Soz Präventivmed 1995; 40: 218–229

0303-8408/95/040218-12 $ 1.50 + 0.20/0

Annlouise R. Assaf[1,2], Uwe Helmert[3], Thomas L. Lasater[1,2], Richard A. Carleton[1,4], Eberhard Greiser[3]

[1] *Division of Health Education, Memorial Hospital of Rhode Island, Pawtucket, Rhode Island*
[2] *Department of Community Health, Brown University Program in Medicine, Providence, Rhode Island*
[3] *Division of Epidemiology, Bremen Institute for Prevention, Research and Social Medicine (BIPS), Bremen*
[4] *Department of Medicine, Memorial Hospital of Rhode Island and Brown University, Pawtucket and Providence, Rhode Island*

Measuring cardiovascular disease risk factor levels: International comparisons between Bremen-North/West (Germany) and two southeastern New England (USA) cities

Summary

Cardiovascular disease risk factor comparisons were made on study populations from communities in two different countries with similar ongoing intervention programs. Baseline survey data from the intervention and comparison communities of the Pawtucket Heart Health Program in Pawtucket, Rhode Island, and from the intervention Region of Bremen-North/West of the German Cardiovascular Prevention Study were compared with respect to these cardiovascular disease risk factors: smoking, overweight, physical inactivity, hypertension, and hypercholesterolemia. The relationship between these variables and social class was also examined in an attempt to partially explain some of the cross cultural differences in risk factors and predicted CHD and CVD mortality. Results indicated statistically significant differences in amount of cigarettes smoked, exercise frequency, diet, body mass index, total cholesterol, HDL, and blood pressure. These risk factors were generally higher in the German population than in the American population as were the predicted CHD and CVD mortality. For the study populations of both countries, however, the lower the social class, the more prevalent the smoking, excess weight, and lack of physical activity.

The identification of the major risk factors for cardiovascular disease (CVD) through studies like the Framingham Heart Study[1] and subsequent intervention trials in both high and not-so-high risk individuals[2,3] has paved the way for a new generation of studies. The Pawtucket Heart Health Program (PHHP) in Rhode Island and the German Cardiovascular Prevention Study (GCP) are two examples of community based intervention studies, the latest generation of studies designed to target population-based CVD prevention.

The PHHP has as its goal the activation of an entire community utilizing lay volunteer facilitators to produce a change in CVD knowledge, risk factor behavior, and attitudes that will then lead to a positive change in both morbidity and mortality from cardiovascular disease. The PHHP research model, study design, and hypotheses have been described in detail elsewhere[4–7]. Pawtucket, Rhode Island, a community of about 71200 citizens, was selected as the intervention city for PHHP and a comparison city of similar size and sociodemographic composition was selected from Southeastern New England. Data from baseline health surveys in both of these communities will be pooled for the purposes of this paper and referred to as simply data from New England.

The German Cardiovascular Prevention Study (GCP) is also a community-based CVD intervention study, but with five centers for the intervention program[8]. For the purposes of this paper, baseline health survey data for only one of the five study regions will be examined: Bremen North/West[9–11]. Risk factor modification in the GCP is aimed at the same five risk factors targeted in PHHP (cigarette smoking, hypertension, high serum cholesterol, lack of exercise, and excess body mass index) as well as stress. The GCP employs principles of health education, behavior change, and organization of the community similar to those advocated by PHHP[4] and other community intervention studies of cardiovascular disease prevention and reduction[12–14].

This paper will document some of the results of the exchange between PHHP and the Bremen region of the GCP by presenting retrospective comparisons between the baseline cross-sectional health surveys in New England and Bremen. The paper will focus on the following major topics:

1. What are the main differences and similarities in regard to the classical coronary heart disease (CHD) risk factors (self-reported and actual) in the study regions of New England and Bremen?
2. What are the main differences and similarities in the sociodemographic characteristics of the two study regions?
3. What is the association between the social, demographic, and economic status of the populations and the health behavior responses and corresponding CHD risk factor problems? In other words, which segments of the population exhibit a higher risk factor profile and does this differ between the two study populations?

Methods and materials

Population Studied

The Pawtucket Heart Health Program utilizes a quasi-experimental design which is described in more detail elsewhere[7,15,16]. The health survey maintains a logo and identity separate from the intervention program. According to PHHP's research desing and timeline, five biennial cross-sectional household surveys of approximately 1400 individuals in each city were planned from 1981 to 1991. A cohort survey with two remeasurements of Survey 1 participants is also part of the design[4].
The first cross-sectional household survey was conducted between 1981 and 1982, before the intervention began in Pawtucket. The study design for each of the five cross-section surveys is similar to this first baseline survey except for the fact that the baseline survey also featured a clinic component where respondents could participate in the bicycle test to estimate maximal oxygen uptake. Subsequent household surveys made use of an in-home step test in place of the bicycle test. This test was cross-validated with the bicycle test and was found to be highly correlated[17].
All households in the two New England study communities were enumerated using available city street directories which had been updated by a block supplement sample according to Kish[18]. Using selection tables adapted from Kish[18] and Deming[19], a single respondent between the ages of 18 through 64 (at last birthday) was randomly selected at each household. In the two cities, there were a total of 2416 completed field interviews in the baseline sourvey. This represents a response rate of approximately 70%. Lipid values were obtained on 2047 respondents. For purposes of comparisons with the Bremen health survey, only data for those respondents between the ages of 25 through 64 (N = 1982) are included here.
The Bremen study region of the GCP consists of Bremen-North and Bremen-West, two of the five districts of the city of Bremen. In 1984, the number of inhabitants of Bremen North/West was 185000, which is about 35% of the total population of Bremen. For the baseline survey, which took place from May through November, 1984, a simple random sample of 2700 individuals aged 25 to 69 was drawn using the compulsory residence registry. After excluding the addresses of persons who had moved prior to the start of the survey, or who had died or could not be located, 2542 potential respondents were identified. The survey protocol is described in more detail elsewhere[9]. The Bremen baseline survey, like the New England baseline survey, yielded a 70% response rate (N = 1801). For the purposes of this paper, only those 1673 respondents between the ages of 25 through 64 were included in the analyses.

Self-Reported Measurements

Smoking Status: Smoking status in both surveys was assessed using self-report information. For the purposes of this paper, only self-report data will be discussed. In Bremen, cigarette smokers were defined as those regularly smoking at least one cigarette per day. In the New England surveys, cigarette smokers were defined as those who had smoked more than a total of five packs of cigarettes in their lifetime AND who were currently smoking cigarettes when interviewed. Daily amount of cigarettes smoked was also obtained in both PHHP and Bremen.

Exercise Frequency and Diet Composition: These two variables were obtained by simple frequency counts in both studies.

Occupation: Occupational codes in Pawtucket were determined using the Standard Occupational Classification Manual from the U.S. Department of Commerce[20]. Those for Bremen were obtained using similar German classifications. All codes were grouped into major classifications: white collar (including civil servants); blue collar; and other.

Antihypertensive Medication: This was determined by self-report in both surveys and was validated by obtaining the bottle of prescription medication and recording the name of the medication.

Income: In Pawtucket, respondents are shown a card with 12 potential income categories and asked to pick the choice which best represents the income of the household. In Bremen, respondents are asked to choose from 11 such categories. For the purposes of analysis in this paper, independent quintiles of income were constructed.

Sociodemographic Variables: All other sociodemographic variables, such as education, marital status, and working status were collected in similar ways for both countries.

Physiological Measurements

Lipid Measurements: In both surveys, serum total cholesterol and HDL were measured on non-fasting blood samples. In PHHP, total cholesterol samples and HDL subfractions were analyzed at a Lipid Research Clinic standardized laboratory using the enzymatic method[21]. In Bremen, total serum cholesterol was analyzed using the Boehringer Mannheim method ($Mg\,2+$/Phosphotungstic acid) in the laboratory of the Federal Health Office in Berlin and standardized against a World Health Organization (WHO) reference laboratory in Prague.

Blood Pressure: In PHHP household surveys, two blood pressure measurements were taken about 20 minutes apart using a Baumanometer mercury sphygmomanometer (folding purposes, the second measurements were used for ascertaining the systolic and diastolic (fifth phase) readings. In Bremen, blood pressure was also measured twice, but only three minutes apart. As in PHHP, Bremen measurements were taken in a seated position on the right arm. Bremen used a random-zerosphygmomanometer. For determination of the diastolic pressure, Korotkov-phase V was used.

Height: In both surveys, height was measured without shoes. At PHHP, a specially designed folding wooden set square and a standard carpenter's folding six-foot wooden ruler with six inch metal extension was also used following a protocol recommended by the Center for Disease Control.

Weight: Body weight was measured in the New England survey on a portable scale with outer garments and shoes removed. In Bremen, a calibrated balance beam scale was used to measure weight in the survey center. Less than 1% of the Bremen visits took place in the home. For these, a portable scale was used. Body mass index (BMI) was calculated using the following formula: BMI = (weight)/(height)**2.

Statistical Analysis

Standard descriptive statistics, multiple logistic regression, and significance tests were calculated using SAS – the Statistical Analysis System computer package[22]. To summarize the general risk factor load of each population, the CHD and CVD risks for males and females were calculated for both surveys using the logistic regression coefficients based upon the U.S. National Health and Nutrition Examination I Epidemiologic Follow-up Survey (NHANES I)[23] which was provided to the GCP courtesy of the National Center for Health Statistics (Drs. Feinleib and Madans).

Results

As seen in Table 1, there were several statistically significant differences between Bremen and New England. Bremen survey participants had a mean age 1½ years older than New England survey participants. There was a slightly greater preponderance of females in the New England sample as compared with Bremen (58% vs. 51%; $X^2 = 15.7$; $p < 0.001$). There was also a difference in martial status between the two countries; 75% of the Bremen group were currently married as compared with 67% of the New England group. The percentage of those working was also slightly higher in New England than in Bremen (71% vs. 64%); but there was a greater percentage of white collar workers in Bremen than in New England (49% vs. 33%).

There was a statistically significant difference in the percentage of female respondents who reported attempts to quit smoking within the last twelve months prior to interview as is seen in Table 2. This difference was not apparent among male smokers. There was, however, a difference between the two regions in respondents who had actually quit smoking over the course of their lifetime (28% in Bremen vs. 18.5% in New England). The rate of current smoking (cigarettes, cigars, cigarillos, pipes) was identical in both regions (43%). The mean number of cigarettes smoked daily by self-reported cigarette smokers, however, was statistically different (Bremen = 19.4 N.E. = 22.6, $p < 0.001$). Self-reported exercise frequency was statistically different between the two countries. Those reporting exercising less than once per week in Bremen comprised 58% of the Bremen respondents as compared with 50% reporting this same practice in New England.

Table 3 presents a summary of physiologic measurement comparison between New England and Bremen by gender.

Some differences in diet were noted. New Englanders were more likely to eat poultry (87% vs. 35%; $p < 0.01$), and fish (72% vs. 50%; $p < 0.01$) at least once per week while the German study population was more likely to eat processes meat (95% vs. 62%; $p < 0.01$), red meat (97% vs. 93%;

Variable		(N)	New England	(N)	Bremen	
Age	male	(838)	43.7 ± 12.14+++	(817)	44.8 ± 10.76*	
	female	(1144)	43.5 ± 12.36	(856)	45.3 ± 11.40***	
Years of school	male	(834)	11.0 ± 4.53	(805)	11.0 ± 2.09	
	female	(1135)	10.6 ± 3.88	(840)	9.9 ± 1.89***	
Female respondents		(1982)	57.7 %	(1673)	51.2 %	$X^2 = 15.73$***
Married	male	(838)	74.9 %	(802)	74.7 %	$X^2 = 0.01$
	female	(1144)	61.2 %	(852)	75.5 %	$X^2 = 45.24$***
Working respondents	male	(838)	83.1 %	(798)	80.1 %	$X^2 = 2.42$
	female	(1144)	61.8 %	(845)	49.5 %	$X^2 = 30.09$***
White collar workers	male	(838)	34.4 %	(817)	44.4 %	$X^2 = 17.56$***
	female	(1144)	32.5 %	(856)	53.0 %	$X^2 = 85.04$***

* $p < 0.05$ for differences between countries
*** $p < 0.001$ for differences between countries
\+ New England = Pawtucket, RI and Comparison City
\++ Bremen = Bremen North/Bremen West
\+++ Mean ± standard deviation

Table 1. *Summary of sociodemographic comparisons by gender between New England+ and Bremen++.*

Risk factor		(N)	New England %	(N)	Bremen %	
Current smokers	male	(838)	53.3	(815)	53.6	$X^2 = 0.01$
	female	(1144)	35.2	(854)	32.6	$X^2 = 1.56$
Smokers who attempted to quit (last 12 months)	male	(447)	39.2	(422)	41.2	$X^2 = 0.39$
	female	(403)	39.0	(267)	44.6	$X^2 = 2.09$
Exercise less than once per week	male	(838)	42.8	(814)	54.7	$X^2 = 23.12$***
	female	(1144)	54.6	(844)	60.8	$X^2 = 7.72$**

* $p < 0.05$ for differences between countries
** $p < 0.01$ for differences between countries
*** $p < 0.001$ for differences between countries
\+ New England = Pawtucket, RI and Comparison City
\++ Bremen = Bremen North/Bremen West

Table 2. *Summary of cardiovascular risk factor comparisons by gender between New England+ and Bremen++.*

Variable		(N)	New England Mean ± standard deviation	(N)	Bremen Mean ± standard deviation
Body mass index	male	(828)	26.9 ± 4.55	(816)	26.1 ± 3.56 ***
	female	(1129)	26.6 ± 5.91	(855)	25.6 ± 4.58 ***
Total cholesterol	male	(748)	216.0 ± 43.90	(800)	230.3 ± 45.99 ***
	female	(959)	214.1 ± 47.76	(825)	230.8 ± 50.22 ***
HDL cholesterol	male	(746)	44.8 ± 11.62	(717)	49.4 ± 14.20 ***
	female	(942)	53.3 ± 13.66	(736)	63.0 ± 16.86 ***
Systolic blood pressure	male	(833)	131.1 ± 16.77	(815)	137.0 ± 17.81 ***
	female	(1132)	123.6 ± 17.53	(852)	133.4 ± 21.37 ***
Diastolic blood pressure	male	(832)	81.6 ± 10.79	(814)	81.3 ± 11.80
	female	(1130)	76.4 ± 11.16	(852)	79.2 ± 12.36 ***

*** $p < 0.001$ for differences between countries by gender
+ New England = Pawtucket, RI and Comparison City
++ Bremen = Bremen North/Bremen West

Table 3. *Summary of physiological measurement comparisons by gender between New England⁺ and Bremen⁺⁺.*

$p < 0.01$), eggs (87% vs. 76%; $p < 0.01$), and cheeses (95% vs. 77%; $p < 0.01$) at least once per week. New Englanders also drank whole milk more frequently than those in Bremen (66% vs. 34%; $p < 0.01$).

Much evidence has been accumulated regarding the role of social class in determining health related behaviors, morbidity and mortality. We analyzed the relationships which exist between social class and the classic cardiovascular risk factors in the regions of New England and Bremen to detect possible incremental effects of the application of broad scale intervention methods on social class differences and risk factor prevalence.

Social class was based on an additive index of the following variables: household yearly net income (divided into quintiles) and duration of education (years of formal schooling). Four social class categories were constructed, each containing approximately 25% of the participants (Fig. 1).

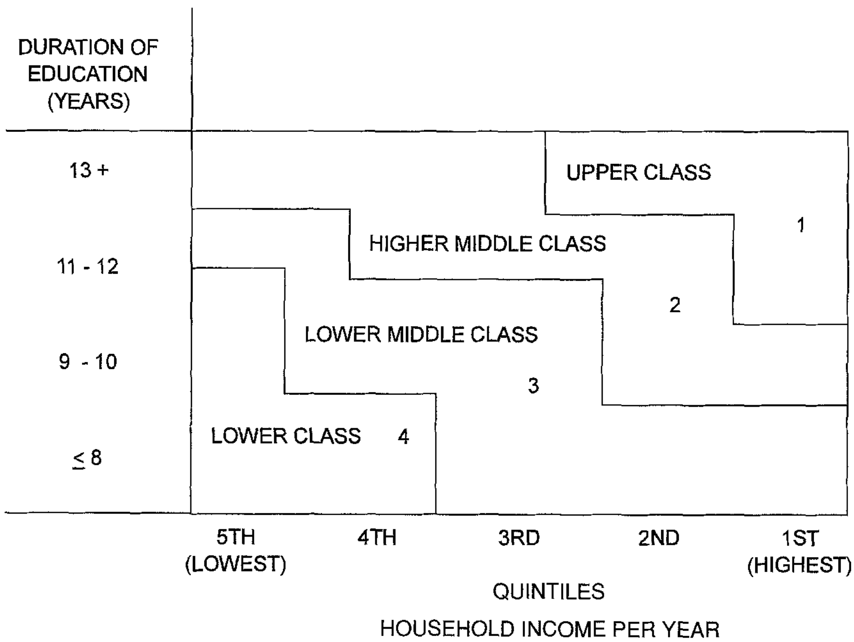

Figure 1. *Index: Socio Economic Status.*

Risk factors^{+++}	Survey	SOCIAL CLASS Upper		Higher middle		Lower middle		Lower	
Males smoking	Bremen	1.00^{++}		1.25	(0.84–1.88)	1.53*	(1.00–2.32)	4.82***	(2.61–8.84)
	New England	0.93	(0.60–1.44)	1.37	(0.91–2.09)	1.87**	(1.23–2.86)	1.78*	(1.12–2.84)
Overweight	Bremen	1.00^{++}		1.29	(0.66–2.54)	1.43	(0.72–2.86)	1.80	(0.80–4.05)
	New England	2.23*	(1.14–4.41)	2.49**	(1.29–4.79)	2.61**	(1.36–5.01)	2.43*	(1.21–4.87)
Physical inactivity	Bremen	1.00^{++}		0.92	(0.61–1.39)	1.12	(0.73–1.73)	2.51**	(1.38–4.57)
	New England	0.44	(0.28–0.68)	0.51	(0.33–0.78)	0.81	(0.53–1.23)	1.06	(0.67–1.69)
2+ risk factors	Bremen	1.00^{++}		1.32	(0.82–2.06)	1.52	(0.96–2.41)	4.14***	(2.32–7.41)
	New England	0.99	(0.61–1.62)	0.99	(0.61–1.56)	1.65*	(1.04–2.60)	1.95**	(1.21–3.23)
Hypertension	Bremen	1.00^{++}		2.06*	(1.16–3.68)	1.50	(0.82–2.73)	1.20	(0.56–2.59)
	New England	0.78	(0.39–1.41)	1.97*	(1.08–3.59)	1.80	(0.99–3.27)	1.53	(0.81–2.93)
Hyper-cholesterolemia	Bremen	1.00^{++}		1.36	(0.87–2.10)	1.04	(0.66–1.65)	0.92	(0.50–1.70)
	New England	0.71	(0.42–1.20)	0.60	(0.38–1.00)	0.71	(0.43–1.15)	0.63	(0.36–1.10)
Females smoking	Bremen	1.00^{++}		1.51	(0.79–2.90)	2.33**	(1.26–4.38)	2.82***	(1.46–5.42)
	New England	1.74*	(0.90–3.37)	2.17**	(1.16–4.06)	2.22**	(1.20–4.10)	2.40**	(1.26–6.62)
Overweight	Bremen	1.00^{++}		1.38	(0.50–3.84)	1.86	(0.70–4.94)	3.74**	(1.43–9.96)
	New England	2.01	(0.73–5.55)	3.32*	(1.26–8.64)	3.80**	(1.44–9.79)	5.39***	(2.06–14.00)
Physical inactivity	Bremen	1.00^{++}		1.23	(0.71–2.16)	2.61***	(1.51–4.53)	3.25***	(1.82–5.90)
	New England	1.06	(0.60–1.88)	1.23	(0.73–2.11)	1.73*	(1.02–2.92)	2.22**	(1.28–3.85)
2+ risk factors	Bremen	1.00^{++}		1.81	(0.83–3.91)	3.28**	(1.55–6.92)	5.52***	(2.58–11.85)
	New England	2.11	(0.97–4.63)	2.31*	(1.10–4.88)	3.09**	(1.48–6.43)	4.61***	(2.19–9.72)
Hypertension	Bremen	1.00^{++}		1.00	(0.42–2.41)	1.30	(0.57–2.97)	1.97	(0.84–4.53)
	New England	1.05	(0.42–2.59)	0.90	(0.38–2.14)	0.87	(0.38–2.00)	0.84	(0.35–1.97)
Hyper-cholesterolemia	Bremen	1.00^{++}		1.47	(0.71–3.07)	1.23	(0.60–2.46)	1.39	(0.66–2.86)
	New England	0.80	(0.36–1.75)	0.66	(0.31–1.38)	0.72	(0.35–1.48)	0.61	(0.29–1.26)

\+ Controlled for age (numbers in parentheses) = 95 % Confidence Intervals

++ Reference category

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

+++ Risk factors: Smoking – Self reported current smokers; Overweight – BMI > 30 for males and females; Physical inactivity – Self-reported exercising less than once per week; Hypertension – SBP ≥ 160 mm Hg and/or DBP ≥ 95 mm Hg or an antihypertensive medication with controlled BP; Hypercholesterolemia – Total cholesterol > 250 mg/dl

Table 4. *Odds Ratios+ for cardiovascular risk factors by social class and gender.*

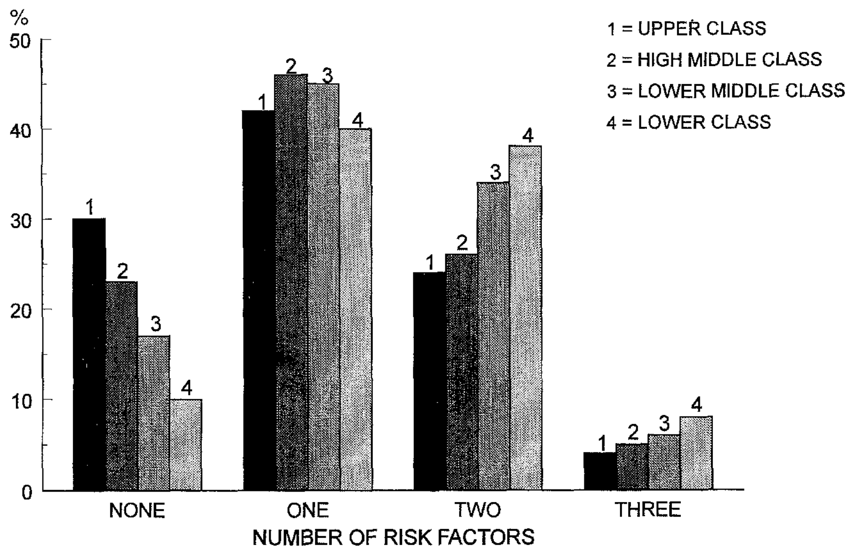

Figure 2A. *Number of Risk Factors* and Social Class: Smoking, Overweight, Physical Inactivity. Males: New England and Bremen N = 1558.*
** Risk Factor: Smoking – Self-Reported current smokers; Overweight – BMI > 30; Physical Inactivity – Self-Reported exercising less than once per week.*

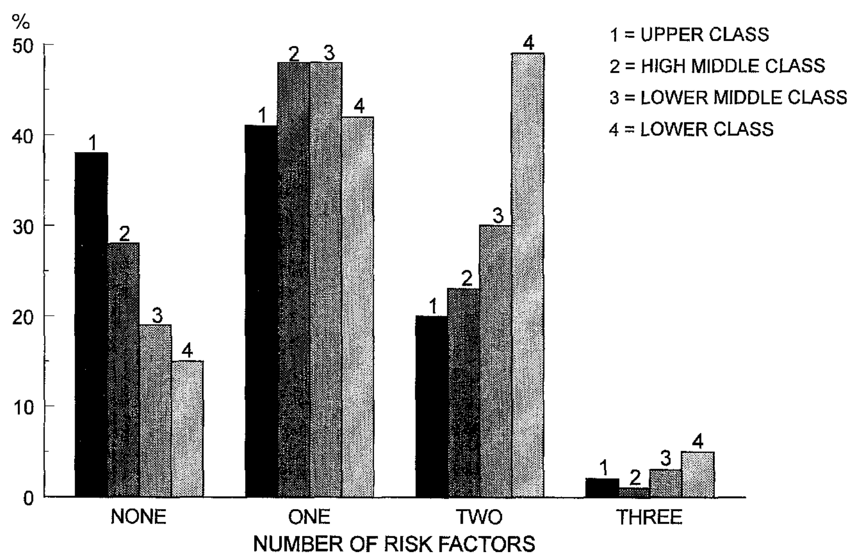

Figure 2B. *Number of Risk Factors* and Social Class: Smoking, Overweight, Physical Inactivity. Males: New England and Bremen N = 1558.*
** Risk Factor: Smoking – Self-Reported current smokers; Overweight – BMI > 30; Physical Inactivity – Self-Reported exercising less than once per week.*

To control for the confounding factor of age, multiple logistic regression was used to calculate the odds ratio as a measure of the relationship between social class and the various CHD risk factors. The four social classes in both regions were included as dummy variables in the model. The reference categories for odds ratio determination were always the upper class for the Bremen survey (Table 4). As Table 4 shows, there is a distinct relationship between social class and the risk factors of smoking, overweight, and lack of physical activity. In general, the lower the social class, the more prevalent the smoking, excess weight, and lack of physical exercise.

When these three risk factors are examined for an additive effect, it becomes apparent that there is a strong relationship between the number of risk factors and social class. As seen in Table 4 and Fig. 2A and 2B, the lower the social class the higher the number of combined risk factors.

In general, it would appear that behavior related risk factors such as smoking, overweight, and physical inactivity are strongly influenced by social class determinations. The question then arises whether the same relationships exist for two other major risk factors for coronary heart disease – hypertension (systolic blood pressure ≥160 mm Hg and/or diastolic blood pressure ≥95 mm Hg or on antihypertensive medication with controlled BP) and hypercholesterolemia (total cholesterol > 250 mg/dl). As seen in Table 4, the age adjusted odds ratios for neither hypertension nor hypercholesterolemia showed significantly higher rates for the lower social classes in either Bremen or New England.

Hypertension is an important risk factor for CHD. Non-pharmaceutical treatments (weight reduction, dietary changes, etc.) play an important role as does pharmaceu-

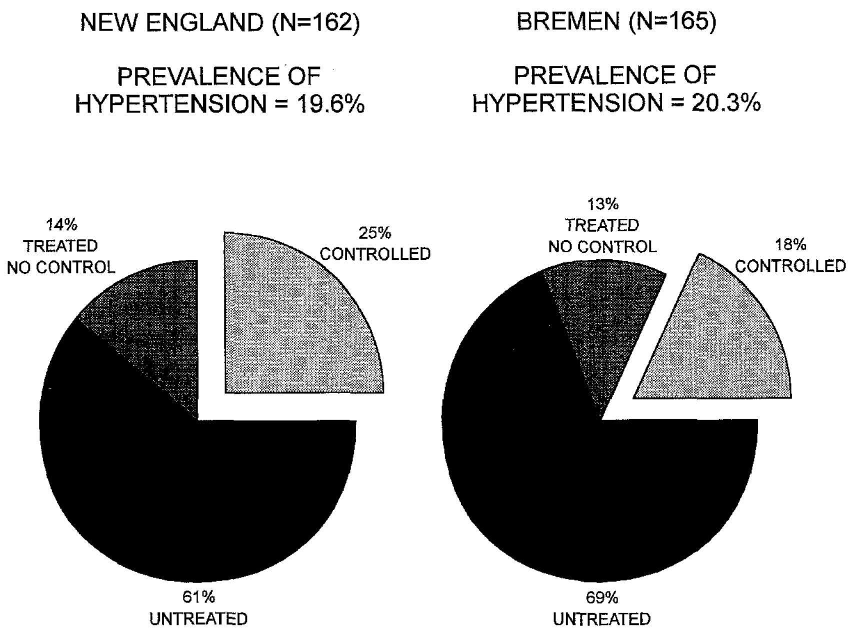

Figure 3. *Treatment and Control of Hypertension: Males.*

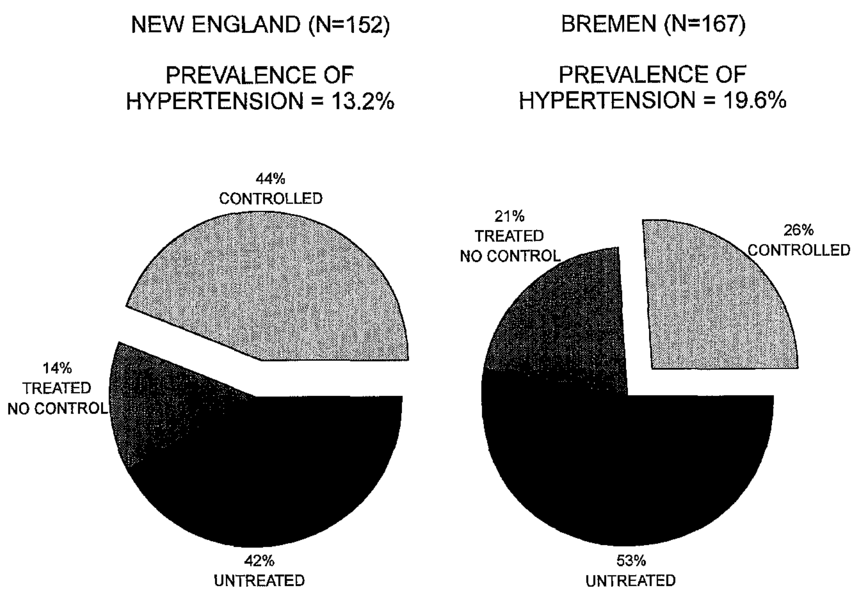

Figure 4. *Treatment and Control of Hypertension: Females.*

tical therapy in the reduction of hypertension. To measure the importance of non-pharmaceutical treatments such as weight loss, we calculated the attributable risk for hypertension related to being overweight for each of the two regions by age and gender. About 30 percent of the prevalence of hypertension in males in both surveys appears to be related to being overweight (BMI > 25 for males; BMI > 24 for females). In both regions age and increased BMI are strongly related to hypertension.

Other interesting findings are the differences in the percent of hypertensives in Bremen and New England who are receiving pharmaceutical treatment for hypertension and the percent who have suitable blood pressure control. Figures 3 and 4 show that the percentage of controlled hypertensives in New England (males = 25%; females = 44%) is much higher than in Bremen (males = 18%; females = 26%) (X^2 males = 2.93; N.S.; X^2 females = 10.87; $p < 0.001$).

Finally, to summarize the overall risk factor status of the population in reference to predicted cardiovascular disease and coronary heart disease mortality, we applied the multiple logistic function coefficient from NHANES on the following age groups: 40–44; 45–54; and 55–64. In all age groups, the predicted CHD and CVD mortality is slightly higher for the Bremen population as compared to the New England survey population.

Discussion

This comparison of study populations in two different countries with similar community intervention programs and evaluation strategies has shown some striking differences in risk factor patterns between the two populations. Indeed, in females, the differences are so striking that they even affect the overall predictive mortality coefficients for both CHD and CVD.

In the Bremen survey significantly higher mean blood pressure values have been found compared to the survey in New England. These differences are most likely not due to the fact that in Bremen the blood pressure measurements were done using random-zero sphygmomanometer and in New England using standard mercury sphygmomanometer, because in general random-zero sphygmomanometers yield slightly lower readings than the standard mercury sphygmomanometer[24]. The much longer time interval between the first and second blood pressure measurement in New England (20 minutes) versus in Bremen (3 minutes) is also not likely to explain the significantly lower mean blood pressure values for the New England survey. Unfortunately for the lipid determinations no common reference laboratory was used, but it is unlikely that the striking differences in cholesterol levels between the survey in New England and Bremen occurred primarily because of the use of laboratory assessments which may not have been identical.

When one attempts to find a common thread that would run through both populations despite several obvious differences, it would appear that social class transcends even international barriers. In particular, our research has shown us that explicit attention should be paid to the lower social classes when attempting to change behavior in regards to smoking, overweight, and physical inactivity. Further analyses need to be done to explain why hypertension and hypercholesterolemia do not exhibit these same social gradients. Perhaps a different construction of social class (for example, using only years of school or including occupation) would yield different results.

Our findings of an inverse association between the risk factors smoking, overweight, and lack of physical activity with SES are consistent with the results of many other studies. Smoking patterns are characterized by a striking social gradient in the United States[25–27] and Western Europe[28–30] with a clearly higher percentage of cigarette smokers in lower social classes for males, and a similar but less striking pattern for females. Recent studies have also reported significant associations between educational levels and leisure time physical activity[31–35]. In our study, as in other studies, obesity has also been found to be more prevalent among lower social classes[35,36].

For the risk factors hypertension and hypercholesterolemia, neither of which showed a social gradient in our study, there exist conflicting associations to social class characteristics. Hypertension has been found to have an inverse association with SES[25,36,37] in the US and in a recent British study[35], but no relation to SES was observed in Switzerland[38] and Bavaria[39]. Other studies have documented a weak positive[35], a weak negative[25] or no relationship of hypercholesterolemia to SES[37,39].

In summarizing these results, one may conclude that health promotion programs in combination with increased interest in a more healthy lifestyle in recent years in the US[40] and in other industrialized countries, have led to health orientated behavior changes such as quitting smoking, doing more exercise and controlling body weight. This is especially evident in the middle and upper classes. It may be that these behavior changes do not directly and immediately reduce the risk factors hypertension and hypercholesterolemia to the same degree. Longer observations of these proximal outcomes may be necessary as well as morbidity and mortality surveillance for documentation of distal outcomes.

Zusammenfassung

Untersuchung von kardiovaskulären Risikofaktoren: Internationaler Vergleich zwischen Bremen-Nord/West (Deutschland) und zwei Städten im Südosten Neu-Englands (USA)

Die Prävalenz kardiovaskulärer Risikofaktoren wurde in Studienpopulationen aus Gemeinden in zwei Ländern mit einem ähnlichen Interventionsprogramm untersucht. Daten der Baseline-Surveys für das Pawtucket Heart Health Program in Pawtucket, Rhode Island, und des Bremer Teils der Deutschen Herz-Kreislauf-Präventionsstudie wurden im Hinblick auf die folgenden kardiovaskulären Risikofaktoren analysiert: Rauchen, Übergewicht, Bewegungsmangel, Bluthochdruck und Hypercholesterinämie. Ausserdem wurde der Zusammenhang zwischen diesen Variablen und der Sozialschichtzugehörigkeit untersucht, um Erklärungen für die Unterschiede in der Risikofaktorenprävalenz sowie der prognostizierten kardiovaskulären Mortalität liefern zu können. Es ergaben sich statistisch signifikante Unterschiede zwischen den beiden Ländern für das Zigarettenrauchen, die körperliche Aktivität, das Ernährungsverhalten, den Body-Mass-Index, das Gesamtcholesterin, das HDL-Cholesterin und den Blutdruck. Diese Risikofaktoren wiesen alle für die deutsche Studienpopulation eine höhere Prävalenz auf als für die amerikanische Vergleichspopulation. Für beide Studienpopulationen zeigte sich übereinstimmend, dass die Risikofaktoren Rauchen, Übergewicht und Bewegungsmangel einen starken sozialen Gradienten aufweisen.

Résumé

Examen des facteurs de risque cardio-vasculaire: Comparaison internationale entre la ville de Brème (nord-ouest l'Allemagne) et deux villes du sud-ouest de la Nouvelle-Angleterre (USA)

La prévalence des facteurs de risque cardio-vasculaire a été examinée dans les populations de municipalités de deux pays ayant des programmes d'intervention similaires. Les données de l'enquête initiale du programme cardio-vasculaire Pawtucket, au Pawtucket, Rhode Island, et celle de la partie de Brème de l'étude allemande de prévention des maladies cardio-vasculaires a été analysée pour les facteurs de risque cardio-vasculaire suivant: Le fait de fumer, l'excès de poids, le manque de mouvement, l'hypertension artérielle et l'hyperpercholestérolémie. En outre la relation entre ces variables et la couche sociale a été examinée afin de pouvoir trouver des explications aux différences de prévalence des facteurs de risque ainsi qu'aux différences de la mortalité cardio-vasculaire prévue. On trouve des différences statistiquement significatives entre les 2 pays pour le fait de fumer la cigarette, l'activité physique, le comportement alimentaire, l'indexe de poids corporel, le cholestérol total, le HDL-cholestérol et la tension artérielle. Tous ces facteurs de risque avaient une prévalence plus élevée dans la population allemande que dans la population américaine. Un fort gradient social est montré clairement dans les 2 populations pour les facteurs de risque suivant: le fait de fumer, l'excès de poids et le manque de mouvement.

References

1 *Higgins, MW.* The Framingham Heart Study: Review of epidemiological design and data, limitations and prospects. In: Genetic Epidemiology of Coronary Heart Diseases: Past, Present, and Future. New York: Alan R. Liss, Inc., 1984: 51–64.

2 Multiple Risk Factor Intervention Trial Research Group. Risk Factor Changes and Mortality Results. JAMA 1982; *248*:1465–1477.

3 The Lipid Research Clinic Coronary Primary Prevention Trial Results. JAMA 1984; *251*:351–374.

4 *Carleton RA, Lasater TM, Assaf AR, Lefebvre RC, McKinlay SM.* The Pawtucket Heart Health Program: An Experiment in Population-Based Disease Prevention. RI Medical Journal 1987; *70*:533–538.

5 *Lasater TM, Abrams D, Artz L,* et al. Lay Volunteer Delivery of a Community-Based Cardiovascular Risk Factor Change Program: The Pawtucket Experiment. In: Matarazzo J. D., Miller N. E., Weiss S. M., et al., eds. Behavioral Health: a Handbook of Health Enhancement and Disease Prevention. Silver Spring MD: John Wiley, 1984:1166–1170.

6 *Lasater TM, Lefebvre RC, Carleton RA.* The Pawtucket Heart Health Program: Community Level Programming for Heart Health. RI Medical Journal 1988; *71*:31–34.

7 *Assaf AR, Banspach SW, Lasater TM, McKinlay SM, Carleton RA.* The Pawtucket Heart Health Program: Evaluation Strategies. RI Medical Journal 1987; *70*:541–546.

8 GCP Study Group. The German Cardiovascular Prevention Study (GCP): Design and Methods. European Heart Journal, 1988; *9*:1058–1066.

9 *Herman B, Greiser E, Helmert U,* et al. Prevalence of Cardiovascular Disease Risk Factors in the City of Bremen – The 1984 Bremen Baseline Health Survey of the German Cardiovascular Prevention Study. Soz Präventivmed 1987; *32*:31–38.

10 *Helmert U, Herman B, Joeckel KH, Greiser E.* Social Class and Risk Factors for Coronary Heart Disease in the Federal Republic of Germany. J Epidemiol Comm Health 1989; *43*:37–42.

11 *Helmert U, Herman B, Klesse R, Greiser E.* Prävalenz und Behandlungsstatus des Bluthochdruckes – Ergebnisse des 1. Bremer DHP – Gesundheitgssurveys (Hypertension Prevalence and Treatment Status – GCP Baseline Health Survey). Off Gesundh-Wes 1987; *49*:621–627.

12 *Farquhar JW.* The community-based Model of Lifestyle Intervention Trials. Am J Epidemiol 1987; *108*:103–111.

13 *Blackburn H, Leupker RV, Kline FG,* et al. The Minnesota Heart Health Program: A Research and Demonstration Project in Cardiovascular Disease Prevention. In: Matarazzo J. D., Miller N. E., Weiss S. M., et al., eds. Behavioral Health: A Handbook of Health Enhancement and Disease Prevention. Silver Spring MD: John Wiley, 1984: 1171–1178.

14 *Puska P, Tuomilehto J, Salonen J,* et al. Community Control of Cardiovascular Diseases: The North Karelia Projection. Copenhagen: WHO Regional Office for Europe, 1981.

15 *McKinlay SM, Kipp DM, Johnson P,* et al. A Field Approach for Obtaining Physiological Measures in Surveys of General Populations: Response Rates, Reliability, and Costs. In: Health Survey Research Methods: Proceedings of the Fourth Conference on Health Survey Research Methods, Washington, D.C.: 1982. DHHS Pub. No. (PHS) 84-3346 (September, 1984).

16 *McKinlay SM, McGraw SA, Assaf AR,* et al. An Innovative Approach to the Evaluation of Large Community Programs. In: Proceedings of the Academy of Behavioral Medicine 1981–1982. W. Gordon, J.A. Herd, A. Baum, eds. Academic Press, in press.

17 *Siconolfi SF, Garber CE, Lasater TM and Carleton RA.* A Simple, Valid Step Test for Estimating Maximal Oxygen in Epidemiologic Studies. Am J Epidemiol 1985; *121*:282–290.

18 *Kish L.* Survey Sampling. New York: John Wiley and Sons, 1984.

19 *Deming WE.* Sample Design in Business Research. New York: John Wiley and Sons, 1960.

20 U. S. Department of Commerce – Office of Federal Statistical Policy and Standards. Standard Occupational Classification Manual. 1980.

21 The Lipid Research Clinics Program. The Coronary Primary Prevention Trial: Design and Implementation. J Chronic Dis 1979; *32*:609–631.

22 SAS Institute Inc. SAS User's Guide: Statistics, Version 5. Cary, NC.: SAS Institute Inc., 1985.

23 *Cornoni-Huntly J, Barbano HE, Brody JA,* et al. National Health and Nutrition Examination I – Epidemiologic Follow-up Survey. Public Health Reports 1983; *98*: 245–251.

24 *Guademaris R, Folsom AR, Prineas RJ, Luepker R.* The Random-zero Versus the Standard Mercury Sphygmomanometer: A Systematic Blood Pressure Difference. Am J Epidemiol 1985; *121*:282–290.

25 *Kraus JF, Borhani NO, Franti CE.* Socioeconomic Status, Ethnicity, and Risk of Coronary Heart Disease. Am J Epidemiol 1980; *111*:407–414.

26 *Shekell RB, Ostfeld AM, Paul O.* Social Status and Incidence of Coronary Heart Disease. J Chronic Dis 1969; *22*:381–394.

27 *Remington PL, Forman MR, Gentry EM,* et al. Current Smoking Trends in the United States. The 1981–1983 Behavioral Risk Factor Surveys. JAMA 1985; *253*:2975–2978.

28 *Borgers D, Menzel R.* Wer raucht am meisten? Die Analyse des Zigarettenkonsums in der Bundes-

republik nach Berufen. Muench med Wschr 1984; *126*:1092–1096.
29 *Jacobsen BK, Thelle DS.* Risk Factors for Coronary Heart Disease and Level of Education. Am J Epidemiol 1988; *127*:923–932.
30 *La Vecchia C, Gutzwiller F, Wietlisbach V.* Sociocultural Influences on Smoking Habits in Switzerland. Int J Epidemiol 1987; *4*:624–626.
31 *Folsom AR, Caspersen CJ, Taylor HL,* et al. Leisure Time Physical Activity and Its Relationship to Coronary Risk Factors in a Population-based Sample. The Minnesota Heart Survey. Am J Epidemiol 1985; *121*:570–579.
32 *Salonen JT, Puska P, Tuomilehto J.* Physical Activity and Risk of Mycocardial Infarction, Cerebral Stroke and Death. A Longitudinal Study in Eastern Finland. Am J Epidemiol 1982; *115*:526–537.
33 *Holme I, Helgeland A, Hjermann I, et al.* Coronary Risk Factors and Socioeconomic Status: The Oslo Study. Lancet 1976; *2*:1396–1398.
34 *Leon AS, Conett J, Jacobs DR, Rauramaa R.* Leisure-time Physical Activity Levels and Risk of Coronary Heart Disease and Death. The Multiple Risk Factor Intervention Trial. JAMA 1987; *258*:2388–2395.
35 *Pocock SJ, Shaper AG, Cook DG, et al.* Social Class Differences in Ischemic Heart Disease in British Men. Lancet 1987; II:197–201.
36 National Center for Health Statistics. Vital and Health Statistics, Series 10, No. 121. Characteristics of Persons with Hypertension. United States, 1974. DHEW Publication No (PH) 79-1549. Washington DC; US GPO, November 1978.
37 Hypertension Detection and Follow-up Cooperative Group. Race, Education and Prevalence of Hypertension. Am J Epidemiol 1977; *106*:351–361.
38 Schweizerisches Nationales Forschungsprogramm 1A. Die Epidemiologie der Risikofaktoren für kardiovaskuläre Krankheiten in der Schweiz. Schweiz Med Wochenschr 1981; *12 (suppl.)*:5–62.
39 *Härtel U, Keil U.* Psychosoziale Faktoren und Herz-Kreislauf-Erkrankungen. Fortschr Med 1986; *104*:943–947.
40 *Barsky AJ.* The paradox of health. N Engl J Med 1988; *318*:414–418.

Acknowledgement

Supported, in part by Grant HL 23629 from the National Heart, Lung, and Blood Institute, United States Department of Health and Human Services and by funds from the German Federal Ministry of Research and Technology, the German Federal Ministry of Youth, Family, Women Affairs, and Health and the Bremen State Department of Health, Federal Republic of Germany. The authors would like to thank the staff of the Pawtucket Heart Health Program and the German Cardiovascular Prevention Study/Bremen.

Address for correspondence

Dr. rer. pol. Uwe Helmert
Bremen Institute for Prevention Research and Social Medicine
P. O. Box 106767
D-28067 Bremen