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Does Swimming in Cold Water Protect Against Upper Respiratory Infections? A Preliminary Study of the Incidence of Upper Respiratory Infections in Cold-Water Swimmers

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ABSTRACT

Nuckton TJ, Moore DH. Does Swimming in Cold Water Protect Against Upper Respiratory Infections? A Preliminary Study of the Incidence of Upper Respiratory Infections in Cold-Water Swimmers. **JEPonline** 2017;20(1):231-248. Ninety-six cold-water swimmers (age: range 23 to 79 yrs; median 57 yrs) swam consistently in the San Francisco Bay without wetsuits as part of a 3-month winter swim event (water temperature range: 9.6° C [49.3° F] – 12.6° C [54.7° F]). From post-event survey questions about upper respiratory infections (URIs), the winter URI incidence in cold-water swimmers (0.53 URI/person-per-winter; 95% CI: 0.40 - 0.70) was similar to a general U.S. population winter incidence (0.54 URI/person-per-winter) and a winter incidence from a prior study of runners (0.51 URI/person-per- winter). We found significant associations between numbers of URIs in cold-water swimmers and age (URIs reduced by 0.26 per 10 yr age increase; Coef = -0.026; P=0.007) and swim distance per day (URIs increased by 0.7 per mile/day swum; Coef = 0.701; P=0.016). Our results do not support an overall reduction in URIs as a specific health benefit related to recreational swimming in cold water. Older age and moderate exercise may contribute to a general decrease in URIs in cold-water swimmers, while aggressive swimming may increase the likelihood of infection.

Key Words: Cold Exposure, Hypothermia, Swimming, Upper Respiratory Infection,

INTRODUCTION

Cold-water swimming attracts diverse individuals and continues to increase in popularity (3,20,32-34). Prior studies have suggested that a wide variety of health benefits may be associated with cold-water swimming (22,23,33). In particular, a possible enhancement of immune function has been attributed to cold exposure (4,6,24) and, more specifically, to immersion or swimming in cold water (8,19,22,23). However, detailed studies of infection rates in dedicated cold-water swimmers are lacking.

Exercise itself adds complexity to the potential relationships between cold exposure and immunity. While moderate exercise has been associated with fewer upper respiratory infections (URIs) (16-18,28,30,31), aggressive athletic training has been associated with an increase in URIs (10,11,16-18,28-31,37). URI rates have also been shown to be influenced by age, with greater numbers of URIs typically reported in younger adults, and fewer URIs reported in older adults (14,18,26,27).

In this study, we examine the incidence of reported winter URIs in a large group of cold-water swimmers. These swimmers swam consistently throughout the winter months in the San Francisco Bay without wetsuits. Results are compared to general adult epidemiological data from U.S. populations (13,14,26,27) and to data from U.S. adult runners (16). Additionally, we examined the potential associations between reported URI numbers and swimmer characteristics, including exercise patterns and age.

METHODS

Subjects, Survey, and Winter Swim Event

As part of a larger prior study (33,34), 96 dedicated cold-water swimmers completed the following survey questions about their number of URIs in the winter and fall months: (1) In the period, December 21, 2010 – March 21, 2011, how many upper respiratory illnesses (e.g., colds, flus) did you have? (2) In the past 6 months, how many upper respiratory illnesses (e.g., colds, flus) did you have?

All swimmers participated in the 2010/2011 San Francisco Dolphin Club Polar Bear Swim, which began on December 21, 2010 and ended on March 21, 2011. Technically, swimmers were not required to swim outside of the 90-day winter (December 21- March 21) period. However, because all swimmers were members of a local cold-water swim club (Dolphin Swimming and Boating Club, San Francisco, CA), it is likely that most swimmers also swam both before and after the official Polar Bear Swim interval.

Subjects completed surveys within 15 days of the end of the Polar Bear Swim period (surveys were distributed and completed from March 19 – April 5, 2011). The first survey question refers to the number of URIs a swimmer had during the Polar Bear Swim interval (specifically, December 21, 2010 – March 21, 2011). The second survey question is less precise and refers to the number of URIs a swimmer had in the 6 months prior to the date he or she completed the survey. The survey questions were presented directly, without prior validation.

The Polar Bear event required swimmers to swim throughout the winter months in the San Francisco Bay without wetsuits. Water temperature during the winter swim period ranged from 9.6°C [49.3° F] – 12.6°C [54.7° F]) (33). Swimmers were able to participate in one of either two categories. In the regular category, swimmers were required to swim a minimum cumulative total of 40 miles (64.4 km). Participants could exceed the 40-mile minimum, with honors going to those who accumulated the greatest number of miles. Swimmers 60 yrs of age or older could opt to participate either in the regular category or in a special senior category, which required a minimum of only 20 miles (32.2 km) over the same time period. Warm showers and saunas were available to all participants both before and after swimming. Although wetsuits were prohibited, insulating neoprene caps were permitted.

The majority of swimmers had a recreational swimming background, and most were not elite athletes (33). Swimmers swam at an individual pace and self-recorded their daily mileage on a public recording chart, which was posted in a common area of the Dolphin Club. Study subjects were also asked to comment on their swim/exercise habits in the aforementioned survey. Additional details pertaining to the Polar Bear event, survey details and completion rates, swimmer characteristics, and outcomes can be found in prior publications (33,34). The California Pacific Institutional Review Board approved the study and informed consent was obtained from all participants.

Determination of URI Incidence

We compared results from our swimmers to winter and annual general epidemiological data from the United States (13,14,26,27) and to winter and annual data from a study of U.S. runners (16). For the purposes of this study, the term winter refers to astronomical winter (December 21 – March 21) unless otherwise specified. In general, the terms "upper respiratory infection", "common cold", "upper respiratory tract infection", and "upper respiratory illness" are often used broadly or interchangeably. In this study, we have opted to use consistently the U.S. National Institute of Health Medical Subject Heading (MeSH) "upper respiratory infection" (URI) when reporting the results from our subjects and when comparing our data to data from other groups.

When comparing our data to data from other groups, we assumed that the 2010/2011 winter URI activity in San Francisco was not atypical. Although the incidence of general upper respiratory infections was not tracked by local public health agencies, the regional influenza and influenza-like activity for 2010/2011(from regional epidemiological data) was moderate and comparable to previous non-pandemic seasons (5).

Information pertaining to the calculation or utilization of URI incidence in each group is outlined below:

Winter and Fall/Winter Incidence: Our Subjects

The winter URI incidence (URI/person; 3-month period) and the fall/winter URI incidence (URI/person; 6-month period) for our subjects were calculated directly from survey responses (the total number of reported URIs was divided by the number of study subjects).

Annual Incidence: Our Subjects

In prior studies, approximately 25% to upwards of 40% of the total annual number of URIs in the U.S. occurred during the winter months (9,14-16). The annual URI incidence in our swimmers was estimated by assuming that 35% percent (an intermediate value from prior data) of annual URIs occurred during astronomical winter (the winter incidence of our subjects was divided by 0.35 to yield an estimated annual incidence).

Winter Incidence: General U.S. Population

From a recent summary (13), adults average 6 to 8 colds per 1000 persons per day during the peak months of the respiratory disease season in the United States. This summary statistic was derived from a study of a large U.S. adult population (14). The lower end of the range (6 colds per 1000 persons per day) corresponds to 0.54 infections/person in a 90-day winter period: 6 infections/1000 persons per day = 0.006 infections/person per day; 0.006 infections/person per day X 90 days/winter = 0.54 infections/person per winter. We compared the winter incidence from our subjects to the lower end of the above range because URI rates are lower in older adults (14,18,26,27), and the average age of our subjects was in a middle-aged category.

Annual Incidence: General U.S. Population

We compared the estimated annual URI incidence of our subjects to an annual total respiratory illness incidence range from frequently quoted general epidemiological data, from a large community in the United States (26,27). From these prior general population data, the annual total respiratory illness incidence range (of mean values by age) that covers adults from ages 20 to 60 yrs of age or older is 1.3 to 2.8 infections/person per year. This range reflects a span of mean values by age, in which the U.S. population URI incidence was seen to decrease with age: those over 60 years of age averaged 1.3 infections/person per year, while those 20-24 yrs of age averaged 2.8 infections/person per year (26,27).

Winter and Annual Incidence: U.S. Runners

We calculated the winter URI incidence in a group of U.S. runners from survey data presented in a prior work (16). From our calculations, the winter URI incidence in this group of runners was 0.51 infections/person per winter. Also from this work, the reported annual URI incidence in runners was 1.2 infections/person per year. The winter and annual incidences from our swimmers were compared to these corresponding values from runners.

Use of Additional Fall/Winter (6-Month) Data: Our Subjects

From our survey data, in addition to the winter incidence and estimated annual incidence, we were also able to calculate a URI incidence in cold-water swimmers for a 6-month fall/winter period (6 months prior to survey completion near the end of the Polar Bear event). General U.S. population URI incidence data are not typically expressed for 6-month intervals, and we did not specifically compare the fall/winter URI incidence in our swimmers to data from other groups. However, this 6-month fall/winter URI incidence data from our swimmers was used to examine the relationships between the numbers of reported URIs per swimmer and swimmer characteristics and exercise patterns as outlined below.

Statistical Analyses

For descriptive statistics, means ± standard deviations (SD) are presented unless otherwise specified. Spearman correlations and Wilcoxon tests were used to examine the relationships between the number of reported URIs per swimmer in both the winter (3-month) and fall/winter (6-month) periods, and a variety of variables, including subject age, sex, body mass index, number of days per week of swimming, swim distance per day, time per swim, swim time per week, and total accumulated swim distance during the winter period. As mentioned above, swimmers were not required to swim every day. The swim distance per day refers to the distance reported by the swimmer as his or her swim distance on a typical day of swimming. Poisson regression was used to further examine the relationships that were found to be significant by Spearman correlations. For regressions of URI/person on swim distance/day, three outliers (one with swim distance <0.5 $mi \cdot d^{-1}$, two with distance ≥3 $mi \cdot d^{-1}$), were removed prior to the analyses. These outliers were removed because they had high leverage (a disproportionately large influence on the regression coefficient). Chi-square goodness-of-fit tests were used to test the distributional assumptions of Poisson regression for our data and data from a reference source (15). Deviance goodness-of-fit and Pearson goodness-of-fit tests were used to test the fit of the regression models themselves.

RESULTS

Subjects

The study group was composed of 96 swimmers: 71 men (74%) and 25 women (26%). Additional swimmer characteristics are outlined in Table 1.

Table 1. Characteristics and Swim Patterns of Study Population (N = 96).

Age (yrs)	54.2 ± 11.0 (range: 24 - 79)
Subjects ≥60 yrs	n = 39 (41%)
Men	n = 71 (74%)
Women	n = 25 (26%)
Body Mass Index ($kg \cdot m^{-2}$)	25.8 ± 3.5 (range: 19.0 - 37.1)
Average Total Winter Swim Distance (miles*[km]*)	46.7 ± 19.0 (range: 20.5 - 154.0) *[75.2 ± 30.6 (range: 33.0 - 247.8]*
Average Swim Distance per Day (miles*[km]*)	1.1 ± 0.5 (range: 0.25 - 3.5) *[1.8 ± 0.8 (range: 0.4 - 5.6]*
Average Time per Swim (min)	31.3 ± 8.2 (range: 17 - 60)
Average Swim Time per Week (min)	131.3 ± 50.8 (range: 51 - 315)

Survey Response Rates

One hundred and twenty-five San Francisco swimmers participated in the 2010-2011 Polar Bear Swim event. One hundred and three of the 125 swimmers volunteered for our original study (33,34). Ninety-six of the 103 subjects satisfactorily completed the survey questions related to upper respiratory infections.

Swimmer URI Incidence (Winter, Fall/Winter, and Annual)
The winter, fall/winter, and annual URI incidence results for our subjects are presented in Table 2.

Table 2. Incidence of Upper Respiratory Infections in Cold-Water Swimmers.

Winter Incidence (3-month period; from survey response)	0.53 infections/person per winter
Fall/Winter Incidence (6-month period; from survey response)	0.92 infections/person per fall/winter
Annual Incidence (estimated, attributing 35% of annual infections to winter months)	1.5 infections/person per year

From the survey data, the winter incidence (3-month period, December 21- March 21) in our subjects was 0.53 ± 0.63 (95% CI: 0.40 to 0.70) infections/person per winter. Also from our survey data, the fall/winter incidence (6-month period prior to the end of the Polar Bear event) in our subjects was 0.92 ± 0.91 (95% CI: 0.74 to 1.13) infections/person per fall/winter. Assuming that 35% of upper respiratory infections occur in the winter, the estimated annual incidence in our subjects was 1.5 infections/person per year.

Comparisons to General U.S. Populations and U.S. Runners
The winter incidence in our subjects (0.53 infections/person per winter) was similar to a summary winter incidence attributed to the general U.S. population (0.54 infections/person per winter) (13), and to a winter incidence from a prior study of runners (0.51 infections/person per winter) (16) (Figure 1).

The estimated annual incidence in our subjects (1.5 infections/person per year) was within the range (of mean values by age) of annual infections from a general U.S. population (1.3 to 2.8 infections/person per year) (26,27), and was similar to the annual incidence reported in a prior study of runners (1.2 infections/person per year) (16) (Figure 2).

As mentioned above, general population data are not typically expressed for 6-month periods, and the 6-month incidence in our swimmers was not specifically compared to data from other groups.

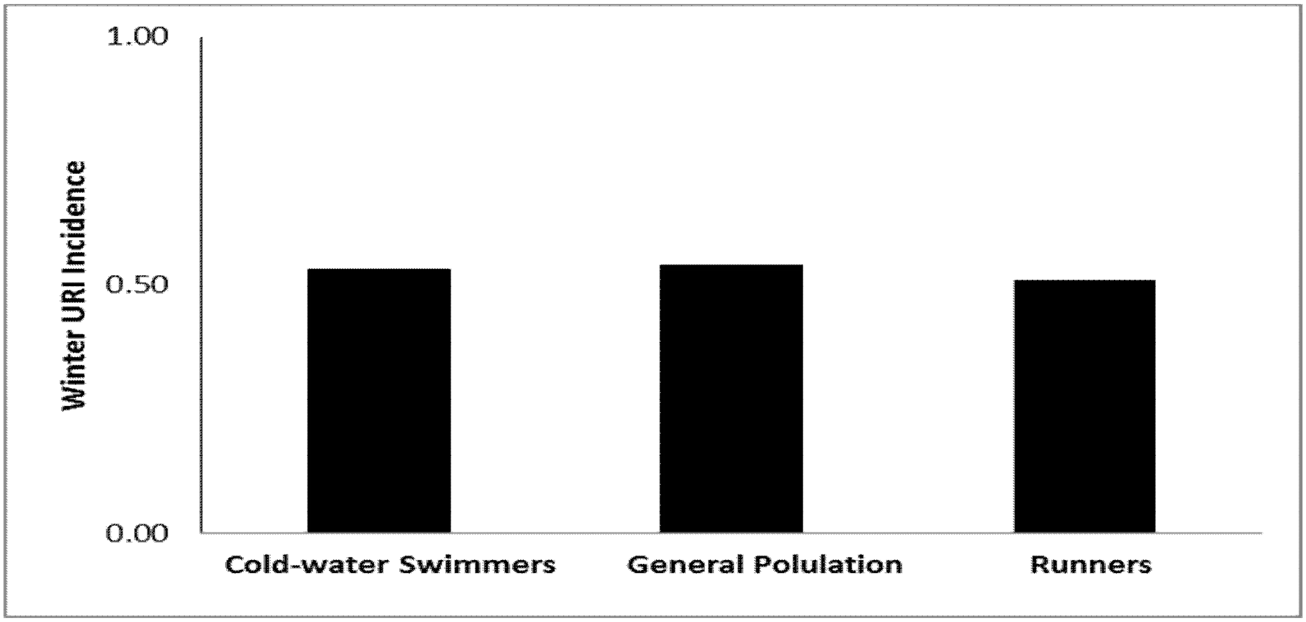


Figure 1. Winter Incidence of Upper Respiratory Infections in Cold-water Swimmers, General Population, and Runners. Winter URI incidence for cold-water swimmers from survey response of recreational cold-water swimmers (this study; incidence: 0.53 URI/person per winter; N = 96; mean age: 54.3 yrs). Winter URI incidence for general population from summary statistic (the lower end of adult range) of incidence during the peak U.S. respiratory season (incidence: 0.54 URI/person per winter) (13). Winter URI Incidence in runners calculated from previously published study of a group of recreational U.S. runners (incidence: 0.51 URI/person per winter)(16).

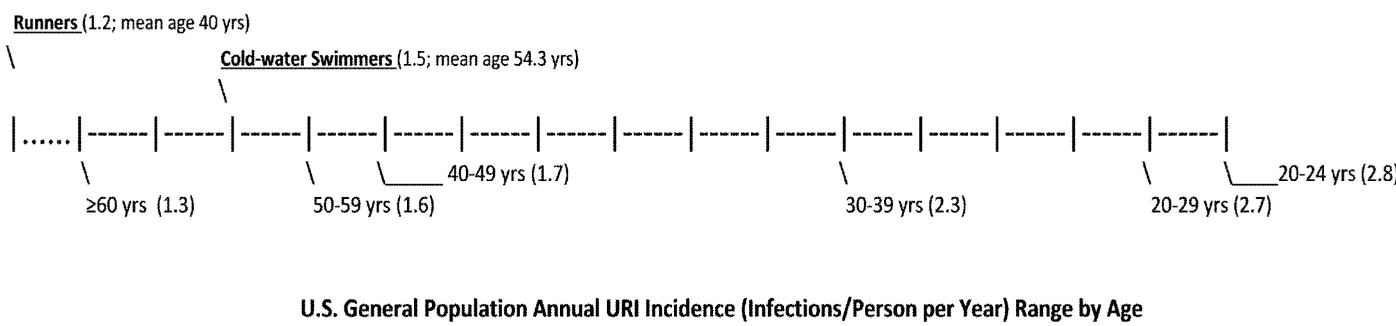


Figure 2. Annual URI Incidence in Cold-water Swimmers and Runners Relative to Annual URI Incidence Range in U.S. General Population by Age. From a large U.S. population (26,27) the annual URI incidence (mean values by age) ranged from 1.3 (≥60 yrs) to 2.8 (20 to 24 yrs) infections/person per year. Cold-water swimmers in our study (N = 96; mean age: 54.3 yrs) had an estimated annual URI incidence of 1.5 infections/person per year. From a prior study (16), recreational runners (N = 530; mean age: 40 yrs) had an annual URI incidence of 1.2 infections/person per year.

Associations with Swimmer Characteristics and Exercise Patterns

The numbers of infections per swimmer (both 3-month winter period and 6-month fall/winter period), and associations with swimmer characteristics and exercise patterns, are presented in Table 3.

Table 3. Numbers of Upper Respiratory Infections Per Swimmer and Associations with Swimmer Characteristics and Exercise Patterns.

Winter (3-Month Period)	
Range of Numbers of Infections per Person	0 to 2
Subjects with No Infections	n = 52 (54%)
Subjects with 1 Infection	n = 37 (39%)
Subjects with 2 Infections	n = 7 (7%)
Associations (Spearman Correlation)	
Swim Distance/Day	rho = 0.21; P = 0.047
Fall/Winter (6-Month Period)	
Range of Numbers of Infections per Person	0 to 4
Subjects with No Infections	n = 36 (38%)
Subjects with 1 Infection	n = 39 (41%)
Subjects with 2 Infections	n = 15 (16%)
Subjects with 3 Infections	n = 5 (5%)
Subjects with 4 Infections	n = 1 (1%)
Associations (Spearman Correlation)	
Swim Distance/Day	rho = 0.23; P = 0.029
Age	rho = 0.22; P = 0.031

There was a modest association between swim distance per day and the number of infections per swimmer during the 3-month winter period (Spearman; rho = 0.21, P = 0.047), but no significant association between subject age and the number of infections per swimmer during the 3-month winter period (P>0.1). Additionally, there was a highly significant and inverse association between subject age and swim distance per day during the 3-month winter period (Spearman; rho = -0.46; P<0.001; results not shown in Table 3).

A modest association was also found between swim distance per day and the number of infections per swimmer during the 6-month fall/winter period (Spearman; rho = 0.23, P = 0.029). There was a modest inverse association between subject age and the number of infections per swimmer during the 6-month fall/winter period (Spearman; rho = -0.22; P = 0.031).

No significant associations were found between any other variable (sex, body mass index, time per swim, swim time per week, and total accumulated swim distance during the winter period), and either the number of infections per swimmer during the 3-month winter period or the number of infections per swimmer during the 6-month fall/winter period (P>0.1 for each association).

Poisson Regression

Poisson regression supported and further defined the relationships between numbers of URIs and other variables that were significant by Spearman correlations. Poisson regression results are summarized in Table 4 (tabular results) and Figure 3 (corresponding lowess smoothed plots).

Notably, by Poisson regression, for every 1.0 mi (1.6 km) increase in swim distance per day, there was an increase of 0.70 URIs per person in the 6-month fall/winter period (Poisson regression; Coef = 0.701; P = 0.016), and for every 10-yr increase in subject age, there was a decrease of 0.26 URIs per person in the 6-month fall/winter period (Poisson regression; Coef = -0.026; P = 0.007).

Additional Poisson regression analyses with swim distance per day and subject age in the same model (Table 5), suggested that age predicted the number of URIs per person in the 6-month fall/winter period independently from swim distance per day (Poisson regression; Coef = -0.021; P = 0.043); after correction for age the relationship between swim distance per day and the number of URIs per person in the 6-month period was decreased and with borderline statistical significance (Poisson regression; Coef = 0.53; P = 0.093).

Table 4. Poisson Regressions: Numbers of URIs/Swimmer, Age, and Swim Distance/Day

Results Below Correspond to Lowess Smoothed Plots in Figure 3 (A to C)

A. Swim distance/day (mi) and number of URI/Person (Winter; 3-Month Period)

No. URI/Person (Winter; 3-Month)	**Coef.**	**P-value**
Swim Distance/Day (mi)	0.718	0.063

*For every 1.0 mi increase in swim distance/day, there was an increase of 0.72 URI/person (borderline significance)

B. Swim Distance/day (mi) and Number of URI/Person (Fall/Winter; 6-Month Period)

No. URI/Person (Fall/Winter; 6-Month)	**Coef**	**P-value**
Swim Distance/Day (mi)	0.701	0.016

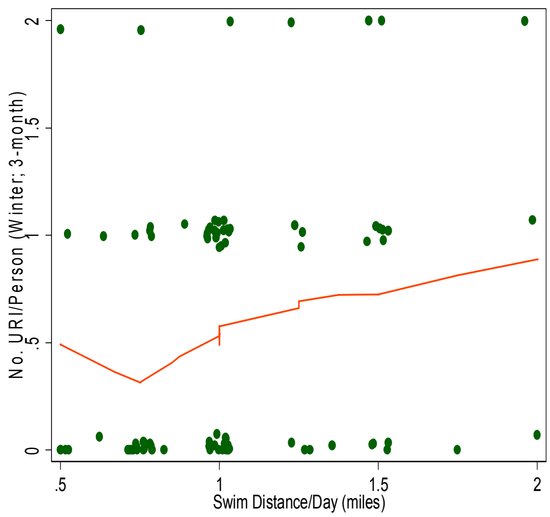
*For every 1.0 mi increase in swim distance/day, there was an increase of 0.70 URI/person

C. Subject Age (Yrs) and Number of URI/Person (Fall/Winter; 6-Month Period)

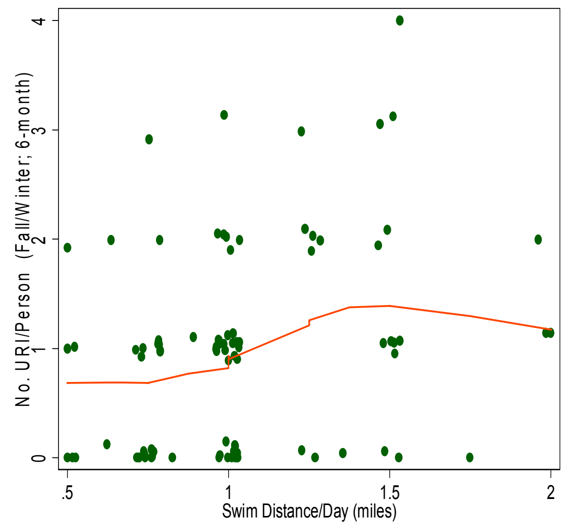
No. URI/Person (Fall/Winter; 6-Month)	**Coef**	**P-value**
Age (yrs)	-0.026	0.007

*For every 1-yr increase in age, there was a decrease of 0.026 URI/person (for every 10-yr increase in age, there was a decrease of 0.26 URI/person)

A.



B.



C.

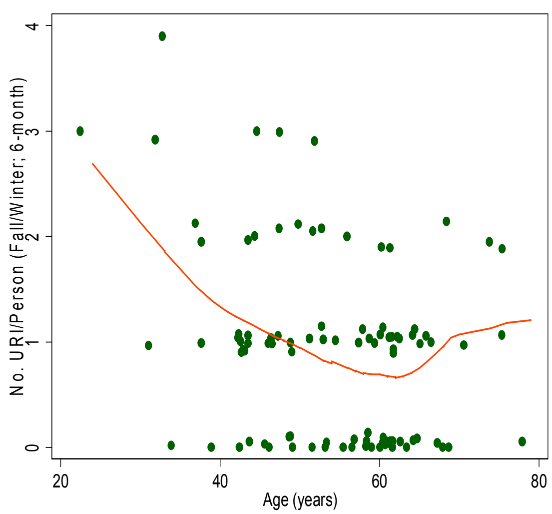


Figure 3. Lowess Smoothed Plots for A. Number of URI/person (winter; 3-month period) versus swim distance/day (mi); (three outliers removed; one with distance/day <0.5 mi, two with distance/day ≥3 mi). **B.** Number of URI/person (fall/winter; 6-month period)) versus swim distance/day (mi); (three outliers removed; one with distance/day <0.5 mi, two with distance/day ≥3 mi). **C.** Number of URI/person (fall/winter; 6-month period) versus subject age (yrs); (all subjects).

Table 5. Multivariable Poisson Regression: Subject Age (yrs), Swim Distance/Day (mi) in Same Model; (6-Month Period).

No. URI/Person (Winter; Fall/Winter; 6-Month)	Coef	P-value
Age (yrs)	-0.021	0.043
Swim Distance/Day (mi)	0.53	0.093

* For every 1-yr increase in age there was a decrease of 0.021 URI/person (for every 10-yr increase in age, there was an decrease of 0.21 URI/person), and for every 1-mi increase in swim distance/day there was an increase of 0.53 URI/person (borderline significance)

Chi-square goodness-of-fit tests (to test the distrubtional assumptions of Poisson regression) indicated that the distributional fits were adequate for both our data and data from a reference source (15) (P>0.2 for all chi-square tests). Goodness-of-fit tests (both deviance goodness-of-fit and Pearson goodness-of-fit) indicated good fit of the regression models themselves (P>0.4 for all deviance and Pearson goodness-of-fit tests).

DISCUSSION

Results from this preliminary study suggest that the winter and annual URI incidences in cold-water swimmers are similar to URI incidences in general U.S. populations (13,14,26,27) and in runners (16). These similarities likely reflect a complex interplay between immunity, age, exercise, and cold exposure.

Several sources have suggested that cold exposure (4,6,24) and, more specifically, swimming or immersion in cold water (8,19,22,23) may actually improve immune function. Perhaps most notably, Jansky and colleagues (19) reported a trend toward an increase in the plasma concentrations of both T and B lymphocytes in subjects after 6 wks of consistent cold-water immersion. Further, Dugue and Leppanen (8) also reported potentially beneficial changes in cytokines after regular swimming in ice-cold water, and others have reported potentially beneficial increases in cytokines and lymphocytes following non-immersion cold exposure (4,6,24).

Conversely, while there is a consensus that exposure to a cold environment per se does not increase susceptibility to infection (7,12,13), others have suggested the possibility of at least a partial blunting of the immune response related to cold exposure or hypothermia (1,2,4,6, 21,35,36). Adding further complexity is the possibility that immune responses may be less than optimal in individuals with both cold exposure and fatigue related to exertion (2,4,6).

It is difficult to draw firm conclusions from our data that directly apply to the debate about the effects of cold exposure on immunity. However, in our opinion, the close similarity of the winter URI incidence of our cold-water swimmers to a winter incidence attributed to the general U.S. adult population (13) suggests that immune function is not substantially altered by recreational cold-water swimming.

The estimated annual URI incidence in our swimmers was within, but toward the lower end of the annual URI incidence range (of mean values by age) in a large population of U.S. adults (26,27). This is not surprising given that URIs are less common in older adults compared to younger adults (14,18,26,27), and that over 40% of our subjects were 60 yrs of age or older. The significant inverse correlation between age and numbers of URIs per swimmer in our study, which was supported by Poisson regression is also consistent with prior data (14,18, 26,27) that suggest that older individuals are less susceptible to URIs.

The incidence data in our subjects was similar, not only to the data from the general U.S. populations, but also to the URI incidence data from a group of recreational U.S. runners (16). Although these runners on average were moderately younger than our swimmers, overall the groups appeared to be broadly similar; in particular both groups were composed primarily of recreational athletes.

Moderate exercise has been associated with a decline in URI infection rates (16-18,28,30,31) and may have contributed to a decrease in URI incidence in both our swimmers and in the runners from a different study. However, had cold-water swimming imparted a clear immune benefit in addition to that from exercise, a lower URI incidence in our cold-water swimmers compared to runners would have been expected. Because of the similarities in URI incidence between the groups, no clear additional benefit can be attributed to cold-water swimming over running. Further study with direct matching of runners and swimmers, not only based on age, but also on athletic level and training regimen would be needed for more definitive conclusions.

While a decrease in URI incidence has been associated with moderate exercise, aggressive athletic training has been associated with an increase in infections (10,11,16-18,28-31,37). The significant correlation between swim distance per day and numbers of URIs per swimmer in our study is consistent with this finding and suggests that those swimmers who swam greater distances per swim had a higher number of infections.

We are cautious about this interpretation given that the associations were modest and that other exercise outcomes, including time per swim, swim time per week, and total accumulated swim distance during the winter period were not associated with an increase in the numbers of URIs per swimmer. Further, the significant correlation between swim distance per day and subject age suggests that the relationship between swim distance per day and the number of URIs per swimmer may have been confounded by subject age.

Nonetheless, the positive correlations between swim distance per day and numbers of URIs per swimmer were generally supported by a confirmatory Poisson regression. Thus, our data could reasonably be viewed as suggesting not only that swimming in cold water provides no clear protection from URIs, but increased cold-water swimming, like other forms of aggressive exercise (10,11,16-18,28-31,37), might actually increase URI susceptibility.

Prior studies have suggested that shivering may be an important component of the possible improvements in immune responses or other metabolic changes related to cold exposure (19,25). Our subjects had access to warm showers and saunas and, thus may not have had the optimal shivering needed for these potentially beneficial responses. Alternatively, because the cold exposure in most of our subjects was relatively brief, our subjects may not have had sufficient declines in core temperature to trigger the possibly detrimental effects of cold or hypothermia on the immune system.

Limitations of This Study

Although the results from our study are generally consistent with those from prior studies, our study had several limitations. We utilized simple, non-validated survey questions and a projected estimate for the annual URI incidence in our swimmers. Comparison of our swimmers to other groups was limited by many factors: the reported incidence of URIs in general U.S. populations (9,13-15,18,26,27) varies, often dates to the 1960s or 1970s, and is impacted by age, differences in illness definitions and study methods, season-to-season differences, and other population and environmental factors. Without an accepted standard, we compared our data to the prior data that we determined to be the most appropriate for comparison. Additionally, the winter incidence for the general U.S. population that we used was based on a summary statistic (13) and required conversion in order to correspond to our data. We did not assess or account for many potentially confounding factors, such as occupation, physical activity other than swimming, sleep habits, or the presence of young children in the home. Use of a Poisson regression model requires an assumption that URI events are independently distributed, an assumption for which we have limited data. However, we found that the distributional fits for a Poisson regression model were adequate for both our data and data from a reference source (15). Also, use of a Poisson regression model is consistent with the reality that counts of URIs are non-negative and discrete. Our study did not involve immersion in ice water, which was a characteristic of a prior study (8). Plasma lymphocytes, cytokines, or other markers of immune function were not measured in our study, and the relationships between markers and infections could not be assessed. Lastly, we did not track or otherwise assess the length or duration of illnesses in our swimmers, which could have been either positively or negatively impacted by cold-water swimming. Because of the limitations, we stress the preliminary nature of our work; further studies, particularly those done prospectively, would allow for more definitive conclusions.

CONCLUSIONS

Our preliminary study from a large group of dedicated cold-water swimmers suggests two broad conclusions. Based on our data, recreational cold-water swimmers do not appear to be at increased risk for URIs. Also, they do they appear to have substantial protection from URI, one of the most common ailments in our society.

In summary, our results suggest that the URI incidence in cold-water swimmers is similar to the URI incidence in the general U.S. populations and in runners. Older age and moderate exercise may contribute to a decrease in URIs in cold-water swimmers, while aggressive swimming may increase the likelihood of infection. However, from our data, no clear URI susceptibility benefit or detriment can be attributed to recreational swimming in cold water.

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