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A pilot cross-sectional study of physical activity and digital engagement among older adults in conflict-affected Eastern Ukraine

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Adequate physical activity (PA) is crucial for healthy ageing, but evidence on digital tools for PA among older adults in conflict-affected settings remains limited. To quantify PA levels and the use of digital tools for tracking PA (DTPA) among older adults in conflict-affected eastern Ukraine, and to identify sociodemographic and health-related predictors of both outcomes. This pilot cross-sectional study included 223 community-dwelling adults aged 60 years or older. PA was assessed by self-report using the Rapid Assessment of Physical Activity questionnaire. Use of DTPA was a binary outcome. Analyses used age- and gender-weighted statistics and logistic regression to examine associations with PA and DTPA use. PA levels among older adults were critically low: 31.8% of participants were sedentary, 57.0% were underactive, and only 11.2% met aerobic activity recommendations. More than half (51.1%) reported no strength or flexibility exercises, and only 13.5% met combined PA recommendations. DTPA was used by 14.8%; among users, smartwatches were most common (28.7% regular, 18.2% occasional), followed by fitness trackers (26.0% regular) and health/fitness apps (7.2%). Multivariable analysis showed older age (≥ 70 years) and having a chronic disease were significantly associated with lower odds of being nonsedentary (odds ratio [OR] = 0.14, 95% confidence interval [CI] [0.04, 0.53] and OR = 0.35, 95% CI [0.12, 0.88], respectively). Despite limited statistical power due to low DTPA prevalence (14.8%, *n* = 33), exploratory analysis suggested DTPA use was more likely among men (OR = 4.06, 95% CI [1.47, 11.27]) and less likely among adults aged ≥ 70 years (OR = 0.11, 95% CI [0.03, 0.45]). Among older adults in Ukraine, low PA and limited DTPA use were common. These outcomes were associated with age, sex, and chronic disease, but not with each other. Larger studies with refined digital metrics are needed to assess digital tools' potential for supporting PA in crises.

ageing population, sedentary behavior, digital health adoption, digital divide, health disparities

Population ageing is one of the most significant demographic shifts of the 21st century. According to global projections, by 2050, people aged 60 years and older will account for more than one quarter of the world's population, placing substantial pressure on healthcare and social support systems (Dogra et al., 2022; World Health Organization, 2021). This process is particularly pronounced in Europe, where rapid demographic change has intensified the need for strategies aimed at preserving functional capacity and autonomy in later life (OECD & European Commission, 2024; World Health Organization, 2021).

In Ukraine, population ageing is occurring against a backdrop of prolonged armed conflict. As of 2023, more than 23% of the population was aged 60 years or older, and this proportion continues to rise (State Statistics Service of Ukraine, 2023). Over half of older Ukrainians report difficulties in performing basic and instrumental activities of daily living, which directly undermines independence and quality of life (Pavlova et al., 2015; Yena & Khrystoforova, 2023). The war has further exacerbated these challenges through mass displacement, destruction of infrastructure, reduced access to healthcare and social services, and increased social isolation (Aleksandrenko et al., 2025). Estimates suggest that more than 40% of older adults in affected regions lack regular access to essential medical or social support (Armocida et al., 2022; HelpAge International, 2024). Combined with already low levels of physical activity (PA) and a high prevalence of chronic conditions, these factors substantially increase the risk of functional decline and long-term dependency (Kurylo, 2023; Vorobiova et al., 2024).

Maintaining adequate levels of PA is a well-established determinant of functional health and quality of life in older age (Bull et al., 2020). Nevertheless, available evidence indicates that approximately two-thirds of older adults in Ukraine lead a predominantly sedentary lifestyle (Hakman et al., 2019; Pavlova et al., 2015), a situation likely aggravated by wartime restrictions on mobility and access to safe environments for exercise. Efforts to promote active

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ageing are further constrained by digital inequality: around one-third of Ukrainians aged 60 years and older lack basic digital skills, limiting their access to online health, social, and educational resources (Haimi, 2024; Ministry of Digital Transformation of Ukraine, 2023).

Recent publications highlighting socio-environmental perspectives and the concept of the digital divide report that intersecting individual and structural factors influence technology use and health behaviour in older age (Fang et al., 2019; Ramalho et al., 2024). The digital divide leads to inequality in access, use, and outcomes of digital technologies, which particularly affects older people and socially vulnerable groups (Yang et al., 2024). Age-related declines in functional abilities and gender differences in specific cohorts are reported to exacerbate inequalities in digital technology use (Yang et al., 2024). Moreover, limited access and insufficient self-efficacy reduce older people's ability to search for health information online, which in turn affects their health behaviour and use of services (Hua et al., 2025; Shi et al., 2024; Zhang et al., 2025). These factors are exacerbated in crisis conditions, in the Ukrainian context, by damaged infrastructure and reduced support services, which increase digital isolation and limit the use of digital health tools.

At the same time, international research suggests that digital technologies may support PA in older adults by enhancing motivation, self-monitoring, and goal setting (Osawa et al., 2022; Ramalho et al., 2024; Skalii & Mulyk, 2024). Tools such as mobile applications, fitness trackers, and telemedicine platforms have demonstrated potential benefits for physical health and social engagement in later life (Shcherbina et al., 2019; Weber et al., 2023; Western et al., 2021). However, their implementation in humanitarian or conflict-affected settings remains limited due to low digital literacy, unequal access to technology, and insufficient adaptation to the needs of older users (Aleksandrenko et al., 2025; Chen & Schulz, 2016). In Ukraine, these barriers coexist and are intensified by the ongoing war, while empirical evidence on the use and effectiveness of digital tools for supporting PA in such conditions remains scarce. The present pilot study addresses this gap by examining PA levels and the use of digital tools for tracking PA among older adults living in war-affected regions of Ukraine.

This study aims to quantify self-reported PA levels and the use of digital tools for tracking PA among older adults in conflict-affected eastern Ukraine and to identify sociodemographic and health-related predictors of both outcomes. The specific objectives are to (1) assess PA levels in the study population; (2) identify sociodemographic and health-related predictors of PA status; and (3) examine the prevalence of using digital tools for tracking PA (DTPA) and identify sociodemographic predictors associated with their use.

We hypothesize that the use of DTPA is positively associated with higher levels of PA among older adults in conflict-affected settings. However, we acknowledge that this association may be masked or substantially attenuated in the present study due to prevalent contextual barriers (e.g., low digital literacy, limited access to technology) and methodological constraints (e.g., binary measurement of DTPA use, limited sample size).

This pilot cross-sectional study was conducted between April and June 2024 among older adults residing in three major urban centres in eastern Ukraine: Zaporizhzhia, Dnipro, and Kharkiv. Eligibility criteria included age 60 years or older and sufficient proficiency in the Ukrainian language to complete the questionnaire. Owing to ongoing security constraints and the absence of a reliable sampling frame during the armed conflict, participants were recruited using a convenience sampling strategy. Recruitment was facilitated through community centres, primary healthcare facilities, and social service organizations in the selected cities. Trained research assistants informed potential participants about the study aims and procedures. To enhance accessibility, the questionnaire was administered in both paper-based and digital formats.

Of the 400 questionnaires distributed, 289 were returned. After excluding 66 questionnaires due to substantial missing data or unreliable response patterns, the final analytical sample comprised 223 participants.

Although multisite recruitment across large urban areas increased sample heterogeneity, the convenience sampling approach likely overrepresented individuals who were more mobile, socially engaged, or had better access to services. To partially address discrepancies between the study sample and the national population structure, poststratification weights were applied based on official age and gender distributions (State Statistics Service of Ukraine, 2023). These weights were used in all descriptive and regression analyses.

The study was approved by the Commission on Ethics and Bioethics of Zaporizhzhia Polytechnic National University (Extract from Minutes No. 2, March 16, 2024) and conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent.

Data were collected using a self-administered questionnaire consisting of 19 closed-ended items, distributed in print and online formats (Google Forms, QR codes).

Participants reported sex, age, education level, marital status, employment status, household composition, and the presence of chronic diseases. PA was assessed using the Rapid Assessment of Physical Activity (RAPA) questionnaire (Topolski et al., 2006). The RAPA consists of two subscales, scored independently. RAPA-1 evaluates aerobic physical activity through seven dichotomous items and classifies respondents as sedentary (no regular PA), underactive (some activity below recommended levels), or active (meets aerobic guidelines). PA levels were categorized according to the RAPA-1 scoring algorithm: respondents reporting no regular PA were classified as sedentary; those engaging in some activity that fell below the recommended frequency

or intensity thresholds were designated as underactive; and participants were classified as active if they met established aerobic guidelines, defined as at least 30 min of moderate-intensity activity on 5 or more days per week, or 20 min of vigorous-intensity activity on 3 or more days per week. RAPA-2 is a separate subscale assessing participation in strength and flexibility exercises through three items, scored independently of RAPA-1. Respondents are classified into four categories: no strength or flexibility activity, strength only, flexibility only, or both. A Ukrainian-language version of the RAPA was developed using a forward–backward translation procedure, followed by expert review and pilot testing among older adults (n = 23). In this sample, the RAPA-1 demonstrated acceptable internal consistency (Cronbach's α = .78). Preliminary convergent validity was supported by a moderate correlation between the RAPA-1 score and self-rated physical health (r = .42, p < .01). These psychometric findings should be interpreted as initial and require confirmation in larger, representative samples.

General digital device use was assessed across seven categories (smartphones, laptops, desktop computers, tablets, internet-enabled televisions, landlines, and video calling platforms), with all participants (N = 223) rating each as regular, rare, or non-use. Additionally, ownership and use of three PA-specific tools (smartwatches, fitness trackers, and health/fitness applications) were recorded separately among respondents who reported DTPA use (n = 33), with each tool rated as regular, occasional, or rare/non-active use.

DTPA use was assessed with a single item asking whether respondents used any tools to track PA, steps, or heart rate (e.g., mobile health applications, fitness trackers, or smartwatches). Throughout this paper, DTPA refers specifically to tools used for tracking PA, rather than to digital health or health-promotion tools more broadly. Responses were dichotomized into users (*yes*) and nonusers (*no*).

An a priori power analysis conducted using G*Power indicated that a sample of approximately 315 participants would be required to detect a medium effect size (f^2 = .15) with a significance level of α = .05 and 80% statistical power. Due to ongoing armed conflict, security constraints, and limited access to the target population, the final analytical sample comprised 223 participants.

Given this reduced sample size, post hoc sensitivity analyses were performed to evaluate the magnitude of effects that remained detectable. With N = 223 and a prevalence of approximately 68% for the combined nonsedentary PA outcome, the study was sufficiently powered to detect relatively large associations (minimum detectable odds ratio ≈ 2.5). For the less prevalent outcome of digital tool use for PA (approximately 15% of participants), only large effects (minimum detectable odds ratio ≈ 3.0) could be reliably detected. These findings indicate that the study was underpowered to identify small-to-moderate associations.

Data analysis was conducted via IBM SPSS Statistics (Version 26 for Windows; IBM). Descriptive statistics were computed for all study variables and are presented as weighted percentages or means with standard deviations, as appropriate. Poststratification weights based on age group and gender were applied to all analyses to improve population representativeness.

For analytical purposes, aerobic PA assessed by RAPA-1 was dichotomized into sedentary versus nonsedentary (underactive or active). Use of DTPA was treated as a binary outcome (user vs. nonuser). Although three age groups were retained for descriptive purposes (60–69, 70–79, and ≥ 80 years), the 70–79 and ≥ 80 categories were combined into a single ≥ 70 group for logistic regression. This decision was made to maintain adequate cell counts (n ≥ 10 per category in each outcome group) and to improve model stability given the modest sample size. Group differences in PA and DTPA use across sociodemographic and health characteristics were examined using chi-square tests.

Associations between independent variables and outcomes were evaluated using binary logistic regression models. Separate models were fitted for nonsedentary PA and DTPA use. All collected sociodemographic and health-related variables (sex, age category, education, marital status, employment status, household composition, presence of chronic disease, and DTPA use) were included in bivariate analyses and subsequently considered for entry into the multivariable logistic regression models. Variables showing associations at p < .10 in bivariate analyses were entered into multivariable models. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) are reported. Model fit was assessed using the Hosmer–Lemeshow test, and multicollinearity was evaluated using variance inflation factors.

Statistical significance was set at p < .05. Given the exploratory nature of the study and limited statistical power, findings are interpreted with an emphasis on effect size and consistency rather than solely on statistical significance.

The sample included 223 older adults (52.0% women, n = 116, mean age 74.03 ± 8.22 years; 48.0% men, n = 107, mean age 74.75 ± 6.97 years), with a mean age of 74.38 ± 7.66 years and an even distribution across three age groups (60–69, 70–79, ≥ 80 years), see Table 1. The majority were retired (80.3 %), lived without a spouse or children (43.9%), and reported at least one chronic disease (83.4 %).

PA levels were critically low: only 11.2 % met aerobic guidelines (RAPA-1 "active"), while 31.8 % were sedentary and 57.0 % underactive (Table 2). Strength and flexibility exercises were even less favourable: 51.1 % performed none, and only 13.5 % met combined recommendations (RAPA-2).

Figure 1 presents the distribution of general digital device use across the full sample; Figure 2 presents the device-specific breakdown within the DTPA user subsample (n = 33). Smartphones were the primary device, with

95.1% regular use. However, a gap exists between access and feature utilization: only 19.3% used video calling regularly. Other hardware adoption was lower: internet-enabled televisions (44.8%), desktop computers (32.7% regular; 44.8% total including rare use), and laptops (26.9%). Traditional landlines remained relevant for 26.1% of participants. Tablets showed the lowest regular uptake at 12.1%.

A subset of respondents (n = 33) reported using digital tools to monitor their PA. Smartwatches were the most commonly utilized device, with almost half of this group indicating regular or occasional use. Fitness trackers followed a comparable pattern for regular adoption but had a notably lower rate of occasional use. Health and fitness smartphone applications demonstrated the lowest uptake, with nearly 90% of this user group reporting rare or no use. The regular use of any dedicated application was minimal, at 7.2%.

A multivariable binary logistic regression (Table 3) showed that adults aged ≥ 70 years had 86 % lower odds of being nonsedentary (OR = 0.14; 95 % CI [0.04, 0.53]) and those with chronic disease 65 % lower odds (OR = 0.35; 95% CI [0.12, 0.88]) than their respective reference groups. The model explained 34.5 % of the variance (Nagelkerke R^2) and displayed good calibration (H-L p = .625). Other factors, including sex, education, marital status, employment status, household composition, and DTPA use, were not significantly associated with PA status.

A separate multivariable binary logistic regression model for DTPA use (Table 4) revealed that men were four times more likely to use such tools than women (OR = 4.06, 95% CI [1.47, 11.27]), while participants aged ≥ 70 had 89 % lower odds than those aged 60–69 (OR = 0.11, 95% CI [0.03, 0.45]). No other covariates—education, marital status, employment, or household composition—were significantly associated with DTPA use. No significant association between DTPA use and PA level was observed in this cross-sectional sample.

Table 1 Sociodemographic characteristics and health status of the participants (N = 223)

Characteristics/Category	n	%
Sex		
Female	116	52.0
Male	107	48.0
Age group		
60–69 years	79	35.4
70–79 years	72	32.3
≥ 80 years	72	32.3
Marital status		
Married	75	33.6
Single	38	17.0
Divorced	51	22.9
Widowed	59	26.5
Education level		
Higher education	91	40.8
Incomplete higher special technical education[a]	93	41.7
Secondary education	39	17.5
Employment status		
Currently working	44	19.7
Retired	179	80.3
Household composition		
With spouse only	69	30.9
Single-person household	98	43.9
With children (with or without spouse)	56	25.1
Chronic disease status		
No chronic diseases	37	16.6
One or more chronic diseases	186	83.4

Note. The analysis was conducted on a complete case basis (N = 223); there were no missing data for any variables included in this table or the subsequent regression models; education categories reflect the highest level of education completed, as classified in Ukrainian national surveys; secondary education was compulsory and near-universal for this age cohort, and therefore serves as the reference category rather than an intermediate step in a primary–secondary–tertiary framework. [a]Incomplete higher special technical education refers to the Soviet and post-Soviet Ukrainian system of vocational-technical education beyond secondary school, which did not confer a full university degree but provided professional qualifications (e.g., technician, nurse). In contemporary classifications, it is often comparable to "vocational education".

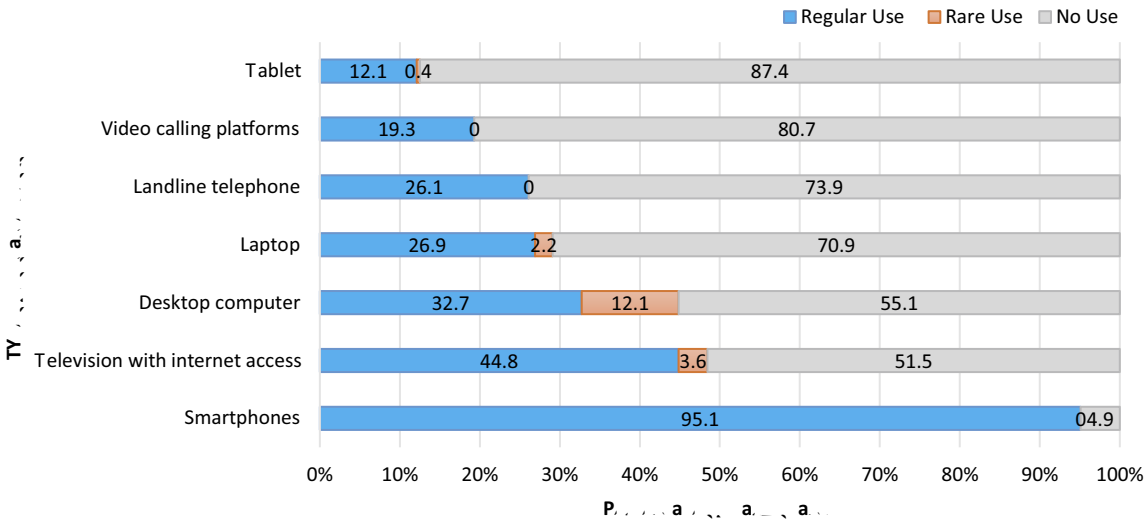
This pilot cross-sectional study examined PA levels and the use of DTPA among older adults living in conflict-affected regions of eastern Ukraine. By comparing the observed patterns with existing evidence, the study provides

Table 2 Physical activity levels and digital tracking tool use by age category in older adults

Characteristics/Category	Total (N = 223)	60–69 years (n = 79)	70–79 years (n = 72)	≥ 80 years (n = 72)
RAPA-1 (aerobic activity)				
Sedentary	71 (31.8)	5 (6.3%)	33 (45.8%)	33 (45.8%)
Underactive	127 (57.0%)	57 (72.2%)	33 (45.8%)	37 (51.4%)
Regular active	25 (11.2%)	17 (21.5%)	6 (8.3%)	2 (2.8%)
RAPA-2 (strength and flexibility)				
No activity to improve muscle strength or flexibility	114 (51.1%)	24 (30.4%)	49 (68.1%)	41 (56.9%)
Activity to improve muscle strength	45 (20.2%)	5 (6.3%)	15 (20.8%)	25 (34.7%)
Activities to improve flexibility	34 (15.2%)	21 (26.6%)	7 (9.7%)	6 (8.3%)
Both (muscle strength and flexibility activity)	30 (13.5%)	29 (36.7%)	1 (1.4%)	0 (0.0%)
Use of digital tools for tracking PA (e.g., smartwatches, fitness trackers, health/fitness apps)				
Used	33 (14.8%)	24 (30.4%)	9 (12.5%)	0 (0.0%)
Not used	190 (85.2%)	55 (69.6%)	63 (87.5%)	72 (100.0%)

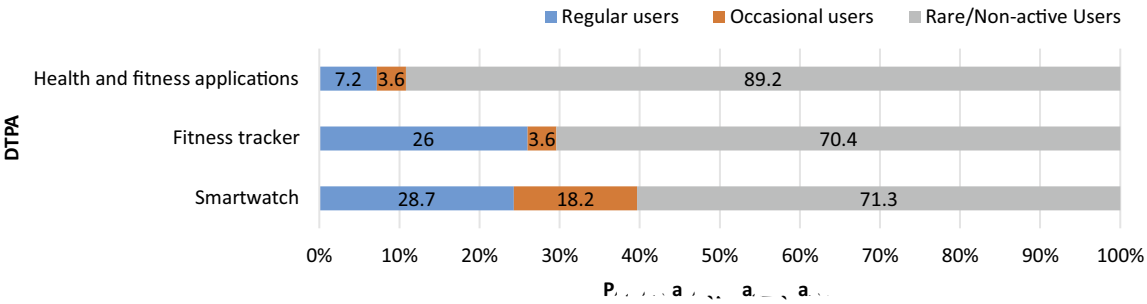
Note. RAPA = Rapid Assessment of Physical Activity. The analysis was conducted on a complete case basis (N = 223); there were no missing data for any variables included in this table or the subsequent regression models. Percentages in the age-specific columns (60–69, 70–79, and ≥ 80 years) represent the proportion within each respective age group (row percentages) to facilitate direct comparison. For the purpose of regression analysis, the 70–79 and ≥ 80 groups were combined into a single "≥ 70 years" category (n = 144) to ensure statistical power and address small cell counts in specific activity categories.

Figure 1 Use of general digital technologies among older adults (*N* = 223)



Note. Participants indicated their use of seven digital device types (smartphones, laptops, desktop computers, tablets, internet-enabled televisions, landlines, and video calling platforms) as regular, occasional, or non-use. Percentages represent the proportion of the full sample reporting each use level; multiple responses were permitted and total percentages therefore exceed 100%.

Figure 2 Use of digital tools for tracking physical activity (DTPA) among older adults who reported DTPA use (*n* = 33)



Note. Among participants who reported using any physical activity tracking tool, ownership and use of three physical activity specific tools (smartwatches, fitness trackers, health/fitness apps) were recorded separately and categorized by use frequency (regular, occasional, rare/non-active). Percentages are based on this subsample and exceed 100% due to multiple responses.

context-specific insights into PA and digital engagement in a humanitarian setting.

In summary, while smartphone ownership was nearly universal, the use of other hardware and advanced functional applications was substantially lower across the sample. The PA levels observed in this study were critically low. As shown in Table 2, only 11.2% of participants met aerobic activity recommendations, while the majority were classified as sedentary or underactive. These findings are consistent with previous studies conducted among older adults in Ukraine (Hakman et al., 2019; Pavlova et al., 2015; Vorobiova et al., 2024) and indicate a substantially lower prevalence of sufficient PA compared with European estimates, where approximately one-third of older adults meet recommended levels (OECD & European Commission, 2024). Similar patterns of lower PA levels have been reported in populations exposed to prolonged crisis or instability, suggesting that environmental and social disruptions may exacerbate age-related inactivity (Alruwaili et al., 2023; Armocida et al., 2022; Ding, 2018).

Multivariable analysis identified advanced age and the presence of chronic disease as the primary correlates of physical inactivity. Participants aged 70 years and older had markedly lower odds of being nonsedentary, a pattern that aligns with international evidence on age-related reductions in PA (Ustad et al., 2024). The association between chronic disease and lower activity levels is also well documented and reflects the reciprocal relationship between morbidity and functional limitation in older age (Bull et al., 2020; Pavlova et al., 2015; Ustad et al., 2024). In the context of armed conflict, these associations may be particularly pronounced, although causal inferences cannot be drawn from the present design.

Despite widespread access to digital devices, particularly smartphones, the use of digital tools specifically for tracking PA was limited, with only 14.8% of participants reporting such use. This gap between device ownership and health-related digital engagement has been observed in other Eastern and Central European settings (Cancela et al., 2021; Ćwiklicki et al., 2020; Gomes & Dias, 2025; Van Dijk, 2017). In contrast to findings from studies conducted in stable environments, where digital interventions have sometimes been associated with higher PA levels (Shcherbina et al., 2019; Western et al., 2021), no association between DTPA use and PA status was observed in this study. This finding suggests that evidence generated

Table 3 Multivariable logistic regression for the prediction of physical activity status (sedentary vs. active/underactive, *N* = 223)

Predictor	OR	95% CI for OR		*p*
		LL	UL	
Gender (Ref: Female)				
Male	1.03	0.48	2.17	.948
Age category (Ref: 60–69 years)				
≥ 70 years	0.14	0.04	0.53	.004
Education (Ref: Higher)				
Secondary	0.99	0.30	3.28	.981
Incomplete higher special technical	0.37	0.13	1.04	.059
Marital status (Ref: Married)				
Widowed	0.73	0.11	4.74	.738
Divorced	0.65	0.10	4.30	.650
Single	1.16	0.17	7.80	.875
Employment status (Ref: Currently working)				
Retired	1.15	0.32	4.14	.829
Household composition (Ref: Single-person household)				
With children (with/without spouse)	0.94	0.42	2.10	.873
With spouse only	1.40	0.26	7.52	.698
Chronic disease (Ref: Absence)				
Presence of chronic disease	0.35	0.12	0.88	.049
Digital tools for tracking physical activity use (Ref: Not Used)				
Used	0.51	0.14	1.83	.299

Note. OR = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit. The dependent variable is physical activity status (0 = sedentary, 1 = active/underactive). Model fit: $\chi^2(12) = 63{\cdot}14$, $p < .001$; Cox & Snell $R^2 = .247$; Nagelkerke $R^2 = .345$; Hosmer–Lemeshow $\chi^2(8) = 6{\cdot}20$, $p = .625$. Overall classification accuracy = 77.1%.

Table 4 Multivariable logistic regression for predicting the use of digital tools for tracking physical activity (No vs. Yes, *N* = 223)

Predictor	OR	95% CI for OR		*p*
		LL	UL	
Gender (Ref: Female)				
Male	4.06	1.47	11.27	.007
Age Category (Ref: 60–69 years)				
≥ 70 years	0.11	0.03	0.45	.002
Education (Ref: Higher)				
Secondary	0.37	0.07	1.99	.246
Incomplete higher special technical	0.38	0.10	1.42	.149
Marital status (Ref: Married)				
Widowed	1.39	0.20	9.59	.738
Divorced	0.89	0.12	6.59	.906
Single	0.71	0.09	5.43	.743
Employment status (Ref: Currently working)				
Retired	0.47	0.18	1.25	.131
Household composition (Ref: Single-person household)				
With children (with/without spouse)	0.28	0.07	1.16	.079
With spouse only	0.30	0.04	2.03	.215
Chronic disease (Ref: Absence)				
Presence of chronic disease	0.37	0.12	1.13	.080

Note. OR = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit. The dependent variable is digital tools for tracking physical activity use (0 = not used, 1 = used). Model fit: $\chi^2(11) = 39.84$ $p < .001$; Cox & Snell $R^2 = .164$; Nagelkerke $R^2 = .288$; Hosmer–Lemeshow $\chi^2(8) = 5.44$, $p = .709$. Overall classification accuracy = 86.5%.

in non-crisis contexts may not be directly transferable to conflict-affected populations. Importantly, this null association should be interpreted with caution. Beyond limited statistical power, it may reflect attenuation due to measurement constraints, as the binary indicator of digital tool use did not capture frequency, duration, purpose, or specific functionalities of engagement, which are likely to be more proximal determinants of PA behaviour.

Analysis of predictors of DTPA use revealed clear age and gender differences. Participants aged 60–69 years and men were more likely to report using digital tools for tracking PA, findings that are consistent with a broad literature on digital divides in later life (König & Seifert, 2023; Seifert et al., 2017). Similar age-related patterns of technology adoption have been reported across diverse settings, while gender differences remain context-dependent and inconsistently documented (Chae, 2018). The present findings suggest that even among older adults with high levels of device access, engagement with DTPA remains uneven. However, given the small number of DTPA users (n = 33, 14.8%), these multivariable findings should be

interpreted as preliminary and hypothesis-generating rather than definitive (see Limitations).

Taken together, the results indicate that low PA and limited use of digital tools coexist among older adults in conflict-affected eastern Ukraine. This pilot study does not provide evidence for an association between DTPA use and PA level. Rather, it offers hypothesis-generating insights that may inform the design of future studies employing larger samples, longitudinal designs, and more detailed measures of digital engagement tailored to crisis contexts.

This study has several limitations that should be considered. The convenience sampling approach, although necessary due to security and access constraints, may overrepresent more mobile, socially active, or healthier older adults, which could influence the observed prevalence of PA and digital tool use. Poststratification weighting was applied to partially adjust for age and gender, but unmeasured factors such as socioeconomic status, health status, or technology access remain potential sources of bias.

The final sample size (N = 223) was smaller than initially planned, limiting statistical power and necessitating dichotomization of key variables, including PA status and age categories. This reduces granularity and may restrict detection of smaller associations.

Mental health factors were not measured, though they can influence both PA and digital engagement.

The binary measurement of DTPA does not capture differences in frequency, intensity, or specific functionalities. The low number of DTPA users (n = 33, 14.8%) resulted in an events-per-variable ratio of approximately 3.0 in the multivariable model (33 events across 11 model parameters), substantially below the recommended threshold of 10 events per predictor (Vittinghoff & McCulloch, 2007). This increases the risk of overfitting, unreliable parameter estimates, and wide confidence intervals, which is evident in Table 4. The multivariable regression for DTPA use was conducted primarily for hypothesis generation rather than definitive inference, and findings should be interpreted as exploratory and directional. Only large effect sizes (OR ≈ 3.0 or greater) could be reliably detected with the current sample size. Future research should prioritise recruiting substantially larger samples (at least 100–150 DTPA users) to enable robust multivariable modelling and detection of moderate associations. Although participants were recruited across three cities in eastern Ukraine (Zaporizhzhia, Dnipro, and Kharkiv), a city-level indicator was not included in the regression models. Given the comparable conflict exposure and socioeconomic conditions across these urban centres, between-city variance was considered limited relative to the individual-level variation captured by the included covariates. Future studies with larger, geographically diverse samples should explicitly adjust for location.

Despite these limitations, the study provides valuable preliminary insights into PA patterns and digital technology use among older adults in conflict-affected regions of Ukraine, offering directions for future research.

In conclusion, this pilot study provides preliminary evidence of critically low levels of PA and limited engagement with DTPA among older adults in our sample from conflict-affected regions of Ukraine. The identified predictors (older age, presence of chronic disease) and of DTPA use (male sex, older age) align with broader patterns of health disparity and digital inequality.

Within the constraints of the present study—including the binary measurement of digital tool use and limited statistical power—no statistically significant association between the use DTPA and PA level was detected in this sample. This finding should not be interpreted as evidence of the absence of an association, but rather highlights the need for more nuanced measurement and larger-scale studies to investigate this relationship.

Consequently, the findings of this pilot study do not support a direct transfer of digital intervention strategies from stable settings to conflict-affected populations without adaptation. Future research should prioritize longitudinal designs, refined measures of digital engagement (e.g., frequency, purpose, and perceived usefulness), and objective PA assessments to better understand whether and how digital tools could be effectively leveraged to promote PA in humanitarian contexts. Before specific digital interventions are recommended, rigorous feasibility and efficacy studies, grounded in detailed contextual and behavioural data, are essential. Accordingly, the findings are most relevant to community-dwelling older adults in urban conflict-affected settings with at least minimal access to services and digital infrastructure. This study underscores the urgent need to address physical inactivity in crisis-affected older populations and clarifies that the potential role of digital tools in this setting remains an open, empirically testable question rather than a proven solution.

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