

# Weighting of the data and analytical approaches may account for differences in overcoming the inadequate representativeness of the respondents to the third wave of a cohort study

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## Abstract

**Objectives:** Attrition in cohort studies can cause the data to be nonreflective of the original population. Although of little concern if intragroup comparisons are being made or cause and effect assessed, the assessment of bias was undertaken in this study so that intergroup or descriptive analyses could be undertaken.

**Study Design and Setting:** The North West Adelaide Health Study is a chronic disease and risk factor cohort study undertaken in Adelaide, South Australia. In the original wave (1999), clinical and self-report data were collected from 4,056 adults. In the third wave (2008–2010), 2,710 adults were still actively involved. Comparisons were made against two other data sources: Australian Bureau of Statistics Estimated Residential Population and a regular conducted chronic disease and risk factor surveillance system.

**Results:** Comparisons of demographics (age, sex, area, education, work status, and income) proved to be statistically significantly different. In addition, smoking status, body mass index, and general health status were statistically significant from the comparison group. No statistically significant differences were found for alcohol risk.

**Conclusion:** Although the third wave of this cohort study is not representative of the broader population on the variables assessed, weighting of the data and analytical approaches can account for differences. © 2013 Elsevier Inc. All rights reserved.

**Keywords:** Cohort study; Representativeness; Bias; Attrition; Nonresponse; Biomedical

## 1. Background

Biomedical cohort studies based on random representative populations are powerful epidemiologic tools [1]. Inherent in these cohort studies is that the participants, at least initially, are representative of the population from which they come. Bias occurs in cohort studies when respondents and nonrespondents deviate from population norms because of nonrandom factors [2]. The deviation should be measured and controlled for in subsequent analyses, especially if the data are used in any descriptive analyses [1]. Although not necessary for cause and effect analysis, it is important to assess the representativeness of the cohort at each iteration and make adjustments in the analysis based on any discrepancies so that misleading results are not produced or published [3]. Bias as a result

of loss to follow-up is not relevant in analyses limited to each wave of the cohort (intragroup comparisons) but is extremely important when broader generalizations (e.g., to the population) are made (intergroup comparisons) [3].

Issues of selection bias in a cohort study should be addressed in the initial recruitment stage, and subsequent avenues to minimize attrition bias should be routinely implemented [3]. Mortality, the ultimate outcome measure, is usually captured via linkage with death records, but other noninvolvement in subsequent interactions of the cohort could be the result of a range of factors including the movement from the geographical area of interest, ill health, loss of interest, increasingly busy lifestyle, or a change in priorities. Loss to follow-up does not happen randomly, threatens the internal validity of the study, damages the power and precision, and is as important in subsequent waves of data collection as the initial stage [1,3]. Of most concern to cohort studies is losing those whose ill health prevents the involvement or those who have developed the disease or risk factor of interest, known as the differential loss to follow-up [1].

Conflict of interest: There are no conflicts of interest.

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### What is new?

- A detailed description of the different proportion of respondents still involved in a population-based cohort study after 10 years of operation addressing the epidemiologic aspects that are important to consider with a maturing cohort study.

Cohort studies are expensive, time and resource intensive especially in regard to minimizing loss to follow-up, and data and cohort maintenance [2,4,5]. Both nonselection attrition (occurs in both the sample and population at the same level) and selection attrition (disproportionately affecting the sample) influence the outcomes. Although some attrition is to be expected, there are advantages if the cohort is kept as representative as possible, and as such, every endeavor to produce results that reflect true findings should be made. This includes monitoring carefully the “make-up” of the cohort.

## 2. Methods

The North West Adelaide Health Study (NWAHS) is a risk factor and chronic disease cohort study. The methodology has previously been published [6] and the initial bias reported [7]. The results have been published widely, and a list can be found on the study's website ([www.nwadelaidhealthstudy.org](http://www.nwadelaidhealthstudy.org)). Initially, 4,056 adult (aged 18 years and older) participants from the northern and western regions of Adelaide were recruited by random selection from the electronic white pages telephone directory. Computer-assisted telephone interviews (CATI), self-completed questionnaires, and clinical appointments were undertaken over a 4-year period (1999–2003). A range of demographic, socioeconomic, risk factor, quality of life,

and related information was collected by telephone and self-completed questionnaire. At the 60-minute clinic appointment, blood and urine samples were taken for primarily lipids and glucose testing, together with measures of respiratory function, grip strength, skin allergy, blood pressure, height, weight, and waist and hip circumference.

The third wave of the cohort, the focus of this study, was undertaken from June 2008 to August 2010 (the second wave was between 2004 and 2006). A similar methodology was used in each stage, in which respondents were initially contacted/recontacted by telephone for a subsequent clinic appointment. Respondents at wave 3 were aged 25 years or older. In total, 2,487 respondents attended the clinic (61.5% of the original sample), while at least some data were collected from 2,710 respondents (66.8% of original sample). The data were reweighted to the 2009 Australian Bureau of Statistics (ABS) Estimated Residential Population (ERP) profile for the North West Adelaide region.

Categorical data were analyzed using Pearson chi-square test with a 0.05 level of significance. All analyses were carried out using SPSS version 17.0 (SPSS, Inc., Chicago, IL, USA). To compare demographic data (age and sex), information from the ABS ERP profile was used. Analyses were limited to people aged 25 years or older who lived in the same geographic area as covered by NWAHS ( $N = 299,787$ ). To compare risk factor and other demographic data with the third wave of the NWAHS, information collected from the South Australian Monitoring and Surveillance System (SAMSS) was used. Details on SAMSS methodology can be found at <http://health.adelaide.edu.au/pros/data/samss/>. SAMSS is a chronic disease and risk factor surveillance system, in which approximately 600 interviews are undertaken by CATI with different randomly selected persons of all ages (surrogate interviews with children) each month. For this analysis, so as to be comparable with the NWAHS, SAMSS data were limited to those aged 25 years and older who participated from June 2008 to August 2010

**Table 1.** Comparison of NWAHS demographic variables with ABS profile

	ABS 2009 ERP <sup>a</sup> n (%)	NWAHS stage 3			
		Unweighted		Weighted	
		n (%)	95% CI	n (%)	95% CI
Sex					
Male	144,986 (48.4)	1,169 (47.0)	45.1, 49.0	1,203 (48.6)	46.6, 50.5
Female	154,801 (51.6)	1,316 (53.0)	51.0, 54.9	1,275 (51.4)	49.5, 53.4
Age group, yr					
25–29	32,660 (10.9)	48 (1.9)	1.5, 2.6	235 (9.5)	8.4, 10.7
30–39	61,367 (20.5)	213 (8.6)	7.5, 9.7	518 (20.9)	19.3, 22.5
40–49	62,814 (21.0)	477 (19.2)	17.7, 20.8	527 (21.3)	19.7, 22.9
50–59	53,978 (18.0)	591 (23.8)	22.1, 25.5	444 (17.9)	16.5, 19.5
60–69	40,128 (13.4)	576 (23.2)	21.6, 24.9	342 (13.8)	12.5, 15.2
70+	48,840 (16.3)	580 (23.3)	21.7, 25.0	412 (16.6)	15.2, 18.1
Total	299,787 (100.0)	2,485 (100.0)		2,478 (100.0)	

*Abbreviations:* NWAHS, North West Adelaide Health Study; ABS, Australian Bureau of Statistics; ERP, Estimated Resident Population; CI, confidence interval.

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

<sup>a</sup> ERP, South Australia, June 30, 2009.

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