.[7]

Pharmacotherapy focuses on symptomatic treatment and multidisciplinary surveillance to avoid lethal complications.[1] Modalities such as genetic typing have eased early prenatal and postnatal diagnosis.[1] HSCT and bone marrow transplantation are the only definitive cures for osteopetrosis. HSCT may reduce the risk of neurological complications in cases diagnosed prenatally through genetic typing, increasing life expectancy. However, HSCT outcomes may vary depending on the genetic mutation.[8] However, access to such procedures remains limited in low socioeconomic countries such as Pakistan. Interferon gamma treatment has also been fruitful in improving immune function and bone homeostasis.[9] Family physicians should consider ARO as a differential for infants presenting with unexplained anemia, hepatosplenomegaly, and growth retardation, allowing early referral and reduced mortality.

CONCLUSION

Osteopetrosis either remains undiagnosed or progresses to a high mortality rate. Such rare disorders should be considered, ensuring timely referral and management. Radiological investigations confirm the diagnosis, and timely symptomatic intervention and HSCT have been associated with improved survival and quality of life.

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A Case of Malnutrition Inflamation Atherosclerosis Syndrome in Home Care

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ABSTRACT

Malnutrition-inflammation-atherosclerosis (MIA) syndrome is a major determinant of mortality and morbidity in patients with end-stage renal disease (ESRD). While each component alone can lead to adverse clinical outcomes, the coexistence of all components significantly reduces survival. An 81-year-old male patient with stage 5 chronic kidney disease, hypertension, and coronary artery disease was monitored through home health services; he underwent hemodialysis twice weekly, and severe MIA were identified. Despite nutritional and anti-inflammatory interventions during approximately 1 month of follow-up, the patient's condition deteriorated, and the patient died after admission to the intensive care unit. This case highlights the critical role of primary care and family medicine in the early detection and multidisciplinary management of MIA syndrome in ESRD patients. Integration with home health services allows for early identification of malnutrition and inflammation, enabling timely intervention and referral to higher-level care. In conclusion, systematic assessment of MIA syndrome components and coordination through home health services and family medicine may facilitate early recognition and multidisciplinary management in ESRD patients.

Keywords: Family medicine end-stage renal disease, mia syndrome, home health care

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INTRODUCTION

The malnutrition-inflammation-atherosclerosis (MIA) syndrome was first described by Bergström et al.[1] in 1998 and refers to the coexistence of three interrelated clinical conditions that are closely associated with increased morbidity and mortality in patients with end-stage renal disease (ESRD). Although each component of the syndrome may independently lead to adverse clinical outcomes, their coexistence has been shown to markedly reduce survival.[2] In patients with chronic kidney disease (CKD), elevated proinflammatory cytokine levels contribute to the development of protein–energy malnutrition and accelerate the progression of atherosclerosis.[3] This interaction forms a vicious cycle within the MIA axis. Previous studies have demonstrated that MIA syndrome is one of the most important determinants of cardiovascular mortality, particularly in dialysis patients.[4] In patients with ESRD, one, two, or all three components of the syndrome may be present simultaneously, and the coexistence of all components is associated with a significant reduction in life expectancy.[5] However, in daily clinical practice, these components are often evaluated separately, and a comprehensive assessment of MIA syndrome may be overlooked, especially in patients receiving home healthcare services.

Home healthcare services represent an essential component of family medicine practice and play a key role in the follow-up of patients with chronic diseases who have limited access to healthcare facilities.[6] Early recognition of MIA syndrome in ESRD patients within primary care

is crucial for prognostic evaluation, determination of care goals, and assessment of mortality risk. This case report aims to emphasize the importance of a holistic evaluation of MIA syndrome in family medicine practice through a patient with ESRD followed under home healthcare services, in whom all components of the syndrome were identified.

CASE REPORT

An 81-year-old male patient with a history of Stage 5 CKD, hypertension, and coronary artery disease was evaluated within the scope of home healthcare services on request for medical consultation. The patient was receiving hemodialysis twice weekly and was using phosphate binders, acetylsalicylic acid, a beta-blocker, folic acid, and vitamin B12. At the time of initial assessment, loss of appetite was the only reported complaint.

Physical examination revealed that the patient was conscious, oriented, cooperative, and cachectic in appearance. Vital signs were as follows: Body temperature 36.6°C, respiratory rate 22/min, pulse 88/min, and blood pressure 130/80 mmHg. Abdominal and systemic examinations were unremarkable. The patient's body weight was 56 kg, and height was 180 cm, yielding a body mass index (BMI) of 17.3 kg/m^2.

Laboratory findings were consistent with ESRD and demonstrated elevated creatinine and urea levels, low albumin and total protein levels, elevated C-reactive protein (CRP), and decreased Vitamin B12 and Vitamin D3 levels. Laboratory parameters are summarized in Table 1.

During the initial follow-up, dependency level, nutritional status, and fall risk were evaluated using standardized assessment tools. Dependency was assessed using the Barthel ındex of activities of daily living, nutritional status using the mini nutritional assessment (MNA), malnutrition–inflammation score (MIS), and subjective global assessment (SGA), and fall risk using the Itaki Fall Risk Scale.[7-11] The results indicated high dependency (Barthel score: 55), severe malnutrition (MNA: 10; MIS: 20; SGA: C), and high fall risk (Itaki score: 11). Assessment results are presented in Table 2.

Based on nutritional assessment tools, the patient was diagnosed with severe malnutrition. As the upper normal limit for CRP at the testing center was <10 mg/L, a CRP level ≥10 mg/L was accepted as an indicator of inflammation. The presence of coronary artery disease in the patient's medical history was considered evidence of atherosclerosis. Accordingly, all three components of MIA syndrome were present.

The patient was followed by the home healthcare unit for approximately 1 month after initial evaluation. During the final visit, due to rapid clinical deterioration, the patient was referred to hospital care and died after approximately 3 days of hospitalization in the intensive care unit. Written informed consent for publication was obtained from the patient's relative.

Table 1. Laboratory parameters of the patient

Parameters	Patient's values	Normal range
Hemoglobin (g/dL)	11.3	11.5–17.5
Hematocrit (%)	33.1	37–53
RBC (10^3/U)	3.76	3.9–5.5
MCV (fl)	88.2	80–97
WBC (10^3/U)	5.6	4.5–11
Platelet (10^3/U)	229	140–400
Blood glucose (mg/dL)	110	70–99
Creatinine (mg/dL)	4.8	0.66–1.09
Urea (mg/dL)	134	17–43
Uric acid (mg/dL)	5.24	3.5–7.2
Sodium (mmoL/L)	136	136–145
Potassium (mmoL/L)	5.1	3.5–5.1
Phosphorus (mg/dL)	3.65	2.5–4.5
Alkaline phosphatase (mg/dL)	76	43–115
CRP (mg/dL)	13.2	0–5
Albumin (g/L)	27.63	35–52
Total protein (g/L)	64.1	66–83
Iron (ug/dL)	60	60–180
Iron binding capacity (ug/dL)	118	118–418
Ferritin (ug/dl)	506	11–306.8
Vitamin B12 (ug/L)	126	145–914
25-Hydroxy vitamin D3 (ug/L)	9.7	13–56.9
Calcium (mg/dL)	8.6	8.8–10.6

CRP: C-reactive protein, MCV: Mean corpuscular volume, RBC: Red blood cell, WBC: White blood cells

Table 2. Evaluation of scales applied to the patient

	Scores from scales	Results
Barthel scale	55	Highly dependent
MNA	10	Malnutrition
MIS	20	Malnutrition
SGA	C	Severe malnutrition
Itaki scale	11	High fall risk

MNA: Mini nutritional assessment, MIS: Malnutrition-inflammation score, SGA: Subjective global assessment

DISCUSSION

Primary care plays a central role in the long-term management of chronic diseases and in ensuring continuity of care. Within family medicine practice, regular follow-up of patients with ESRD allows early identification of malnutrition and clinical findings suggestive of inflammation. Family physician–led care integrated with home healthcare services is particularly valuable in elderly patients with functional limitations, enabling early recognition of MIA syndrome components and timely referral to secondary or tertiary care.

MIA syndrome has been recognized as one of the leading determinants of mortality in patients with ESRD.[12] In the present case, all three components of MIA syndrome were identified concurrently in an elderly patient followed under home healthcare services, consistent with the high mortality risk reported in the literatüre.[12,13] The comprehensive assessment performed in the primary care setting enabled the detection of malnutrition and inflammation. A BMI of 17.3 kg/m^2 and a serum albumin level of 27.6 g/L indicated severe malnutrition, findings that have been shown to significantly affect survival in dialysis patients.[12,13]

Recent studies have demonstrated a high prevalence of MIA syndrome among hemodialysis patients and a strong association between malnutrition, inflammation, and mortality.[12] Long-term follow-up studies have also shown that inflammatory markers are predictive of MIA syndrome progression and cardiovascular mortality.[13]

Despite nutritional interventions and efforts to control inflammation during follow-up, the patient's clinical condition rapidly deteriorated and resulted in death. This outcome highlights that MIA syndrome is a severe clinical condition associated with high mortality, even when early diagnosis and appropriate management are provided.

CONCLUSION

This case underscores the importance of systematic and individualized evaluation of MIA syndrome components during regular follow-up of patients with ESRD in primary care. It also highlights the critical role of family medicine–coordinated home healthcare services in the early recognition of MIA syndrome and the implementation of a multidisciplinary approach, as well as the importance of early detection and management of malnutrition and inflammation.

Disclosures

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Letter to the Editor

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The Interdisciplinary Role of Family Medicine in the Age of Infodemic

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A recent study by Arman et al.[1] demonstrates the importance of family medicine. Although patients who consulted only endocrinology clinics appeared more competent in self-management tasks such as glucose monitoring and insulin dose adjustment, glycated hemoglobin levels were found to be similar, and access to preventive care (e.g., blood pressure, foot, and neurological examinations) was higher among those in contact with family physicians. This highlights the need for trust-based, holistic approaches in an age of infodemic.

Infodemic refers to an excessive amount of information – including false or misleading information – spreading in digital and physical environments during a disease outbreak.[2] It can lead to increased behaviors such as vaccine resistance or hesitancy and the irresponsible sharing of personal opinions as facts without citing reliable sources. In short, this creates a self-perpetuating vicious cycle.

The World Health Organization (WHO) emphasizes that misinformation weakens not only vaccination efforts but also the management of chronic diseases.[2] In a global survey conducted in 2023, only 69% of participants reported trust in the healthcare sectors. Of these, primary care physicians were the most trusted professionals.[3] In such an environment marked by increasing skepticism, family physicians, with their accessibility, continuity, and well-established presence within communities, are uniquely positioned to revive trust in evidence-based care.

The biopsychosocial mission of family medicine serves as an antidote to this distrust. Family physicians treat individuals not as organ systems but as holistic beings at the intersection of biological, psychological, and socioeconomic contexts.[4]

Opportunistic algorithms or competition between specialties that determine the information patients have access to and the care they receive will only serve to reinforce this structure of mistrust. However, the structure that needs to be strengthened is well defined by the WHO: WHO has adopted as a primary goal the strengthening of individuals' resilience to misinformation.[2]

In addition, we now need to work interdisciplinarily rather than just multidisciplinarily. While a multidisciplinary approach may involve different paths to the same goal, an interdisciplinary approach forces us to work together towards the same goal. This spirit of teamwork – a necessity – makes us feel not like "competitors" but like "colleagues," leading to greater efficiency. Moreover, the patient is an inseparable part of the interdisciplinary approach; we must never forget this. Perhaps due to the nature of their discipline, family physicians/general practitioners have the greatest responsibility in this regard.

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Academic publishers, educators, policy makers, civil society organizations, and the media need to reinforce this attitude. Recommendations for action include:

- Embedding interdisciplinary pathways directly into clinical guidelines
- Teaching the ability to refute misinformation in medical education
- Valuing continuity and teamwork as well as productivity in health care evaluation
- Encouraging policymakers to remove structural barriers that limit continuity in family medicine (e.g., reimbursement restrictions)
- Discredit unsourced information to maintain academic rigour
- Promoting health literacy to immunize the public against misinformation
- Establish specialized "rapid response teams" to counter misinformation in real time (e.g., family physicians, public health experts, communication specialists).

Demonstrating unity with patients and colleagues alike can foster patient empowerment.

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