Original Article

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Winter Swimming and Influenza Morbidity: A Pilot Study in Western Poland

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Abstract: Background: Winter swimming (WS), defined as brief immersion in cold or icy water, is gaining popularity in Poland as a recreational activity and potential health-promoting practice. Regular exposure to cold has been hypothesized to enhance immune function and reduce susceptibility to respiratory infections, yet empirical data on its relationship with influenza are limited. This pilot study aimed to assess the association between WS and the incidence of influenza and other respiratory infections among adults in Western Poland. Methods: Ninety-four participants (46 men, 48 women; mean age 39.0±12.0 years) were surveyed using a structured questionnaire assessing winter swimming frequency, physical activity, and the occurrence of influenza, common colds, and infection-related medication use. Statistical analyses included t-tests, chi-square, Fisher's exact, Mann–Whitney U, and Spearman's correlation tests, with significance set at $p<0.05$. Results: No significant differences were observed between winter swimmers (n=67) and non-swimmers (n=27) in influenza incidence or symptom severity ($p>0.05$). However, WS participants reported a significantly lower occurrence of common colds compared to non-swimmers ($\chi^2=4.77$, $p=0.029$), with the relationship remaining significant across swimming frequency cat egories ($\chi^2=9.80$, $p=0.020$). Physical activity levels were higher among WS participants ($p=0.011$) but not independently related to infection outcomes. Conclusions: These findings suggest that regular WS may confer moderate protective effects against mild upper respiratory infections, though its influence on influenza susceptibility remains unconfirmed. Larger longitudinal studies with laboratory-confirmed diagnostics are needed to verify these preliminary observations and clarify underlying mechanisms.

Keywords: winter swimming; cold-water immersion; respiratory infections

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INTRODUCTION

The winter swimming (WS), also referred to as ice swimming (IS), is defined as brief immersion in cold or icy water, typically performed during regular group sessions at lakes or coastal areas. In recent years, this practice has become increasingly popular in Poland as a form of physical activity (PA) and as a method for physical and mental conditioning intended to improve overall well-being and health. Evidence has been accumulating to suggest that regular engagement in WS may contribute to enhanced health indicators through the combined effects of physical activity and repeated cold exposure [1]. Potential benefits have been proposed to include reduced susceptibility to respiratory tract infections, improved immune function, and decreased frequency of common respiratory illnesses [2]. However, no studies to date have specifically examined the association between WS and influenza-related morbidity.

Before the COVID-19 pandemic, seasonal influenza represented the most significant epidemic threat in Poland. During the 2017/2018 influenza season, nearly 4.5 million cases were reported nationwide, resulting in over 17,000 hospitalizations and 150 deaths [3]. According to data from the World Health Organization (WHO), approximately one billion cases of seasonal influenza occur globally each year, including 3–5 million cases of severe illness and 290,000–650,000 deaths due to respiratory complications [4]. In Western Poland, specifically in the Greater Poland Voivodeship (Wielkopolska), over 360,000 confirmed or suspected influenza cases were recorded between January and March 2018 -equivalent to roughly 1% of the regional population. National data from the same season indicated that only 1,542 influenza tests were conducted, of which 47.1% yielded positive results [5]. The limited number of diagnostic tests has been recognized as a major barrier to accurate estimation of true influenza incidence. WHO data further indicate that 5–10% of adults worldwide are infected with influenza each year [6]. The physiological responses induced by cold-water immersion are complex and involve vascular, hormonal, and immunological mechanisms. Appropriate preparation has been emphasized as essential to minimize potential health risks associated with exposure to low temperatures [7]. Acute cold exposure has been associated with increased secretion of cortisol, norepinephrine, and adrenaline, hormones that interact with immune cells through adrenergic receptors located on leukocytes. Adaptations in cytokine production and immune cell populations within the spleen, peritoneal cavity, and peripheral blood have been observed following repeated cold exposure [8-10]. The magnitude and frequency of such exposure appear to determine the direction and extent of these physiological effects. Intermittent cold-water immersion may facilitate adaptive tolerance to thermal stress. Whereas excessive exposure has been reported to disturb circadian cortisol rhythms and impair immune function, resembling the effects of chronic stress. Even water temperatures of approximately 15 °C have been shown to trigger strong stress responses in individuals unaccustomed to cold environments [2]. Short-term, whole-body exposure to cold has been reported to enhance immune efficiency over time, without causing symptoms of illness within 48 hours post-exposure [11].

Repeated cold-water immersion has been associated with several immunomodulatory outcomes [12], including increased counts of circulating monocytes and natural killer (NK) cells, elevated serum interleukin-6 (IL-6) levels [2], and upregulation of lymphocyte activity via enhanced HLA-DR antigen expression [9]. Nonetheless, findings concerning immunoglobulin responses, particularly those involving serum and secretory IgA, remain inconsistent across studies [9,12]. Given these considerations, the potential of winter swimming as a preventive factor against influenza and other respiratory infections warrants investigation.

Therefore, the present pilot study was conducted to evaluate the potential protective effects of winter swimming on the incidence of influenza and non-influenza respiratory infections in Western Poland. Specifically, comparisons were made between regular winter swimmers and their non-swimming relatives regarding infection frequency, antibiotic use, and infection-related complications, while accounting for demographic and activity-related variables. We hypothesized that winter swimmers would report fewer respiratory infections during the winter season compared with non-swimmers.

MATERIAL AND METHODS

Participants Overview

A total of 94 individuals (46 men, mean age 39.09 ± 11.14 years; and 48 women, mean age 38.98 ± 12.90 years) participated in the study. There were no statistically significant age differences between the groups ($t(92) = -0.03$, $p = 0.978$). Participants were recruited from the local winter swimming (WS) community in the suburbs of Poznań, the capital of the Wielkopolska region. The study was conducted at the end of the WS season, in early March 2018. The sample included both regular winter swimmers and their non-swimming relatives.

Inclusion criteria comprised healthy individuals who either practiced or did not practice winter swimming. Exclusion criteria included participants who were under the age of 18. All participants provided written informed consent after being fully informed about the study's aims and procedures. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data Collection

Data were collected using a structured questionnaire specifically developed for this study. The instrument was designed to assess demographic characteristics, winter swimming (WS) habits, levels of physical activity (PA), and the occurrence of influenza and influenza-like illnesses (ILI) during the winter season.

Influenza was frequently diagnosed based solely on clinical symptoms, as differentiation from other respiratory infections, such as those caused by parainfluenza viruses, was often not feasible. Therefore, the survey was designed to record both influenza and influenza-like illnesses collectively, in accordance with the classification system of the Polish National Institute of Public Health, which reports these conditions jointly in national statistics.

Questionnaire Content

A structured questionnaire was used to collect information on participants' demographics, winter swimming habits, influenza occurrence and management, physical activity levels, and other respiratory infections. Winter swimming frequency and physical activity were assessed using categorical scales. Influenza diagnosis was based on self-reported symptoms consistent with clinical influenza. Additional items addressed the use of antiviral medications, influenza vaccination, and complications requiring antibiotics. Participants also reported any common colds or respiratory tract infections during the winter season. All questionnaire items and response options are presented in Table 1.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics v.25 (IBM Corp., Armonk, NY, USA). The level of statistical significance was set at $p < 0.05$.

Before analysis, the data were checked for completeness and outliers. Normality of the age variable was assessed using the Shapiro–Wilk test. As age was normally distributed, comparisons between winter swimmers (WS) and non-winter swimmers (N-WS) were conducted using an independent-samples t-test. Results were reported as means ± standard deviations, along with 95% confidence intervals (CIs) and Cohen's d effect sizes.

For categorical variables (sex distribution, influenza and cold incidence, vaccination status, and antibiotic use), Pearson's chi-square (χ^2) tests or Fisher's exact tests (when expected cell counts were <5) were applied. Strength of association was expressed using Cramér's V.

For ordinal or non-normally distributed data, such as winter swimming frequency or physical activity level, non-parametric tests were used. Group differences were assessed using the Mann–Whitney U test, while relationships between ordinal variables were analyzed using Spearman's rank correlation coefficient (ρ).

When appropriate, data were summarized as frequencies and percentages. For analyses examining winter swimming frequency (none, <1×/week, 1×/week, >1×/week), a four-level categorical variable was used to test for associations with health outcomes (influenza incidence/severity, colds, and antibiotic use).

Effect sizes were interpreted according to standard conventions: Cohen's d (0.2 = small, 0.5 = medium, 0.8 = large) and Cramér's V (0.1 = small, 0.3 = medium, 0.5 = large) [13].

Table 1. Summary of questionnaire items and response options

Category	Question / Item	Response Options
Demographics	Sex	Male / Female
	Age	Years
Winter Swimming	How often do you participate in winter swimming?	Not at all; Less than once per week; Once per week; More than once per week
Influenza Occurrence	Have you experienced influenza during the winter season (high fever, severe bone and joint pain, dry cough, symptoms significantly impairing daily functioning, lasting 1–2 weeks)?	Yes. No. It wasn't too bad.
Influenza Management and Outcomes	Did you use an anti-influenza medication (oseltamivir, Tamiflu, Tamivil, or Ebilfumin)?	Yes / No
	Did you experience influenza complications (e.g., pneumonia) requiring antibiotic treatment?	Yes / No
	Did you receive an influenza vaccination during the current season?	Yes / No
Physical Activity	Do you engage in other outdoor physical activities during the winter season?	Regular vigorous exercise. Irregular vigorous exercise. Light exercise.
Common Cold	Did you experience a common cold during the winter season (treated with OTC medications such as Gripex or Ibuprofen, or resolved spontaneously)?	Yes / No
Respiratory Infection	Did you experience a respiratory tract infection requiring antibiotic treatment (prescription)?	Yes / No

RESULTS

Demographic Characteristics

A total of 94 participants were divided into two main groups: winter swimmers (WS; n = 67) and non-winter swimmers (N-WS; n = 27). The groups did not differ significantly in age or sex distribution ($p > 0.05$; Table 2).

Winter Swimming Frequency

Within the WS group, 24% swam less than once per week, 45% swam once weekly, and 31% swam more than once weekly. Swimming frequency was not significantly associated with either age (ρ = 0.13, p = 0.20) or gender (Mann–Whitney U = 1057, p = 0.71).

Influenza Incidence and Symptom Severity

When influenza was analyzed as a binary variable (any influenza-like illness vs none), no statistically significant difference was found between WSs and N-WSs ($\chi^2(1)$ = 0.49, p = 0.48). The overall self-reported influenza rate was approximately 20% across the sample.

A secondary ordinal analysis considering influenza severity (none = 0, mild = 1, severe = 2) likewise revealed no significant association between WS frequency and influenza severity (Fisher's exact p = 0.729) (Table 3). Although the proportion of severe cases tended to decline with more frequent swimming, the trend was not statistically significant. No participants reported influenza-related complications requiring antibiotic treatment, and use of antiviral medication (oseltamivir or equivalents) was rare (< 5%). Seasonal influenza vaccination was uncommon in both groups.

Table 2. Demographic characteristics of participants (means ± standard deviations)

Variable	Winter Swimmers (n = 67)	Non-Winter Swimmers (n = 27)	Test	p-value	95% CI (LL–UL)	Cohen's d
Age [years]	39.25 ± 11.61	38.48 ± 13.16	t(92)=–0.28	0.779	–6.23 – 4.69	0.06
Sex (M/F)	33 / 34	13 / 14	$\chi^2(1)$=0.31	0.580	–	–

t: t-test; p: statistical significance; M: male; F: Female; LL: lower limit; UL: upper limit; CI: confidence interval

Table 3. Influenza occurrence and severity by winter swimming frequency

Influenza	None [%]	Mild [%]	Severe [%]	Fisher's exact p
No WS (n = 27)	74.1	14.8	11.1	0.729
<1×/week (n = 21)	76.2	19.0	4.8	
1×/week (n = 35)	80.0	17.1	2.9	
>1×/week (n = 11)	90.9	9.1	0.0	

Table 4. Common cold occurrence by winter swimming frequency

Winter Swimming Frequency	Cold: No [%]	Cold: Yes [%]	$\chi^2(3)$	p-value
No WS	59.3	40.7	9.80	0.020
<1×/week	71.4	28.6		
1×/week	65.7	34.3		
>1×/week	90.9	9.1		

χ: chi-square test

Table 5. Antibiotic use and other physical activity (PA)

Variable	No WS	<1×/week	1×/week	>1×/week	Test	p-value
Antibiotic use [%]	18.5	0.0	11.4	0.0	Fisher	0.135
Other PA: None [%]	51.9	28.6	31.4	9.1	Mann–Whitney	0.011
Simple walks [%]	25.9	23.8	31.4	18.2	–	–
Irregular high PA [%]	11.1	19.0	14.3	27.3	–	–
Regular high PA [%]	11.1	28.6	22.9	45.5	Spearman ρ = 0.27	0.008

p: statistical significance

Common Cold Incidence

A significant association was observed between WS participation and the occurrence of common colds ($\chi^2(1) = 4.77$, $p = 0.029$). Winter swimmers reported a lower incidence of colds than non-swimmers, though the effect size was small (Cramér's V = 0.23). When WS frequency was considered, the relationship remained significant ($\chi^2(3) = 9.80$, $p = 0.020$; Cramér's V = 0.32) (Table 4). Interestingly, both the least and most frequent swimmers reported the fewest colds, whereas those swimming once per week reported slightly more frequent colds. Two participants who swam more than once weekly commented that they had not experienced a cold in several years.

Antibiotic Use and Physical Activity Beyond Winter Swimming

Fisher's exact tests revealed no significant differences in antibiotic use between WSs and N-WSs ($p = 0.114$) or across swimming frequency categories ($p = 0.135$). Overall, antibiotic use was low, and none of the participants who swam less than once or more than once weekly reported using antibiotics during the season. Regarding other forms of physical activity (PA), 26% of respondents reported WS as their sole form of exercise, 18% engaged in light walks, 18% in irregular high-intensity PA, and 28% in regular high-intensity PA (Table 5). WS participants demonstrated significantly higher PA levels than N-WSs (Mann–Whitney U = –2.53, $p = 0.011$). Moreover, swimming frequency correlated positively with overall PA level (Spearman ρ = 0.27, $p = 0.008$). However, neither PA level nor frequency was associated with influenza incidence ($p = 0.75$) or colds ($\chi^2(3) = 1.37$, $p = 0.71$) (Table 5).

DISCUSSION

This pilot study examined the association between winter swimming (WS) and the incidence of influenza and common cold infections among adults in Western Poland. Although no significant differences were observed between winter swimmers and non-swimmers regarding influenza incidence, a significantly lower occurrence of common colds was found among individuals practicing WS. These findings suggest that regular exposure to cold water may provide moderate protective benefits against mild upper respiratory infections, but its effect on influenza susceptibility remains uncertain.

The observed reduction in common colds among WS participants aligns with previous research suggesting that repeated cold exposure can enhance immune resilience through adaptive physiological mechanisms.

Repeated immersion in cold water activates the sympathetic nervous system, increasing circulating catecholamines (epinephrine and norepinephrine) and inducing adaptive physiological changes that include transient elevations in leukocyte counts and modulation of cytokine activity. These responses are consistent with broader evidence showing that both cold exposure and structured physical training reshape neuromuscular and physiological load patterns in active populations [7,12,13].

For example, Knechtle, et al. [15] reported that regular winter swimmers exhibited higher levels of interleukin-6 (IL-6) and natural killer (NK) cell activity during the winter season compared to controls, indicating enhanced innate immune responsiveness [8]. Similar findings have been confirmed by research on cold exposure and exercise, showing increased lymphocyte activity and improved immune surveillance following regular cold-water immersion [2].

In the current study, the lack of association between WS and influenza may be due to multiple factors. Influenza virus infection depends on distinct immune pathways, including adaptive humoral responses involving neutralizing antibodies and T-cell–mediated cytotoxicity, which are less directly influenced by the acute hormonal and leukocytic responses triggered by cold exposure [16]. Additionally, the low rate of influenza vaccination observed in both groups could have limited any potential additive protective effects. The limited sample size and self-reported nature of influenza diagnosis also constrain the ability to detect small differences in true infection rates.

The relationship between cold exposure and infection risk has been debated for decades. Studies in cold-adapted individuals have shown improved tolerance to thermal stress and reduced markers of systemic inflammation [17,18]. Conversely, excessive or unaccustomed cold exposure can transiently suppress immune function and increase infection risk, particularly when combined with physical or psychological stressors [19]. Thus, the net immunological impact of WS likely depends on exposure duration, water temperature, individual conditioning, and recovery status.

Interestingly, the present results indicated that both low-frequency and high-frequency winter swimmers reported fewer colds, whereas those swimming once weekly reported slightly higher cold rates. This non-linear pattern may reflect differing adaptation phases: initial exposures might transiently challenge immune homeostasis, while consistent, long-term practice induces beneficial physiological adaptation. Similar U-shaped associations between exercise intensity and infection risk have been documented in exercise immunology, where moderate regular activity reduces infection risk, but excessive training increases susceptibility [10]. Another important observation was that WS participants displayed significantly higher levels of general physical activity compared to non-swimmers. This is consistent with previous findings that individuals engaged in WS often lead more active lifestyles and exhibit greater health awareness [20]. While higher physical activity has been associated with reduced risk of respiratory tract infections in general populations [21], in this study, physical activity level alone was not significantly related to influenza or cold incidence, suggesting that the specific adaptive effects of cold-water exposure might play an independent role.

Overall, the results of this pilot study support the hypothesis that winter swimming may contribute to enhanced immune efficiency and reduced incidence of common colds, although its protective effect against influenza remains unconfirmed. Larger-scale, longitudinal studies using laboratory-confirmed viral diagnostics and immune biomarkers are needed to clarify the underlying mechanisms and establish dose–response relationships for frequency and intensity of cold exposure.

Several limitations should be acknowledged. First, the study relied on self-reported data regarding influenza and cold symptoms, which may be subject to recall bias or misclassification. Second, influenza diagnoses were not laboratory-confirmed, making it impossible to distinguish influenza from other influenza-like illnesses (ILIs). Third, the relatively small sample size limited statistical power, especially for less frequent outcomes such as severe influenza or antibiotic use. Environmental factors (e.g., air temperature, humidity, and group swimming conditions) were not standardized, which may have influenced exposure intensity. Additionally, the cross-sectional design precludes causal inference regarding WS and infection outcomes.

Future studies should incorporate objective immunological measures (e.g., cytokine panels, NK cell activity, salivary IgA), continuous temperature monitoring, and prospective designs across multiple WS seasons. Integration of molecular virology diagnostics and longitudinal immune profiling would provide more robust evidence for whether winter swimming confers sustained protection against respiratory infections, including influenza.

CONCLUSION

This pilot study provides preliminary evidence that regular participation in winter swimming (WS) may reduce the incidence of common colds but does not appear to significantly affect influenza occurrence. While the observed benefits are modest, they support the hypothesis that repeated exposure to cold water can strengthen immune resilience through adaptive physiological mechanisms and lifestyle factors associated with active outdoor behavior. The findings contribute to a growing body of literature indicating that WS, when practiced safely and systematically, can serve as a form of moderate physical activity with potential health-promoting effects. From a public health perspective, WS may represent an accessible, low-cost intervention for enhancing general well-being and possibly mitigating mild respiratory infections during the winter months. This observation aligns with findings showing that structured and consistent training exposure—whether guided traditionally or supported by digital coaching solutions—improves adherence and contributes to measurable health benefits [22]. However, the practice should be approached with caution, particularly among individuals with cardiovascular or respiratory comorbidities, and under appropriate supervision during initial adaptation.

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