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PSYCHOSOCIAL RISK FACTORS FOR UPPER RESPIRATORY INFECTION:

DEMOGRAPHIC PREDICTORS OF OUTPATIENT TREATMENT

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SUMMARY

A risk profile for upper respiratory infections (URIs) could help focus research on individuals who would provide the most information about how to reduce the incidence of this mild, but cumulatively costly, type of illness. This study therefore sought to replicate prior evidence that easily obtained demographic predictors such as age, education, and race would be useful elements of such a risk profile.

Method The health records of 1773 male Marine Corps recruits were reviewed at the end of basic training to determine the number of incidents of URIs, incidents of other types of infectious diseases, and incidents of musculoskeletal problems. Age, education, general classification test (GCT) scores, race, and platoon membership for each recruit was determined from Marine Corps records. Platoon membership data was used to determine the number of men in each platoon and to estimate the URI rate for the platoon. Loglinear and logistic regression procedures provided a predictive equation for URIs and the other health outcomes based on the demographic data.

Results URI incidence was significantly ($p < .05$) higher among recruits with: (a) Above average GCT. (b) White or black as their racial designation. Marginally significant ($p < .10$) relationships linked higher incidence of URIs to: (a) Being 19 years of age or less. (b) Not having a high school diploma.

The occurrence of other infectious diseases was not related to any of the demographic predictors, but race differences for musculoskeletal problems parallelled the URI differences.

Multivariate analysis showed that: (a) The predictive associations for education, GCT, and race were independent and additive. (b) A similar analysis of data reported by Voors, et al. (American Review of Respiratory Disease, 1968, 98, 801-809) did not replicate any of the present multivariate findings. (c) Platoon illness rate did not influence the URI-demographic attribute associations.

Conclusions Demographic variables alone will not provide a satisfactory risk profile for URI. At best, associations between URIs and demographic attributes generally are very weak. However, further investigation of the lower URI rate among non-white, non-black recruits is appropriate because this

difference has been reported in a recent study of hospitalization for respiratory disease in the Navy. Further study of the educational correlates of URIs can be justified on the same basis. If the initial findings replicate, the possibility that the race difference reflects differences in health care seeking rather than differences in susceptiblity to infections must be tested. This need arises because differences in health care seeking could explain both the URI association and the similar pattern of differences obtained in this study for musculoskeletal problems. Although race and education may be components of a risk profile for URI, other possible URI risk factors must be considered because the predictive accuracy feasible with a purely demographic risk profile appears to be low.

INTRODUCTION

Although upper respiratory infections (URIs) typically are mild, self-limiting illnesses, they are so common that their cumulative economic impact is substantial (Harlan, et al., 1986). Recurrent URIs also may identify immunodeficient individuals (Reynolds, 1985). Detailed study of individuals susceptible to URIs, therefore, may be useful for identifying key immunological deficiencies which are associated with a major source of economic losses resulting from poor health. Demographic information can be collected easily and may identify people with above average URI rates (Evans, 1982; Harlan, et al., 1986; NCHS, 1986; Vickers, Hervig, & Edwards, 1986). This study, therefore, evaluated demographic characteristics as potential components of a risk profile for URIs in military basic training.

Increased URI incidence has been reported for young, white, and relatively highly educated recruits (Voors, Stewart, Gutekunst, Moldow, & Jenkins, 1968). The article reporting these findings did not include statistical significance tests, but did table URI rates by demographic classifications. Chi-square tests for the outpatient treatment data provided in these tables showed that the reported associations for race and education were significant ($p < .001$ for both), but the reported association for age was not ($p > .05$). Recent national surveys report mixed findings regarding race (Jacks, 1981; Harlan, et al., 1986; NCHS, 1986) and age trends typically are small for the age range under consideration (Evans, 1982). The fact that findings in other populations are inconsistent across studies suggests the possibility that the previously described associations for recruits may be sample specific. Therefore, one objective of this study was to replicate Voors, et al.'s (1968) findings.

If URI is reliably related to some demographic attribute(s), it is reasonable to ask whether the attribute(s) in question are indicators of differential susceptibility to infectious disease. This interpretation would be tenable if competing alternatives could be eliminated. One important alternative is that the demographic attribute(s) may be related to differences in symptom recognition and/or willingness to seek health care (Mechanic, 1978). A susceptibility interpretation implies that patterns of association between URIs and demographic attributes could generalize to other types of infectious disease, but not to illnesses which are not influenced by resistance to infection. A symptom recognition/health care seeking interpretation implies that the pattern would generalize to all types of illness. Measures of non-URI infectious diseases and musculoskeletal problems, therefore, were included in this study to assess the generality of any URI-demographic attribute associations as an aid to interpreting those associations.

Attempts to identify factors associated with susceptibility to infectious disease should control for differences in exposure if differential exposure is a possibility. Differential exposure poses problems because people with below average susceptibility to infection will become ill given high exposure and people with above average susceptibility will stay healthy given low exposure. Differential exposure, therefore, can cause misclassification of individuals with respect to susceptibility if illness is the only information available to estimate susceptibility. Misclassification will distort estimates of associations between any indicator of susceptibility and illness. This problem can be minimized by assessing and adjusting for differences in exposure when necessary.

Differential exposure is likely in basic training. Interaction with other infected individuals is a potent determinant of the probability of contracting viral infections in susceptible individuals (Meschevitz, Schultz, & Dick, 1984). Such interaction may vary widely across basic training platoons because there are substantial platoon differences in illness rates (Stewart, Voors, Jenkins, Gutekunst, & Moldow, 1969; Vickers, Haight, Wallick, & Conway, 1981). Therefore, platoon URI rates were used as an index of exposure to determine whether these differences affected estimated associations between recruit characteristics and URIs.

METHOD

Sample

Male Marine Corps recruits (N = 1773) were studied during their basic training at the Marine Corps Recruit Depot, San Diego, CA. These recruits comprised a 50% random sample of graduating recruits from 70 platoons starting training between December, 1979, and June, 1980.

Measures

Age, educational level, general classification test score (GCT), and race were obtained from Marine Corps records. These measures are self-explanatory except for GCT which is a general intelligence test developed for military use.

Health Measures

Medical records maintained at the dispensary during the recruits' training were reviewed. An illness incident was defined as a series of one or more visits for a given complaint with no two visits in the series separated by more than seven days. Visits separated by more than seven days were coded as part of a single incident only if the record explicitly stated that the visit was a continuation of a prior problem. The diagnosis recorded for each incident was determined and coded. For the present purposes, the incidents of interest were those in three categories: (a) Respiratory infections, (b) Other infections, and (c) Injury/trauma. Analysis of specific infectious diseases other than URIs was impossible because other types of infection were infrequent.

Platoon Characteristics

Platoon size was defined as the number of recruits who began and completed training with a platoon. This definition excluded recruits who began training with the platoon, but were discharged prior to completing training. Most discharges took place early in basic training, so this definition represents platoon size for the majority of training.

High and low exposure groups were defined by the proportion of recruits with one or more URI incidents, a value which approximates the probability of exposure concept in biomathematical models of infectious disease (Bailey, 1975). The proportion of recruits with one or more URI incidents ranged from 0% to 60% in the platoons studied. The high-low split was at the median for the platoon distribution; this value was 32%.

Analysis Procedures

Chi-square tests for association assessed bivariate relationships between predictors and health outcomes. Loglinear analyses (BMDP4F, Brown, 1983) tested for possible interactions between demographic variables as predictors of health outcomes. Loglinear analysis provided suitable tests for nonadditivity of the predictors given that the quasi-continuous measures of age and GCT were divided into discrete categories (Payne, 1977; Knoke & Burke, 1980). This categorical approach was employed to parallel Voors, et al.'s (1968) treatment of their data. Logistic regression analysis (BMPDLR, Engelman, 1983) with models specified on the basis of the loglinear results provided estimates of coefficients for the risk factor equations.

RESULTS

Demographic Variables as Predictors of URI

URI incidence was higher for younger recruits, recruits who lacked a high school diploma, and recruits with higher GCT scores (Table 1). The URI rate for whites was nonsignificantly higher than that for blacks (Chi-square = .29; $p < .403$). The significant chi-square for the overall race comparison (Table 1) evidently arose because "other" recruits had a much lower rate than either of these groups.

TABLE 1
ASSOCIATIONS BETWEEN URI AND RECRUIT CHARACTERISTICS

PREDICTOR	CELL n	% WITH 1+ URI	CHI-SQUARE	SIGNIFICANCE
AGE				
19 OR LESS	1197	33.0%	2.99	.0863
20 OR MORE	468	28.6%		
EDUCATION				
LESS THAN HS GRADUATE	640	34.5%	3.72	.0537
HS GRADUATE OR HIGHER	1030	30.0%		
GCT				
BELOW AVERAGE	858	27.7%	13.03	.0003
ABOVE AVERAGE	812	36.0%		
RACE				
WHITE	1262	33.0%	9.22	.0100
BLACK	284	31.3%		
OTHER	124	20.2%		

NOTE. "HS" indicates "High School." Average GCT score, to the nearest whole point, was 105.

Multivariate Prediction of URI

All predictors were retained for the multivariate analyses to test for possible interactions and to determine whether any marginally significant bivariate associations were significant after controlling for other URI predictors. The key finding in the loglinear analyses was the absence of any nonadditive effects of demographic attributes on URI rate. Platoon URI rate was included in the multivariate analyses to assess the effects of exposure on the associations between URI and demographic characteristics. Exposure had no effect on the URI-demographic attribute associations.

TABLE 2
LOGISTIC REGRESSION EQUATIONS TO PREDICT URI

PREDICTOR	FULL SAMPLE b	FULL SAMPLE t	FULL SAMPLE SIG.	RACE SUBSAMPLE[a] b	RACE SUBSAMPLE[a] t	RACE SUBSAMPLE[a] SIG.	VOORS, et al[b] b	VOORS, et al[b] t	VOORS, et al[b] SIG.
DIPLOMA	.129	2.35	.020	.166	2.95	.004	−.080	−1.22	.224
GCT	−.200	3.57	.001	−.226	−3.95	.001	.207	.41	.679
RACE[c]:									
WHITE vs BLACK	−.254	−2.17	.030	.043	.57	.568	−.178	−2.41	.016
WHITE vs OTHER	.406	2.58	.001						

[a]Deleting "other" category, see text.

[b]Based on data in Table 10, p. 807, of Voors, et al., 1968.

[c]The overall race comparison was statistically significant for the "Full Sample" analysis ($F = 3.40$, $p < .034$); the table gives significance levels for the specific race group contrasts indicated.

The logistic regression analysis retained race, GCT, and education as statistically significant URI predictors (Table 2). The predicted probability of having one or more URIs during basic training derived from the resulting equation ranged from 16.7% for recruits categorized as "Other, High GCT, High School Diploma" to 42.9% for recruits categorized as "Black, High GCT, No High School Diploma". However, a logistic regression equation derived from Voors, et al.'s (1968) data did not replicate any aspect of the equation derived from the present data (Table 2).

Demographic Variables as Predictors of Other Types of Illness

The probability of non-URI infectious diseases was not related to any demographic characteristic. The frequency of trauma was related to race (Chi-square = 8.42, $p < .015$), primarily because of a high rate of trauma among white recruits (33.6% with one or more problems) compared to black recruits (29.6%) and other recruits (21.6%).

DISCUSSION

No demographic variable was reliably related to URI in both this study and the Voors, et al. (1968) study. The failure to replicate was particularly noticeable in the multivariate analyses, because even the direction of association tended to be unstable in these analyses. The bivariate trends for age and race were similar in the two studies if the race comparison was limited to blacks versus whites. However, in each of these cases, the association was clearly nonsignificant in one of the two studies. For this reason, the conclusion is that both associations are statistically nonsignificant even if the results of the two studies are combined using procedures described by Rosenthal (1978).

Method differences between this study and Voors, et al. (1968) may have influenced the attempt to replicate. Voors, et al. (1968) used clinical judgments by an otolaryngologist as their criterion while this study relied on diagnoses by medical corpsmen. It might be argued that Voors, et al. (1968) employed a more valid criterion given the more extensive medical training of their diagnostician, but at least one systematic program of research on URIs has concluded that otolaryngological findings are less effective for assessing URIs than are symptom complaints (Jackson, Dowling, Spiesman, & Boand, 1958). The content of the health records reviewed for this study suggested that symptom complaints were the major basis for the corpsman diagnoses which defined health status in this study.

The two studies also used different definitions of educational level. This study contrasted recruits with a high school diploma or more and those with no diploma; Voors, et al. (1968) contrasted recruits with a high school diploma or less to those with more than a high school diploma. Palinkas (in press) provides evidence that Navy personnel with a high school education and those with more than a high school education had comparable hospitalization rates while those with no high school diploma had somewhat higher rates. This difference approximates the present findings, so the contrast used in this study may be more germane to differences in URIs than that employed by Voors, et al. (1968). Also, Palinkas' (in press) finding raises the possibility that the educational differences noted here will replicate.

The lower URI rate noted in this study for recruits who were neither black nor white may merit further attention. Voors, et al. (1968) found an opposite trend, but their study involved too few "other" recruits (n = 16) to represent an important contradiction to the current trend. Palinkas' (in press) reports that several of the subpopulations of Navy personnel who would have been classified as "other" in this study had a lower probability of hospitalization for respiratory disease, most of which reflects infectious diseases. This finding suggests the present results merit further study because they may replicate. Also, examination of finer distinctions within the "other" category may be worthwhile.

Additional study of the race difference alluded to above must address the distinction between the "susceptibility to infection" and the "health care seeking" interpretations of the association. This need arises because the race differences for URIs were nearly identical to differences for musculoskeletal injuries. Based on other data, the susceptibility to infection interpretation may be the more plausible at this time. This suggestion is based on Palinkas' (in press) evidence for a similar race trend for hospitalization for respiratory disease. This evidence would support the susceptibility interpretation if the effects of differences in health care seeking are eliminated when the illness becomes severe enough to require hospitalization. The validity of this assumption may be questionable (Kinsman, Dirks, & Jones, 1983), so further study should attempt to elucidate the basis for the association provided it can be replicated.

Platoon URI rate did not affect the relationship between demographic variables and URIs. Extrapolation from this finding to other risk factors would produce the conclusion that platoon URI rate does not need to be taken into account to obtain accurate estimates of relationships. Such extrapolation would be premature because it appears that there were no significant URI-demographic attributes to be distorted by platoon URI rate. The influence of platoon URI rates should be investigated further to determine whether this initial finding generalizes to other risk factors with stronger associations to URIs.

The overall conclusion from this study is that some demographic attributes may be useful components in a risk profile for URI, but demographic attributes alone probably will not produce a satisfactory risk profile. Palinkas' (in press) findings offer reason to believe that some aspects of the race and educational differences will replicate, but demographic attributes alone will not identify a truly high risk group even if the entire logistic regression equation replicates. The highest risk group identified by this equation had a URI rate only 35% higher than the average.

Additional investigations to test the general conclusion should consider two major issues. Replication of the present findings utilizing the same methods would help assess the impact of methodology on the failure to replicate Voors, et al.'s (1968) results. Also, further research almost certainly will have to include other risk factors such as health history (Vickers, et. al., 1986) and possibly psychological characteristics (Voors, Rytel, Jenkins, Pierce, & Stewart, 1969) to define a truly high risk group. These potential risk factors should be considered in conjunction with demographic attributes.

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Upper respiratory infections (URI) have been reported to be more common among military recruits who were younger, white, and relatively highly educated. This study attempted to replicate these findings to identify demographic components for a risk profile for URI. None of the previously reported associations replicated. One new finding was a lower URI rate among non-black, non-white recruits. This trend merits further study because it parallels recent findings regarding race and hospitalization for respiratory disease in the Navy. Further study of the finding that URI were more common among those with less education can be recommended on similar grounds. Additional research should examine the possibility that the race differences result from differences in seeking medical care. This need arises because a similar race difference for musculoskeletal problems was noted in this study. However, even if the race and education trends noted here are replicable, their combined predictive power will be too weak to regard them as a satisfactory risk profile for URI.

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