# Incidence of Cardiovascular Disease and Exposures in Wartime, Beirut 1984-1994

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## Introduction

This paper explores the relationship of war-events exposure to incidence of Cardiovascular Diseases.

War and situations of civil unrest have been documented to be extremely stressful and to have damaging effects on the physical and mental well being of individuals (Farhood et al. 1993). In fact, exposure to acute and chronic war events has been linked to various health problems among adults. Sibai et al (1989), for example, reported an increased risk of coronary artery diseases among Beirut residents who frequently crossed the "green line". The Lebanese people lived through more than 15 years of civil war during which the city of Beirut was divided into two sectarian areas separated by a demarcation line (the Green Line). The citizens of Beirut were exposed to many rounds of shelling and street fighting that continually forced them to take some kind of shelter. Therefore, given the unique situation in Lebanon at the time of data collection, it was important to assess the effect of exposure to war on morbidity.

## Methods

The current study population is based on two population household surveys that were undertaken in the city of Beirut in 1984 and 1994 by the Faculty of Health Sciences, at the American University of Beirut. The population and methods of these surveys have been described in detail previously. (Zurayk, Armenian 1984, Deeb,1997). Briefly the 1983-84 survey population was a representative sample of the households in the city of Beirut. The 1994 survey was a revisit of the same households interviewed in 1984. These two surveys provide a unique longitudinal perspective in describing change over time in health issues.

The aim of the Population laboratory established in 1983 an action-oriented research program in charge of these surveys was mainly

1. To have Beirut as a community that will serve as a human Laboratory.
2. To generate baseline information about the population of a large city that was undergoing an endemic civil war for a decade.
3. To institute a follow-up mechanisms that would provide "continuous information on selected aspects of community life".

For the purpose of this paper, data from both surveys baseline 1984 and follow-up 1994 served as the basis for the study of war-events stressors associated with incident occurrence of coronary artery disease in a cohort population.

## Study Population

A Cohort of sampled household of Beirut city residents was interviewed with respect to their socioeconomic characteristics, exposure to war events, morbidity experience, disabilities, environmental, conditions, utilization of health services, and perception of health. In each household the respondent provided information on all the permanent residents of the household, the survey cohort data covered 1641 households , comprising a total of 6327 individuals.

Morbidity information covered specific current ailments and chronic conditions ever experienced by members of the household. The method that was used was based on perceived morbidity reported by the respondent. The date of start of condition was also ascertained namely whether it was before 1984 or after.

The follow-up survey and baseline interview provided the possibility to ascertain incident cases of heart diseases that occurred after 1984. The follow-up survey inquired about exposure to war events of all permanent members between 1983 and the reference recall period used in the interview was to report war events that took place after the Israeli invasion of Beirut city in 1983. This corresponded roughly to the dates of the baseline survey.

The war events were mainly grouped as physical assault, destruction of properties, theft, the frequency of crossing green-lines and other related war incidents.

## Definition of War Score Study Groups

A case control comparison of incident heart diseases (n=108) and a control group (n=627) that reported no history of coronary heart disease in 1984 and 1994. Hypertension was another outcome investigated in relation to war events exposure.

A cohort case control design allowed the comparison of heart diseases and hypertension incident cases to that of an age-sex adjusted sample from the population.

A case was ascertained by a checklist of chronic diseases, plus the age at which the disease was diagnosed and whether this occurred before or after 1984.

A case-control study comparison using controls from the same data those who reported no disease both in 1984 and 1994. Cases and controls were group matched by age and sex.

## Results

### Heart Disease

Table 1 shows the prevalence of heart disease and hypertension incident and chronic cases during the period 1984-1994. By definition an incident case is a person free of disease prior to 1984 and reporting onset of a disease after 1984. Chronic cases where those who reported the same condition in both surveys prior to 1984 and after.

In a cohort of 6327 persons, the number of heart diseases prevalent cases in 1994 were 310 (4.9%) and 129 in 1984 (2.0%). The prevalence of incident cases was 2.4% and that of chronic diseases 2.0%.

Table 2 shows the distribution of risk factors among the incident case control group and chronic cases. The cases were significantly less educated than the control but not different from the chronic cases. The well-established coronary risk factors investigated in this study were cigarette smoking, alcohol consumption, physical activity, number of chronic conditions reported, and family history. Cases demonstrated significant differences in cigarette smoking and alcohol consumption compared to group-matched controls. The results for cigarette smoking and alcohol consumption show that a lower proportion of incident cases than either controls or chronic cases were non-smokers and never drinkers.

The two main differences between chronic cases, incident cases and controls were employment status and number of chronic conditions reported. A smaller proportion of chronic cases of coronary heart disease is working (31.7%) compared to incident cases (52.7%) and controls (52.6%) (Table 2).

As shown in Table 3, a higher proportion of cases (59%) compared with the total number of individuals exposed (51%) reported that they had experienced more than one major war events. The most significant specific war events experienced by the cases were physical assault or kidnapping or war-related injuries.

To assess the effect of exposure to war events on the risk of developing heart disease, we performed multivariate logistic regression analyses that adjusted for a number of potential confounders and that used different models. These analyses revealed that lower levels of education and intense exposure to war events were significant predictors of developing incident heart disease.

**Hypertension**

In a cohort of 6327 individuals, the prevalence of reported hypertension was 4.4% in "Beirut 1984" and 7.1% in the follow-up "Beirut 1994". The incident cases amounted to 205 (3.2%) and the chronic cases consisted of 191 cases (3.0%). (Table 1).

Table 5 shows the distribution of risk factors among the group for the analysis of hypertension. The only significant differences between incident cases, controls and chronic cases are the employment status, number of chronic conditions and family history of chronic condition. A smaller proportion of chronic hypertensive cases is working (27%) compared to incident cases (48%) and controls (48.9%).

Table 6 shows that a higher proportion of hypertensive incident cases (61%) compared with the total number of individuals in the population exposed (51%) reported that they had experienced more than one major war events. The most significant specific war experienced events by the cases were, physical assault, threatened, loss of residence and other war-related injuries.
The multivariate logistic regression analyses indicates that exposure to war events was the main predictor of developing incident hypertension. (Table 7).

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Table I.

Prevalence of Incident and Chronic Cases in the Period 1984-1994 in Beirut City
(n = 6327)

| | Crude Point Prevalence! | | | | Incident Cases | | Persons who Reported Conditions both in | |
|---|---|---|---|---|---|---|---|---|
| | 1984 | | 1994 | | 1984 - 1994 | | 1984 and 1994 | |
| | N | % | N | % | N | % | N | % |
| Heart disease | 129 | 2.0 | 310 | 4.9 | 152 | 2.4 | 128 | 2.0 |
| Heart disease I* | N.A. | | 209 | 3.3 | 108 | 1.7 | 82 | 1.3 |
| Heart disease II** | N.A. | | 101 | 1.6 | 44 | 0.7 | N.A. | |
| Hypertension | 279 | 4.4 | 447 | 7.1 | 205 | 3.2 | 191 | 3.0 |

* Does anyone have heart problems (chest pains and circulatory)
** Does anyone have heart problems (blockage in arteries)
! Prevalent cases do not add up to Incident + Chronic cases because some persons did not report having the disease in 1984.

Table 2. Comparison of cases of reported incident coronary heart disease to controls with no heart disease and chronic cases as to selected variables: Beirut population (1984-1994)

| | Heart Disease | | | | | |
|---|---|---|---|---|---|---|
| | Incident Cases | | Controls | | Chronic Cases | |
| | N | % | N | % | N | % |
| Age | | | | | | |
| 19-39 | 5 | 5.0 | 34 | 5.4 | 3 | 3.7 |
| 40-49 | 9 | 8.3 | 50 | 8.0 | 8 | 9.8 |
| 50-59 | 41 | 37.7 | 255 | 40.7 | 14 | 17.1 |
| 60+ | 9053 | 49.0 | 288 | 45.9 | 57 | 69.5 |
| Sex | | | | | | |
| Male | 61 | 56.5 | 348 | 55.5 | 38 | 46.3 |
| Female | 47 | 43.5 | 279 | 44.5 | 44 | 53.7 |
| Education | | | | | | |
| Low | 70 | 64.8* | 341 | 54.6 | 54 | 66.7 |
| Medium | 21 | 19.4 | 200 | 32.1 | 19 | 23.5 |
| High | 17 | 15.7 | 83 | 13.3 | 8 | 9.9 |
| Employment Status | | | | | | |
| Working | 57 | 52.7 | 330 | 52.6 | 26 | 31.7** |
| Housewife | 44 | 40.7 | 225 | 35.9 | 33 | 40.2 |
| Other | 7 | 6.5 | 72 | 11.6 | 23 | 28.0 |
| Occupation | | | | | | |
| Professional | 25 | 40.3 | 126 | 36.5 | 10 | 34.5 |
| Employee | 25 | 40.3 | 122 | 35.4 | 13 | 44.8 |
| Skilled | 9 | 14.5 | 83 | 24.1 | 6 | 20.7 |
| Unskilled | 3 | 4.8 | 14 | 4.1 | 0 | 0.0 |
| Cigarette Smoking | | | | | | |
| Yes | 55 | 51.4* | 242 | 38.9 | 23 | 28.0 |
| No | 52 | 48.6 | 380 | 61.1 | 59 | 72.0 |
| Alcohol Consumption | | | | | | |
| Never | 65 | 60.2* | 449 | 72.1 | 65 | 79.3 |
| Occasional | 33 | 30.6 | 144 | 23.1 | 16 | 19.5 |
| Regular | 10 | 9 | 30 | 4.8 | 1 | 1.2 |

Table 2 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Physical Activity | | | | | | |
| Yes | 6 | 5.6 | 53 | 8.5 | 3 | 3.7 |
| No | 102 | 94.4 | 570 | 91.5 | 79 | 96.3 |
| No. of chronic Condition Reported | | | | | | |
| None | 60 | 55.6 | 386 | 61.6 | 17 | 20.7** |
| One | 25 | 23.1 | 150 | 23.9 | 20 | 24.4 |
| $\geq 2$ | 23 | 21.3 | 91 | 14.5 | 45 | 54.9 |
| Family History of Chronic Condition | | | | | | |
| Yes | 33 | 30.8 | 192 | 31.3 | 24 | 29.3 |
| No | 74 | 69.2 | 422 | 68.7 | 58 | 70.7 |

* P-value < 0.05
** P-value < 0.01

Table 3. Number and percentage of reported incident coronary heart disease (n=108), controls with no heart disease (n=627) and total sampled population (n=6327) who experienced war- related incidents between 1984 and 1994.

| Type of Incident | Individuals Exposed | | Coronary Heart Disease Incident Cases Exposed | | Controls Exposed | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Physical Assault | 35 | 0.6 | 2 | 1.9* | 1 | 0.2 |
| Accosted by political group | 41 | 0.6 | 1 | 0.9 | 3 | 0.5 |
| Kidnapped, then released | 32 | 0.5 | 2 | 1.9* | 2 | 0.3 |
| Threatened | 72 | 1.1 | 1 | 0.9 | 3 | 0.5 |
| Lost residence at least once | 694 | 11.0 | 15 | 13.9 | 68 | 10.8 |
| No access to owned house | 467 | 7.4 | 9 | 8.3 | 52 | 8.3 |
| Loss of other real estate | 307 | 4.9 | 3 | 2.8 | 33 | 5.3 |
| Theft of car | 1272 | 20.1 | 22 | 20.4 | 102 | 16.3 |
| Theft of residence | 620 | 9.8 | 14 | 13.0 | 70 | 11.2 |
| Theft of workplace | 233 | 3.7 | 4 | 3.7 | 23 | 3.7 |
| East-West Beirut crossover | 335 | 5.3 | 15 | 13.9 | 64 | 10.2 |
| Other war-related incident | 825 | 13.0 | 21 | 19.4 | 84 | 13.4 |
| War-related injuries | 157 | 2.5 | 8 | 7.4 | 13 | 2.1** |
| War Events Score | | | | | | |
| 0 | 3119 | 49.3 | 44 | 40.7 | 302 | 48.2 |
| 1 | 1917 | 30.3 | 34 | 31.5 | 194 | 30.9 |
| 2 | 891 | 14.1 | 14 | 13.0 | 88 | 14.0 |
| $\geq 3$ | 400 | 6.3 | 16 | 14.8 | 43 | 6.9 |

* P-value <0.05

** P-value <0.01

Table 4. Predictors of coronary heart disease onset, Beirut population (1984-1994), Logistic Regression Model

| Variable | Odds Ratio (95%CI) | Significance level |
|---|---|---|
| Age(continuous) | 1.00 (0.99-1.00) | 0.35 |
| Sex | | |
| Female | 1.00 | |
| Male | 0.87 (0.55-1.38) | 0.55 |
| Education Level | | |
| Low | 1.00 | |
| Medium | 0.49 (0.28-0.85) | 0.01 |
| High | 0.89 (0.46-1.70) | 0.72 |
| Score of War Events | | |
| No exposure | 1.00 | |
| Score1 | 1.23 (0.75-2.04) | 0.40 |
| Score2 | 1.12 (0.58-2.19) | 0.72 |
| Score3 | 2.67 (1.32-5.43) | 0.00 |
| Alcohol Consumption | | |
| No drinking | 1.00 | |
| Moderate | 1.53 (0.93-2.52) | 0.09 |
| Heavy | 1.57 (0.68-3.65) | 0.28 |
| Cigarette Smoking | | |
| No | 1.00 | |
| Yes | 1.53 (0.99-2.40) | 0.06 |
| Physical Activity | | |
| No | 1.00 | |
| Yes | 0.58 (0.23-1.46) | 0.24 |

Table 5. Comparison of cases of reported incident hypertension and controls with no hypertension as to selected variables: Beirut population (1984-1994).

| Variable | Hypertension: Incident Cases N | Incident Cases % | Controls N | Controls % | Chronic Cases N | Chronic Cases % |
|---|---|---|---|---|---|---|
| Age | | | | | | |
| 19-39 | 12 | 5.9 | 67 | 5.5 | 5 | 2.6 |
| 40-49 | 29 | 14.1 | 155 | 12.8 | 20 | 10.5 |
| 50-59 | 69 | 33.7 | 417 | 34.4 | 50 | 26.2 |
| 60+ | 95 | 46.3 | 572 | 47.2 | 116 | 60.7 |
| Sex | | | | | | |
| Male | 100 | 48.8 | 585 | 48.3 | 62 | 32.5 |
| Female | 105 | 51.2 | 626 | 51.7 | 129 | 67.5 |
| Education | | | | | | |
| Low | 123 | 60.0 | 713 | 59.3 | 125 | 65.8 |
| Medium | 58 | 28.3 | 342 | 28.4 | 46 | 24.2 |
| High | 24 | 11.7 | 148 | 12.3 | 19 | 10.0 |
| Employment Status | | | | | | |
| Working | 98 | 47.9 | 592 | 48.9 | 52 | 27.2** |
| Housewives | 95 | 46.3 | 477 | 39.4 | 109 | 57.1 |
| Others | 12 | 5.9 | 142 | 11.7 | 30 | 15.7 |
| Occupation | | | | | | |
| Professional | 37 | 35.9 | 204 | 32.9 | 27 | 45.0 |
| Employee | 36 | 35.0 | 235 | 37.9 | 23 | 38.3 |
| Skilled | 28 | 27.2 | 153 | 24.7 | 9 | 15.0 |
| Unskilled | 2 | 1.9 | 28 | 4.5 | 1 | 1.7 |
| Cigarette Smoking | | | | | | |
| No | 116 | 57.4 | 724 | 59.9 | 120 | 63.2 |
| Yes | 86 | 42.6 | 485 | 40.1 | 70 | 36.8 |
| Alcohol Consumption | | | | | | |
| Never | 136 | 67.3 | 870 | 72.0 | 135 | 71.1 |
| Occasional | 51 | 25.2 | 280 | 23.2 | 47 | 24.7 |
| Regular | 15 | 7.4 | 58 | 4.8 | 8 | 4.2 |

Table 5 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Physical Activity | | | | | | |
| No | 190 | 94.1 | 1111 | 91.8 | 175 | 92.1 |
| Yes | 12 | 5.9 | 99 | 8.2 | 15 | 7.9 |
| No. of Chronic Condition Reported | | | | | | |
| None | 119 | 58.0 | 756 | 62.4 | 47 | 24.6** |
| One | 53 | 25.9 | 299 | 24.7 | 68 | 35.6 |
| 2+ | 33 | 16.1 | 156 | 12.9 | 76 | 39.8 |
| Family History of Chronic Condition | | | | | | |
| Yes | 43 | 21.1 | 217 | 18.4 | 55 | 29.3** |
| No | 161 | 78.9 | 960 | 81.6 | 133 | 70.7 |

** P-value < 0.01

Table 6. Number and percentage of reported incident hypertension disease (n=205), controls with no hypertension (n=1211) and total sampled population (n=6327) who experienced war-related incidents between 1984 and 1994.

| Type of Incident | Individuals Exposed | | Hypertension Incident Cases Exposed | | Controls Exposed | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Physical Assault | 35 | 0.6* | 4 | 2.0 | 4 | 0.3** |
| Accosted by political group | 41 | 0.6 | 1 | 0.5 | 5 | 0.4 |
| Kidnapped, then released | 32 | 0.5* | 1 | 1.5 | 10 | 0.8 |
| Threatened | 72 | 1.1 | 5 | 2.4 | 6 | 0.5** |
| Lost residence at least once | 694 | 11.0 | 35 | 17.1 | 135 | 11.1* |
| No access to owned house | 467 | 7.4 | 22 | 10.7 | 81 | 6.7* |
| Loss of other real estate | 307 | 4.9 | 5 | 2.4 | 64 | 5.3 |
| Theft of car | 1272 | 20.1 | 37 | 18.0 | 224 | 18.5 |
| Theft of residence | 620 | 9.8 | 30 | 14.6 | 120 | 9.9* |
| Theft of workplace | 233 | 3.7 | 9 | 4.4 | 43 | 3.6 |
| East-West Beirut crossover | 335 | 5.3 | 19 | 9.3 | 119 | 9.8 |
| Other war-related incident | 825 | 13.0 | 40 | 19.5 | 170 | 14.0* |
| War-related injuries | 157 | 2.5 | 10 | 4.9 | 34 | 2.8 |
| War Events Score | | | | | | |
| 0 | 3119 | 49.3 | 79 | 38.5 | 585 | 48.3 |
| 1 | 1917 | 30.3 | 63 | 30.7 | 368 | 30.4 |
| 2 | 891 | 14.1 | 41 | 20.0 | 169 | 14.0 |
| $\geq 3$ | 400 | 6.3 | 22 | 10.8 | 89 | 7.3 |

* P-value < 0.05

** P-value <0.01

Table 7. Predictors of hypertension onset, Beirut population (1984-1994), Logistic Regression Model.

| Variable | Odds Ratio (95%CI) | Significance level |
|---|---|---|
| Age(continuous) | 1.00 (0.99-1.00) | 0.89 |
| Sex | | |
| Female | 1.00 | |
| Male | 0.78 (0.57-1.08) | 0.14 |
| Score of War Events | | |
| No exposure | 1.00 | |
| Score1 | 1.25 (0.87-1.79) | 0.21 |
| Score2 | 1.72 (1.12-2.64) | 0.01 |
| Score3 | 1.71 (0.99-2.93) | 0.05 |
| Alcohol Consumption | | |
| No drinking | 1.00 | |
| Moderate | 1.12 (0.78-1.62) | 0.52 |
| Heavy | 1.74 (0.91-3.28) | 0.08 |
| Cigarette Smoking | | |
| No | 1.00 | |
| Yes | 1.06 (0.77-1.46) | 0.71 |
| Physical Activity | | |
| No | 1.00 | |
| Yes | 0.66 (0.35-1.24) | 0.20 |