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PERSONALIZED APPROACH TO NON-COMMUNICABLE DISEASE PREVENTION IN THE WORKING POPULATION

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ABSTRACT

Introduction Effective prevention of noncommunicable diseases (NCDs) requires shifting from generalized advice to personalized interventions.

Aim To develop and justify personalized approaches to NCD prevention for the working population, by identifying key behavioral predictors, focusing on the interplay between diet, physical activity, and social barriers.

Materials and methods A mixed-methods study was conducted, integrating quantitative survey data (pre-pandemic baseline, N = 1252) and qualitative interviews with market employees in early January 2026 (n = 30). Statistical analysis included Odds Ratios (OR), Sensitivity (Se), Specificity (Sp), and Likelihood Ratios (LR).

Results Individual Nutritional Control (INC) and Daily Physical Exercise (DPE) were identified as core markers of health engagement. DPE demonstrated exceptional diagnostic power in ruling out perceived physical inactivity (LR– 0.05, Positive Predictive Value, PPV 0.93). Absence of INC was associated with 4-fold higher odds of physical inactivity (OR 4.03; 95% CI 2.83–5.72). Qualitative data from 2026 revealed "preventive inertia" and a shift toward telemedicine and "proxy" family consultations under extreme environmental stress and power outages.

Conclusions A personalized approach involves identifying "leading components," such as DPE, to catalyze broader lifestyle changes. Integration of tailored health coaching and workplace wellness programs is essential for sustainable NCD prevention.

Keywords Non-communicable diseases, individual nutritional control, physical activity, personalized approach, working population.

ABORDARE PERSONALIZATĂ ÎN PREVENIREA BOLILOR NETRANSMISIBILE LA POPULAȚIA ACTIVĂ

Introducere Prevenirea eficientă a bolilor netransmisibile (BNT) necesită trecerea de la recomandări generalizate la intervenții personalizate.

Scop Obiectivele principale ale acestui studiu rezidă în dezvoltarea și fundamentarea unor abordări personalizate pentru prevenirea BNT în rândul populației active, prin identificarea principalilor predictori comportamentali, cu accent pe interacțiunea dintre alimentație, activitatea fizică și barierele sociale.

Materiale și metode A fost realizat un studiu de tip mixed-methods, care a integrat date cantitative din sondaj (linia de bază pre-pandemică, N = 1252) și interviuri calitative cu angajați din piețe, la începutul lunii ianuarie 2026 (n = 30). Analiza statistică a inclus Raportul de șanse (OR), Sensibilitatea (Se), Specificitatea (Sp) și Raporturile de verosimilitate (LR).

Rezultate Controlul nutrițional individual (CNI) și exercițiul fizic zilnic (EFZ) au fost identificate ca markeri principali ai implicării în sănătate. EFZ a demonstrat o putere diagnostică excepțională în excluderea percepției de inactivitate fizică (LR– 0,05, valoare predictivă pozitivă, PPV 0,93). Absența CNI a fost asociată cu o probabilitate de 4 ori mai mare de inactivitate fizică (OR 4,03; IC 95% 2,83–5,72). Datele calitative din 2026 au evidențiat „inerția preventivă" și o orientare către telemedicină și consultații familiale de tip „proxy" în condiții de stres ambiental extrem și întreruperi de energie electrică.

Concluzii O abordare personalizată implică identificarea „componentelor dominante", precum EFZ, pentru a cataliza schimbări mai ample ale stilului de viață. Integrarea coachingului de sănătate adaptat și a programelor de wellness la locul de muncă este esențială pentru prevenirea durabilă a BNT.

Cuvinte-cheie Boli netransmisibile, control nutrițional individual, activitate fizică, abordare personalizată, populație activă.

INTRODUCTION

Non-communicable diseases (NCDs), including cardiovascular diseases (CVDs), diabetes, and cancer, account for 80% of the disease burden in EU countries and remain the leading causes of premature death. NCDs cost EU economies approximately €115 billion annually due to healthcare expenses and lost workforce productivity (1). Improving health promotion and disease prevention can reduce the prevalence of NCDs by as much as 70% (2).

Accumulating evidence from recent decades identifies eight core risk factors (RFs) responsible for up to 75% of NCD-related mortality (3). Among them, unhealthy diet and lack of physical activity (PA) are the most common and play an important role. The mortality rate and DALY indicators associated with insufficient fruit and vegetable consumption are the highest in European countries (4). Physical inactivity is the fourth most important RF for global mortality, responsible for 9% of premature deaths and significant percentage of diabetes and coronary heart disease cases (5–7). Lifestyle modifications, including a balanced diet, regular PA are essential to reduce the burden of CVDs (8). Today, PA is seen as a public health issue requiring multi-sectoral solutions (transport, urban design, sports) and leads to numerous individual and societal benefits (9, 10). Recent studies explore real-life situations, such as the influence of transport proximity (11) or the common PA of people and their companion dogs (12).

To increase the impact of preventive interventions, we must evaluate the effectiveness of routine practices and expand their coverage (13, 14). In real life, a combination of RFs is more common, requiring multifactorial interventions (15) adapted for primary care (16–18). Modern technologies for tracking PA do not diminish the importance of communicating with the doctor (19–21). Awareness and acceptance of knowledge by different populations must be considered when designing an intervention (22).

By 2022, 2.5 billion adults were overweight, including over 890 million living with obesity (23), a major factor in NCD morbidity (24). Differences in income and education significantly affect food choices and PA options (25, 26). Individual public health strategies developed before the pandemic, now require re-evaluation to address emerging communication patterns and socioeconomic challenges (27). As evidence on occupational PA and gender differences remains inconsistent (28), there is a need for personalized approaches.

Aim: to develop and justify personalized approaches to NCD prevention for the working population, by identifying key behavioral predictors, focusing on the interplay between diet, physical activity, and social barriers.

MATERIALS AND METHODS

Study Design and Setting

This research followed a mixed-methods design, integrating data from two distinct but complementary studies to evaluate lifestyle-related risk factors (RFs) and their diagnostic value in clinical practice. This mixed-methods approach allowed for the triangulation of large-scale behavioral data with specific socio-economic and environmental realities.

1. The Quantitative Study (pre-pandemic baseline): An observational cross-sectional study of the working population in Chernivtsi region, Ukraine (N = 1252), providing a reference point for the distribution of behavioral RFs in the pre-pandemic and pre-war period.

2. The Qualitative Study (January 2026): Structured interviews (n = 30) with market employees were conducted to contextualize lifestyle patterns within modern socio-economic conditions.

Sample Formation and Representativeness

The study population was formed using stratified random sampling to ensure qualitative representativeness. The sample comprised working-age individuals, represented in balanced proportions by market personnel (entrepreneurs and hired employees) and fair attendees. The study was conducted at a semi-enclosed, sprawling market complex covering several dozen hectares, where indoor trading zones are interconnected by unsheltered open-air walkways, exposing both employees and visitors to ambient environmental conditions.

The mean age was 40.49 (SD, 13.22) years. Comparative analysis of the age and gender structure showed no statistically significant differences from the official regional statistics ($p > 0.05$). The 30-39 age group accounted for 26.9% of the regional population and 26.04% of the study sample. The final sample size of N = 1252 was purposefully structured to ensure a minimal overall margin of error of ±2.8% (at a 95% confidence level). Percentage values in the results were presented alongside their calculated standard errors or confidence intervals.

Data Collection and Variables

Data collection involved a direct, face-to-face approach throughout the study period. For the quantitative component (2019), an anonymous survey was conducted using a specifically developed questionnaire; depending on the respondents` preference, they either completed the forms themselves or were interviewed by the researcher. This process was supplemented by direct observation of the study environment. In January 2026, data were gathered through structured face-to-face interviews. Due to extreme weather conditions (severe frost), responses were recorded manually by the researcher to ensure the integrity of the data collection process.

The research instrument was based on the WHO STEPS (29) approach and focused on two key behavioral domains: Individual Nutrition Control (INC) (regulating salt, sugar, and fats) and Physical Activity (PA) (evaluating activity levels according to preventive standards). Additionally, the survey examined the patient experience, as respondents were also asked about their experience as patients of their family physicians.

Statistical Analysis

Quantitative data were processed using IBM SPSS Statistics (v. 27.0). Statistical methods included Association Analysis using Odds Ratios (OR) with 95% Confidence Interval (CI). Diagnostic Validation was performed via cross-tabulation analysis to calculate the sensitivity (Se) and specificity (Sp), and predictive values (PPV, NPV) of lifestyle habits as screening indicators. To assess the clinical utility of behavioral markers, positive and negative likelihood ratios (LR+, LR–) were calculated using sensitivity (Se) and specificity (Sp) values following standard diagnostic accuracy formulas. Comparative Statistics utilized the χ^2 (chi-square) test for categorical variables with significance level set at $\boldsymbol{p < 0.05}$.

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Informed written consent was obtained from all participants prior to their inclusion in the research.

RESULTS

The study focused on a detailed analysis of self-reported **Individual Nutrition Control (INC)** and **Physical Activity (PA)**, including participants' experiences (frequency of preventive medical consultations, and doctor-patient communication as a source of health information). Furthermore, we evaluated the behavioral RFs that were associated with low patient engagement in health management among the working population.

Interdependence of INC, Lifestyle Recommendations, and Risk Factor Clustering

Participants adhering to INC were 2.8 times more likely to be preventive care users (OR 2.82; 95% CI, 1.77-4.51; $P < .001$). However, among respondents who engaged in preventive medical consultations, only 48% demonstrated adherence to INC (specificity, Sp 0.48). Among those who identified the physician as their primary source of health information, only 38% followed INC (Sp 0.38). Respondents adhering to INC were 3.7 times more likely to follow Healthy Lifestyle (HLS) recommendations (OR 3.69; 95% CI, 1.94-7.02) and 2.7 times more likely to follow Healthy Diet (HD) guidelines (OR 2.66; 95% CI, 1.25-5.64).

Among participants who did not maintain INC, 54% reported not receiving HLS guidelines; of those who did receive them, 89% failed to follow them. A similar pattern was observed for HD advice, with 75% and 84% respectively. Notably, for individuals who followed either HLS or HD recommendations, there was an 80% negative predictive value (NPV 0.80) regarding their adherence to INC. As expected, the intake of beneficial and harmful dietary components differed significantly depending on adherence to INC. The most sensitive indicators of insufficient INC were the absence of restrictions on harmful components (Se 0.92-0.94) and the lack of fish consumption (Se 0.93) (Table 1). Conversely, for individuals who consumed adequate healthy foods and limited harmful ones, the probability of INC presence was 80-87% (NPV 0.80-0.87). In cases where the diet lacked beneficial components (e.g., fish) or failed to limit all harmful ones (e.g., fats), this indicated the absence of INC in approximately half of the instances (Positive Predictive Value, PPV 0.54-0.56) (Table 1).

Among the surveyed population, young men as well as middle-aged and elderly women (with approximately 30 years of employment history), rarely practiced INC. In other categories, adherence to dietary composition among male respondents increased with age. Conversely, the majority of women (65%) maintained INC regardless of age. Physically inactive individuals were four times more likely to lack INC (OR 4.03; 95% CI 2.83-5.72), while smokers were twice as likely (OR 2.18; 95% CI 1.51-3.14). Frequent alcohol consumption (daily or several times a week) was associated with a 1.5-fold increase in the likelihood of insufficient INC (OR 1.48; 95% CI 1.02-2.14). However, among those with established INC, nearly one in three remained physically inactive, and one in five was either a smoker or a frequent alcohol consumer.

Table 1. Comparative characteristics of dietary risk factors based on respondents' self-assessment of Individual Nutritional Control (INC)

Dietary Factors and Statistical Metrics	Individual Nutrition Control (INC) (%)		Predictive Value / χ^2/ P-value
	Negative INC (-)	Positive INC (+)	
1. Fruit			
Insufficient Consumption (-)	85.93±2.12	41.81±2.85	PPV 0.65
Sufficient Consumption (+)	14.07±2.12	58.19±2.85	NPV 0.82
Se / Sp	Se 0.86	Sp 0.58	χ^2 118.1
OR 95% CI	8.499 (5.624-12.843)		P < .001
2. Vegetables			
Insufficient Consumption (-)	80.00±2.43	37.79±2.80	PPV 0.66
Sufficient Consumption (+)	20.00±2.43	62.21±2.80	NPV 0.80
Se / Sp	Se 0.80	Sp 0.62	χ^2 103.64
OR 95% CI	6.584 (4.507-9.617)		P < .001
3. Fish			
Insufficient Consumption (-)	92.96±1.56	72.24±2.59	PPV 0.54
Sufficient Consumption (+)	7.04±1.56	27.76±2.59	NPV 0.81
Se/ Sp	Se 0.93	Sp 0.28	χ^2 41.41
OR 95% CI	5.076 (2.986-8.630)		P < .001
4. Salt			
Excessive Intake (-)	92.22±1.63	61.54±2.81	PPV 0.58
Adherence to restrictions (+)	7.78±1.63	38.46±2.81	NPV 0.85
Se / Sp	Se 0.92	Sp 0.39	χ^2 73.44
OR 95% CI	7.411 (4.483-12.250)		P < .001
5. Fat			
Excessive Intake (-)	94.44±1.39	66.89±2.72	PPV 0.56
Adherence to restrictions (+)	5.56±1.39	33.11±2.72	NPV 0.87
Se / Sp	Se 0.94	Sp 0.33	χ^2 67.24
OR 95% CI	8.415 (4.741-14.936)		P < .001

Note: *Se / Sp* – Sensitivity / Specificity (presented as fractions of 1.0); *PPV* – Positive Predictive Value; *NPV* – Negative Predictive Value (presented as fractions of 1.0); *OR* – Odds Ratio; 95% *CI* – 95% Confidence Interval.

Physical Activity Patterns and Behavioral Associations

According to the study, physical activity (PA) was primarily realized through daily physical exercises (DPE 15%), and regular structured physical activity (SPA), including moderate-intensity exercises performed 4-5 times a week (11%) or 2-3 times a week (13%). Notably, 53.71±1.58% of respondents perceived themselves as physically active, with walking (45%) and outdoor activities (52%) played a significant place in their routines. Among inactive

individuals, the absence of DPA or scheduled classes yielded a high sensitivity (Se 0.99) and an NPV 0.96-0.98 regarding overall PA (Table 2). Self-assessed PA was significantly associated with all analyzed mobility factors ($P < .01$, Table 2). Low occupational PA, the absence of gardening, and especially a walking duration of less than 30 minutes per day served as the strongest predictors of perceived inactivity.

Table 2. Comparative characteristics of mobility types based on respondents' self- assessment Physical Activity (PA)

Mobility Factors and Statistical Metrics	Physical Activity (PA) (%)		Predictive Value / χ^2 / P-value
	Negative PA (-) (Consider themselves inactive)	Positive PA (+) (Consider themselves active)	
1. Daily Physical Exercises (DPE)			
Absence (-)	98.48±0.87	82.09±1.66	PPV 0.31
Regular (+)	1.52±0.87	17.91±1.66	NPV 0.97
Se/ Sp	Se 0.99	Sp 0.18	χ^2 33.31
OR 95% CI	1.182 (4.439-45.305)		P < .001
2. Regular Structured Physical Exercise (SPA)			
Absence (-)	98.48±0,87	84,70±1,55	PPV 0.30
Presence (+)	1.52±0.87	15.3±1.55	NPV 0.96
Se/ Sp	Se 0.99	Sp 0.15	χ^2 17.18
OR 95% CI	3.691 (1.941-7.020)		P < .001
3. Occupational Physical Activity (PA)			
Low activity (-)	82.29±2.89	67.16±2.17	PPV 0.31
Moderate load (+)	17.71±2.89	32.84±2.17	NPV 0.83
Se/ Sp	Se 0.82	Sp 0.33	χ^2 14.23
OR 95% CI	2.271 (1.472-3.503)		P < .001
4. Gardening and yard work			
Absence (-)	81.31±2.77	69.59±1.99	PPV 0.30
Seasonal/Regular (+)	18.69±2.77	30.41±1.99	NPV 0.82
Se/ Sp	Se 0.81	Sp 0.30	χ^2 10.03
OR 95% CI	1.902 (1.272-2.842)		P < .01
5. Walking (Commuting or Leisure)			
< 30 min/day (-)	78.28±2.93	48.51±2.16	PPV 0.37
> 30 min/day (+)	21.72±2.93	51.49±2.16	NPV 0.87
Se/ Sp	Se 0.78	Sp 0.52	χ^2 52.17
OR 95% CI	3.826 (2.622-5.584)		P < .001

Note: *Se / Sp* – Sensitivity / Specificity (presented as fractions of 1.0); *PPV* – Positive Predictive Value; *NPV* – Negative Predictive Value (presented as fractions of 1.0); *OR* – Odds Ratio; 95% *CI* – 95% Confidence Interval.

Using an objective proxy for PA (performing SPA ≥ 30 min, 2-3 times/week) showed that physically active individuals had a high probability of adhering to INC (Sp 0.76), though among those with established INC, only 29% were also physically active (NPV 0.29). Notably, in 91% of cases, frequent alcohol consumption or smoking was not accompanied by regular SPA (PPV 0.91; $p < 0.05$), with an error probability of 5.1-6.3%.

Physically active patients demonstrated higher rates of dental visits (Sp 0.42), while 79% of inactive respondents did not (Se 0.79). However, the data showed a low probability that preventive consultations with either a family physician or a dentist serve as a catalyst for initiating regular SPA (NPV 0.26). Regarding PA recommendations specifically, only 27% of those who exercised had received professional recommendations, among them, the specificity of adherence was 0.37 (Sp 0.37). These data indicate that clinical advice in its current form serves as a weak predictor of actual behavioral change toward SPA. Receiving general HLS recommendations showed no significant impact on the decision to engage in regular SPA ($p < 0.05$).

DPE were significantly associated with all analyzed dietary risk factors ($P < .01$ for all parameters, Table 3). Respondents who neglected DPE were 3.5 times more likely to demonstrate poor INC compared to those who exercised regularly (OR 3.50; 95% CI 2.10-5.83). Specifically, 75% of individuals engaging in DPE adhered to INC (Sp 0.75), whereas among those with established INC, only 20% performed daily exercises (NPV 0.20). Similar predictive patterns were observed for specific dietary restrictions. The absence of DPE showed high sensitivity for excessive intake of fat (Se 0.78), sugar (Se 0.75), and salt (Se 0.69). Furthermore, regular DPE was a significant predictor for sufficient fruit consumption (OR 2.72; Sp 0.66) and adherence to sugar restriction (OR 2.81) (Table 3).

The calculated likelihood ratios for self-reported behaviors showed that a negative INC was a predictor of a lack of fruit and vegetables (LR+ 2.05–2.11), while a positive INC corresponded to the absence of excessive salt and fat intake (LR– 0.18–0.21). DPE and SPA yielded LR values of 0.05 and 0.07, respectively. Furthermore, the absence of DPE was associated with poor INC (LR+2.16).

Respondents who did not engage in DPE were 1.5 times more likely to be smokers ($P = .045$) and significantly less likely to have annual visits to the doctor ($P < .001$). The absence of DPE showed high sensitivity for identifying individuals who were not screened for blood sugar (Se 0.70, $P < .01$) and cholesterol testing (Se 0.84, $P < .001$).

Table 3. Association between dietary risk factors and daily physical exercises (DPE): predictive metrics and odds ratios (OR)

Dietary Factors and Statistical Metrics	Daily physical exercises (DPE) (%)		Predictive Value / χ^2 / P-value
	Absent (-)	Present (+)	
1. Individual nutrition control (INC)			
Negative INC (-)	53.86±2.09	25.00±4.62	PPV 0.93
Positive INC (+)	46.14±2.09	75.00±4.62	NPV 0.20
Se / Sp	Se 0.54	Sp 0.75	χ^2 25.40
OR 95% CI	3.502 (2.103-5.831)		P < .001
2. Fruit			
Insufficient Consumption (-)	58.36±1.51	34.04±3.46	PPV 0.91
Sufficient Consumption (+)	41.64±1.51	65.96±3.46	NPV 0.22
Se / Sp	Se 0.59	Sp 0.66	χ^2 38.15
OR 95% CI	2.716 (1.962-3.760)		P < .001
3. Sugar			
Excessive Intake (-)	74.59±1.39	51.12±3.75	PPV 0.89
Adherence to restrictions (+)	25.41±1.39	48.88±3.75	NPV 0.26
Se / Sp	Se 0.75	Sp 0.49	χ^2 40.32
OR 95% CI	2,807 (2.024-3.893)		P < .001
4. Salt			
Excessive Intake (-)	69.31±2.65	50.00±6.06	PPV 0.86
Adherence to restrictions (+)	30.69±2.65	50.00±6.06	NPV 0.21
Se / Sp	Se 0.69	Sp 0.50	χ^2 9.20
OR 95% CI	2.258 (1.323-3.853)		P < .01
5. Fat			
Excessive Intake (-)	78.43±1.47	60.47±4.30	PPV 0.89
Adherence to restrictions (+)	21.57±1.47	39.53±4.30	NPV 0.23
Se / Sp	Se 0.78	Sp 0.40	χ^2 19.53
OR 95% CI	2.378 (1.607-3.520)		P < .001

Note: *Se / Sp* – Sensitivity / Specificity (presented as fractions of 1.0); *PPV* – Positive Predictive Value; *NPV* – Negative Predictive Value (presented as fractions of 1.0); *OR* – Odds Ratio; 95% *CI* – 95% Confidence Interval.

Qualitative Analysis: Barriers and Facilitators of Preventive Care (2026)

The problem of an inadequate number of preventive visits to a family doctor was confirmed through in-depth interviews with market workers. These were conducted during periods of low ambient temperatures, limited customer flow, and frequent 3-4-hour power outages accompanied by generator exhaust. Despite these challenging conditions at workplaces in the winter of 2026 (low temperature, lack of light, and generator emissions), market workers showed high resilience, stating that such conditions "strengthened" them and fostered a deep respect for their workplaces as essential providers.

The qualitative study also revealed behavioral resilience among workers. The main lifestyle patterns were influenced by age and economic factors. INC was supported mainly by the consumption of home-cooked meals, which was associated with the high cost of public catering.

Data revealed that many respondents reported positive shifts in physician-participant interaction, largely due to the expanded telemedicine phone-based consultations. However, many respondents, especially men, accessed medical advice indirectly through family members rather than through direct professional consultation. Two out of three workers with hypertension resolved all medical issues remotely. One respondent, following a negative past experience, sought care only from familiar doctors at a hospital. Only every third person had consulted a family doctor, notably, most of them had completed their annual screenings. Common barriers included: a "nothing bothers me" attitude, reliance on phone consultations, "proxy" contact via relatives, and the use of personal acquaintances to bypass formal waiting lines.

DISCUSSION

The "unpacking" method (30) identifies effective intervention components for complex social issues (31, 32). Our study established regularities in the distribution of behavioral RFs, within a representative working population, where insufficient intake of fruits and vegetables was associated with 5-9 times lower odds of INC (Table 1). The calculated likelihood ratios confirm the clinical utility of self-reported data: negative INC was a moderate predictor for nutritional deficits (LR+ 2.05-2.11), while positive INC reliably excluded excessive salt and fat intake (LR- 0.18-0.21).

Our findings indicated that individuals who did not maintain INC were 4 times more likely to be physically inactive (OR 4.03; 95% CI 2.83-5.72). While STEPS (2019) (33) reported high activity rates in Ukraine, our data suggested this was primarily due to "forced mobility" driven by employment conditions, explaining why traditional medical recommendations had a limited impact (Sp 0.37).

A personalized approach requires identifying age-specific markers to increase diagnostic specificity across all groups. DPE served as a robust "proxy" indicator for health engagement. The use of a specific factor for assessing the activity of a patient from an atypical age group increased its specificity; engaging in regular SPA the likelihood of activity in middle and old age, while DPE increased the likelihood of activity in young age. Notably, DPE emerged as a definitive clinical marker (LR– 0,05; PPV 0.93) for ruling out perceived inactivity.

Effective intervention must assess health literacy (34), which correlates with exercise adherence and life satisfaction (35, 36). Interventions should develop the patient's self-efficacy and demonstrating the benefits of healthy behavior, while avoiding fear-based messages, as these can lead to the opposite result (37, 38).

Health-related behaviors, information seeking, and physician-patient interactions are shaped by a complex of sociodemographic and economic determinants (39–41), with online search increasingly shaping lifestyle choices (42). However, workplace conditions and time constraints remain major barriers for workers, necessitating the integration of individualized health coaching (43) into family medicine. Such coaching should take into account unique cultural and environmental contexts (43), enabling patients to implement the most appropriate lifestyle changes despite existing professional challenges (37, 38).

Identifying the leading component of a risk factor allows the physician to gradually, "like unwinding a ball of thread", guide the patient toward positive changes. The success of a single patient could catalyze similar changes among colleagues and family (1, 38, 44–46).

Study limitations. Data collection in early January 2026 coincided with extreme weather, mobilization, and power outages, which temporarily altered health-seeking behaviors and limited the sample size. Furthermore, relying on self-reported data on INC and PA may lead to recall bias. Future longitudinal research is needed to track the changes in worker behavior and the receipt of preventive interventions.

CONCLUSIONS

1. Daily physical exercise (DPE) was identified as the primary behavioral marker and a "leading component" for NCD prevention, showing exceptional power in ruling out perceived inactivity (LR– 0.05) and indicating high health engagement (PPV 0.93). The established systemic interplay between DPE and INC suggests that starting interventions with this "proxy" marker can catalyze a structured sequence of further lifestyle modifications, including dietary restrictions and enhanced health literacy.
2. Qualitative data from the winter of 2026 demonstrated that extreme environmental and social stressors shifted health-seeking motivation toward "survival-mode" behaviors, characterized by a preference for telemedicine and "proxy" family-based support. Despite these shifts, "preventive inertia" and asymptomatic bias remain significant barriers, necessitating a transition from passive observation to proactive, screening-oriented medical interactions within primary care.
3. The effectiveness of a personalized preventive approach relies on identifying key risk factor components and addressing them through tailored health coaching. To ensure sustainable lifestyle changes under challenging occupational and environmental conditions, this strategy must integrate family-oriented elements and workplace wellness programs aligned with European standards, focusing on patient self-efficacy and the physician-patient interaction.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ETHICAL APPROVAL

The study was conducted in accordance with the Declaration of Helsinki. The study involved the analysis of fully anonymous survey data and qualitative interviews conducted for the purpose of assessing public health. Informed consent was obtained from all study participants. Data confidentiality was maintained throughout all stages of research.

REFERENCES

1. Health and Food Safety Directorate-General. Healthier together – EU non-communicable diseases initiative. 2022. Accessed November 20, 2025. https://health.ec.europa.eu/document/download/d843d53e-c1c1-4664-b31e-febf618d011a_en?filename=eu-ncd-initiative_publication_en_0.pdf .
2. OECD/EU. Health at a Glance: Europe 2016 – State of Health in the EU Cycle. 2016. https://www.oecd.org/content/dam/oecd/en/publications/reports/2016/11/health-at-a-glance-europe-2016_g1g71832/9789264265592-en.pdf
3. World Health Organization. Prevention and control of noncommunicable diseases: responses to specific assignments in preparation for the third High-level Meeting of the United Nations General Assembly on the Prevention and Control of Non-communicable diseases in 2018. Report by the Director-General. Executive Board, 138. 2016. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/d0f21062-e1c3-4cf0-b443-7f9ad259e06e/content
4. World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. 2009. 70 p. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/50e6ba96-c5c3-4e1d-b635-f111bb74f4bf/content
5. World Health Organization. Global action plan on physical activity 2018–2030: more active people for a healthier world. 2018. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/33339c9c-3a9f-46d4-9f12-ae9ff0dfdc6a/content
6. World Health Organization. WHO guidelines on physical activity and sedentary behaviour: at a glance. 2020. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/f3885485-e7eb-4504-8026-edd9bb53a6ee/content
7. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk P. Impact of Physical Inactivity on the World's Major Non-Communicable Diseases. Lancet. 2012;380(9838):219–29. https://doi.org/10.1016/S0140-6736(12)61031-9
8. Yusuf S, Joseph P, Rangarajan S, Islam S, Mente A, Hystad P, et al. Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *Lancet*. 2020;395(10226):795-808. https://doi.org/10.1016/S0140-6736(19)32008-2
9. Mclaughlin M, McCue P, Swelam B, Murphy J, Edney S. Physical activity-the past, present and potential future: a state-of-the-art review. *Health Promot Int*. 2025;40(1):daae175. https://doi.org/10.1093/heapro/daae175
10. Dores H, Ferreira Santos J, Gil V, Gonçalves PA. Cardiovascular Prevention: Current Gaps and Future Directions. *Diagnostics (Basel)*. 2025;16(1):16. https://doi.org/10.3390/diagnostics16010016
11. Saelens BE, Hurvitz PM, Zhou C, Colburn T, Marchese AJ, Moudon AV. Impact of a Light Rail Transit Line on Physical Activity: Findings from the Longitudinal Travel Assessment and Community (TRAC) Study. *J Transp Health*. 2022;27:101527. https://doi.org/10.1016/j.jth.2022.101527
12. Halling KB, Bowden M, Pretty J, Ogeer J. Bonded Green Exercise: A One Health Framework for Shared Nature-Based Physical Activity in the Human-Dog Dyad. *Animals (Basel)*. 2026;16(2):291. https://doi.org/10.3390/ani16020291
13. Kunutsor SK, Kaur K, Laukkanen JA. Protecting the Heart in Motion: The Role of Physical Activity and Cardiorespiratory Fitness in Preventing Sudden Cardiac Death. *Clin Med Insights Cardiol*. 2025;19:11795468251391010. https://doi.org/10.1177/11795468251391010
14. Messing S, Birkholz L, Resch J, Brandl J, Lorenz E, Abu-Omar K, et al. Physical activity and physical activity promotion in Germany – An overview. *J Health Monit*. 2025;10(4):e13557. https://doi.org/10.25646/13557
15. World Health Organization. Montevideo Roadmap 2018-2030 on NCDs as a Sustainable Development Priority . WHO Global Conference on Noncommunicable Diseases. Pursuing policy coherence to achieve SDG target 3.4 on NCDs (Montevideo, 18-20 October 2017). 2017. Accessed November 20, 2025 https://ncdalliance.org/sites/default/files/montevideo_roadmap_2018-2030.pdf
16. World Health Organization. European Food and Nutrition Action Plan 2015–2020. WHO Reg. Of. for Europe; 2014. Accessed November 20, 2025 https://iris.who.int/server/api/core/bitstreams/2a3b47d9-5c59-438b-8796-5f49f32e5783/content
17. World Health Organization. Physical activity strategy for the WHO European Region 2016-2025. WHO Reg. Office for Europe; 2016 Accessed November 20, 2025. http://www.euro.who.int/__data/assets/pdf_file/0003/312762/_Physical-activity-strategy-2016-2025-ru.pdf?ua=1
18. World Health Organization. Integrating diet, physical activity and weight management services into primary care.WHO Reg Of for Europe; 2016. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/6813fc4c-50a6-41ec-9cc4-843eab081135/content
19. Larbi D, Zanaboni P, Årsand E, Randine P, Trondsen MV, Denecke K, et al. Feasibility and usability of a ChatGPT-based app to support physical activity: A pilot study. *Digit Health*. 2026;12:20552076261417860. https://doi.org/10.1177/20552076261417860
20. Daley AJ, Griffin RA, Sanders JP, Edwardson CL, Neal L, Lee S, et al. The effectiveness and cost effectiveness of Snacktivity™ as an intervention to promote physical activity and health outcomes: a study protocol for a multi-centre randomised controlled trial. *Trials*. 2025;27(1):93. https://doi.org/10.1186/s13063-025-09391-8

21. Shi H, Zhang Y, Li Z, Yang J. How physical activity protects against smartphone addiction: examining the mediating pathways of resilience and subjective wellbeing in Chinese university students. *Front Psychol*. 2026;16:1704827. https://doi.org/10.3389/fpsyg.2025.1704827
22. Sharp CA, Hughes K, Pilkington P, Bradley J. The Awareness and Adoption of UK Physical Activity Guidelines by Socio-Demographics: A National Cross-Sectional Survey in Wales. *Int J Environ Res Public Health*. 2025;23(1):5. https://doi.org/10.3390/ijerph23010005
23. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. *Lancet*. 2024;403(10431):1027-1050. https://doi.org/10.1016/S0140-6736(23)02750-2.
24. Hruby A, Hu FB. The Epidemiology of Obesity: A Big picture. PharmacoEconomics. 2015;33:673–689. https://doi.org/10.1007/s40273-014-0243-x.
25. Zurashvili S, Ghanem AS, Ulambayar B, Móré M, Nagy A. Socio-Demographic and Health Determinants of Overnutrition in Hungarian Women Aged 65 Years and Older. *Nutrients*. 2025;17(24):3836. https://doi.org/10.3390/nu17243836
26. Mackenbach JP, Stirbu I, Roskam A-JR, Schaap MM, Menvielle G, Leinsalu M, Kunst AE. Socioeconomic inequalities in health in 22 European countries. N. Engl. J. Med. 2008;358:2468–2481. https://doi.org/10.1056/NEJMsa0707519.
27. Jeoung B, Park S. Changes in Lifestyle Behaviors and Cardiovascular Disease Risk Factors Before and After the COVID-19 Pandemic: A Nationally Representative Study from Korea. *Healthcare (Basel)*. 2025;13(24):3188. https://doi.org/10.3390/healthcare13243188
28. Li Y, Li J, Lei L, Yu F, Yu Y, Zhao Z, et al. Occupational physical activity and risk of all-cause, cardiovascular disease and cancer mortality among adults in the USA: a national cohort study. *BMJ Public Health*. 2025;3(2):e002164. https://doi.org/10.1136/bmjph-2024-002164
29. World Health Organization. The WHO STEPwise approach to noncommunicable disease risk factor surveillance. 2017. Accessed November 20, 2025. https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/steps/steps-manual.pdf?sfvrsn=c281673d_12
30. Petticrew M. When are complex interventions 'complex'? When are simple interventions 'simple'? Eur J Public Health. 2011;21(4):397-8. https://doi.org/10.1093/eurpub/ckr084.
31. Rakers M, van Hattem N, Hiddink E, Peet PV, Vos R, Chavannes N, et al. Tailoring remote patient management to optimise cardiovascular risk management in primary care: a mixed-methods implementation study informing large-scale implementation. *BMC Prim Care*. 2025;26(1):214. https://doi.org/10.1186/s12875-025-02906-x
32. Chouaïd A, Louart S, Faye A, Ba EH, Landier J, Ridde V. Community engagement in mass drug administration participatory interventions: A scoping review. *PLoS Negl Trop Dis*. 2025;19(12):e0013737. https://doi.org/10.1371/journal.pntd.0013737
33. WHO Regional Office for Europe. STEPS: prevalence of noncommunicable disease risk factors in Ukraine 2019. 2020. Accessed November 20, 2025. https://iris.who.int/server/api/core/bitstreams/22799e6a-6840-4992-a5cd-3071ea273b99/content
34. Wetta RE, Severin RD, Gruhler H, Lewis N. Capturing health literacy assessment in the electronic health record through evidence-based concept creation: A review of the literature and recommendations for action. Health Informatics J. 2019;25(3):1025-1037. https://doi.org/10.1177/1460458217739341
35. Zhu W, Liu J, Lou H, Mu F, Li B. The impact of electronic health literacy on emotional management ability among college students: the mediating roles of peer relationships and exercise self-efficacy. BMC Psychol. 2024;12(1):747. https://doi.org/10.1186/s40359-024-02276-6
36. Zhang WH, Han SS, Lou H, Qian YY, Li B, Xu LL. The dual links of health literacy in driving exercise adherence: the interactive effects of emotional management ability and life satisfaction. BMC Psychol. 2025;14(1):143. https://doi.org/10.1186/s40359-025-03889-1
37. Bill V, Sonsmann F, Rottschäfer JR, Wilke A. Self-efficacy in exercise behaviour in persons with a diagnosed condition: a systematic evidence map. BMJ Open. 2026;16(1):e100029. https://doi.org/10.1136/bmjopen-2025-100029
38. Kebede N, Kasaye MD, Muche A, Tsega Y. Application of the extended parallel process model to assess the predictors of physical exercise in preventing non-communicable diseases among civil servants in Ethiopia, a mixed-method study. BMC Public Health. 2025;26(1):402. https://doi.org/10.1186/s12889-025-26097-3
39. Luo A, Yu Z, Liu F, Xie W. The Chain Mediating Effect of the Public's Online Health Information-Seeking Behavior on Doctor-Patient Interaction. Front Public Health. 2022;10:874495. https://doi.org/10.3389/fpubh.2022.874495
40. Aygar H, Zencirci SA, Emiral GO, Alaiye M, Soysal A, Onsuz MF, et al. Assessment of health-promoting lifestyle behaviors of adults living in the semi-rural area. North Clin Istanb. 2019;6(1):13-20. https://doi.org/10.14744/nci.2017.19327
41. Erişen MA. Effect of Health Literacy and Patient Activation on Health-Seeking Behaviour: A Cross-Sectional Study in Turkey. Health Expect. 2024;27(5):e70052. https://doi.org/10.1111/hex.70052
42. Lim HM, Dunn AG, Lim JR, Abdullah A, Ng CJ. Association between online health information-seeking and medication adherence: A systematic review and meta-analysis. Digit Health. 2022;8:20552076221097784. https://doi.org/10.1177/20552076221097784

43. Yang X, Qu G, Luk L, Mo PKH, Yip BHK, Wong SYS, Wong CKM. Multifaceted health coaching intervention for cardiovascular risk prevention – exploratory qualitative study of Chinese clients' perspectives. BMC Prim Care. 2025;26(1):242. https://doi.org/10.1186/s12875-025-02957-0
44. Sofia Razzakh S, Singh R, Uddin Khan B, Hassan N. The health-promoting lifestyle behaviors of healthcare employees in Qatar – A cross-sectional comparative study. Qatar Med J. 2024;(4):74. https://doi.org/10.5339/qmj.2024.74
45. Nelson A, Moses O, Rea B, Morton K, Shih W, Alramadhan F, Singh PN. Pilot Feasibility Study of Incorporating Whole Person Care Health Coaching Into an Employee Wellness Program. Front Public Health. 2021;8:570458. https://doi.org/10.3389/fpubh.2020.570458
46. Niedhammer I, Bertrais S, Witt K. Psychosocial work exposures and health outcomes: a meta-review of 72 literature reviews with meta-analysis. Scand J Work Environ Health. 2021;47(7):489-508. https://doi.org/10.5271/sjweh.3968

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