Universidade de São Paulo
Faculdade de Saúde Pública

VOLUME 32
NÚMERO 5
OUTUBRO 1998
p. 397-407

Revista de Saúde Pública

JOURNAL OF PUBLIC HEALTH

Two-year follow-up study of elderly residents in S. Paulo, Brazil: methodology and preliminary results*

Estudo de seguimento por dois anos de idosos residentes em São Paulo, Brasil: metodologia e resultados preliminares

Luiz R.. Ramos, João Toniolo N., Maysa S. Cendoroglo, Jacqueline T. Garcia, Myrian S. Najas, Monica Perracini, Cristina R. Paola, Fania C. Santos, Tereza Bilton, Simone J. Ebel, Maria B. M. Macedo, Clineu M. Almada F., Fabio Nasri, Roberto D. Miranda, Marília Gonçalves, Ana L. P. Santos, Renato Fraietta, Ismael Vivacqua N., Marcia L. M. Alves and Eliete S. Tudisco (in memoriam)

Centro de Estudos do Envelhecimento da Universidade Federal de São Paulo. São Paulo, SP-Brasil

RAMOS, Luiz R. *Estudo de seguimento por dois anos de idosos residentes em São Paulo, Brasil: metodologia e resultados preliminares* Rev. Saúde Pública, 32 (5): 397-407, 1998

Two-year follow-up study of elderly residents in S. Paulo, Brazil: methodology and preliminary results*

Estudo de seguimento por dois anos de idosos residentes em São Paulo, Brasil: metodologia e resultados preliminares

Luiz R. Ramos, João Toniolo N., Maysa S. Cendoroglo, Jacqueline T. Garcia, Myrian S. Najas, Monica Perracini, Cristina R. Paola, Fania C. Santos, Tereza Bilton, Simone J. Ebel, Maria B. M. Macedo, Clineu M. Almada F., Fabio Nasri, Roberto D. Miranda, Marília Gonçalves, Ana L. P. Santos, Renato Fraietta, Ismael Vivacqua N., Marcia L. M. Alves and Eliete S. Tudisco (in memoriam)

Centro de Estudos do Envelhecimento da Universidade Federal de São Paulo. São Paulo, SP-Brasil

Abstract

Introduction Previous cross-sectional studies have shown a high prevalence of chronic disease and disability among the elderly. Given Brazil's rapid aging process and the obvious consequences of the growing number of old people with chronic diseases and associated disabilities for the provision of health services, a need was felt for a study that would overcome the limitations of cross-sectional data and shed some light on the main factors determining whether a person will live longer and free of disabling diseases, the so-called successful aging. The methodology of the first follow-up study of elderly residents in Brazil is presented.

Method The profile of the initial cohort is compared with previous cross-sectional data and an in-depth analysis of nonresponse is carried out in order to assess the validity of future longitudinal analysis. The EPIDOSO ('Epidemiologia do Idoso') Study conducted a two-year follow-up of 1,667 elderly people (65+), living in S. Paulo. The study consisted of two waves, each consisting of household, clinical, and biochemical surveys.

Results and Conclusions In general, the initial cohort showed a similar profile to previous cross-sectional samples in S. Paulo. There was a majority of women, mostly widows, living in multigenerational households, and a high prevalence of chronic illnesses, psychiatric disturbances, and physical disabilities. Despite all the difficulties inherent in follow-up studies, there was a fairly low rate of nonresponse to the household survey after two years, which did not actually affect the representation of the cohort at the final household assessment, making unbiased longitudinal analysis possible. Concerning the clinical and blood sampling surveys, the respondents tended to be younger and less

*Project was funded by the "Fundação de Amparo à Pesquisa /FAPESP (Projeto Temático nº 90/3935-7), e Pós-doutorado (Processo nº 95/4925-9)
Correspondence to: Luiz Roberto Ramos – Rua dos Otonis, 731 – 04025 – 002 São Paulo, SP - Brasil. E-mail: lrr@uol.com.br
The publication of this article was supported by FAPESP (Process nº 97/09815-2).
Submitted on 2.12.1996. Reviewed on 27.11.1997. Approved on 2.3.1998.

disabled than the nonrespondents, limiting the use of the clinical and laboratory data to longitudinal analysis aimed at a healthier cohort. It is worth mentioning that gender, education, family support, and socioeconomic status were not important determinants of nonresponse, as is often the case.

Aging health. Chronic disease, epidemiology. Longitudinal studies. Frail elderly. Aging.

Resumo

Introdução *Estudos transversais recentes mostraram alta prevalência de doenças crônicas e incapacidades físicas entre idosos. Considerando o rápido processo de envelhecimento do Brasil e as conseqüências que esse aumento de idosos com doenças crônicas e incapacidades associadas acarretará para o sistema de saúde, fazia-se necessário estudo que pudesse superar as limitações dos dados transversais, permitindo determinar quais os fatores determinantes de uma vida longa e livre de doenças incapacitantes, o chamado envelhecimento bem sucedido. É apresentada a metodologia do primeiro estudo epidemiológico longitudinal com idosos residentes na comunidade, no Brasil.*

Método *O perfil do cohorte inicial é comparado com dados de estudos anteriores a com o perfil dos não respondentes para avaliar a validade de análises longitudinais futuras.O projeto EPIDOSO (Epidemiologia do Idoso) seguiu por dois anos 1.667 idosos (65+), residentes em São Paulo. Consistiu de duas ondas, cada qual com três inquéritos: domiciliar, clínico e laboratorial.*

Resultados e Conclusões *O perfil da população não diferiu de estudos anteriores, mostrando maioria de mulheres, viúvas, vivendo em domicílios multigeracionais, com uma alta prevalência de doenças crônicas, distúrbios psiquiátricos e incapacidades físicas. A despeito de todas as dificuldades inerentes a um estudo longitudinal, o grupo de não-respondentes ao segundo inquérito domiciliar não diferiu significativamente dos respondentes, assegurando análises longitudinais livres desse tipo de viés. Em relação aos inquéritos clínico e laboratorial, os não-respondentes mostraram-se mais velhos e mais incapacitados que os respondentes, limitando o uso dos dados clínicos e laboratoriais a análises pertinentes a uma cohorte mais jovem e saudável. Sexo, educação, apoio familiar e nível socioeconômico não influenciaram de forma significativa a taxa de não - resposta, ao contrário do que se costuma verificar.*

Saúde do idoso. Doença crônica, epidemiologia. Estudos longitudinais. Idoso debil. Envelhecimento.

BACKGROUND

Brazil has one of the fastest growing elderly populations in the world. Due to massive urbanization, coinciding with steep declines in both mortality and fertility rates, the proportion of people aged 60 and over is increasing rapidly, and by 2025 the country should have the sixth largest elderly population in the world (over 32 millions), representing 15% of its total population[28].

Previous cross-sectional studies in large urban centers like S. Paulo[23, 27] have shown an elderly population, on average, very poor, living mostly in multigenerational households (cohabiting with children and grandchildren), with a high prevalence of disability, expressed by the inability to perform unaided the activities of daily living - 40% needed help with at least one activity - and a high prevalence of referred chronic diseases - more than 80% referred to at least one disease. Given the obvious consequences of this growing number of old people with chronic diseases and associated disabilities for the provision of informal care and health care services, the need arose for a follow-up study that should overcome the limitations of the cross-sectional data and shed some light on the main factors determining whether a person will

live longer and free of disabling diseases, the so-called successful aging.

Longitudinal studies, with a population based sample, specifically designed to assess the health of the elderly, are still not abundant in the literature[2,8,11,21,22,31,34]. Yet there are several other studies based on non-populational samples[13,14,16,18,29,32], or based on populational samples that were not originally designed to assess only elderly people[3,15,20,30].

It is also important to notice, that none of these longitudinal studies were conducted in a less developed country, where poverty and low educational status might lead to a different set of variables affecting the aging process.

The present article presents the methodology of the first follow-up study of elderly residents in Brazil. The profile of the initial cohort will be compared with those of previous cross-sectional studies and an in-depth analysis of nonresponse will be carried out in order to assess the validity of future longitudinal analyses.

METHOD

Study Design

The EPIDOSO (Epidemiologia do Idoso) Study conducted a two-year follow-up of an elderly population, living in the community in the district *Saude* in the city of S. Paulo, Brazil. The study consisted of two waves, each comprising a household survey, a clinical survey and a biochemical survey. After the home interview the elderly were invited to attend a clinical examination at the University Center for the Study of Aging (CSA), and having done that, were further invited to return for biochemical exams. The same methodology was repeated after two years (Figure 1).

In addition, after the first wave, a subsample was randomly selected, stratified by age and gender, to be followed up on an outpatient basis with routine assessments every 6 months during the study period, with access to a multidisciplinary team. This particular cohort will be better described and analyzed in future publications.

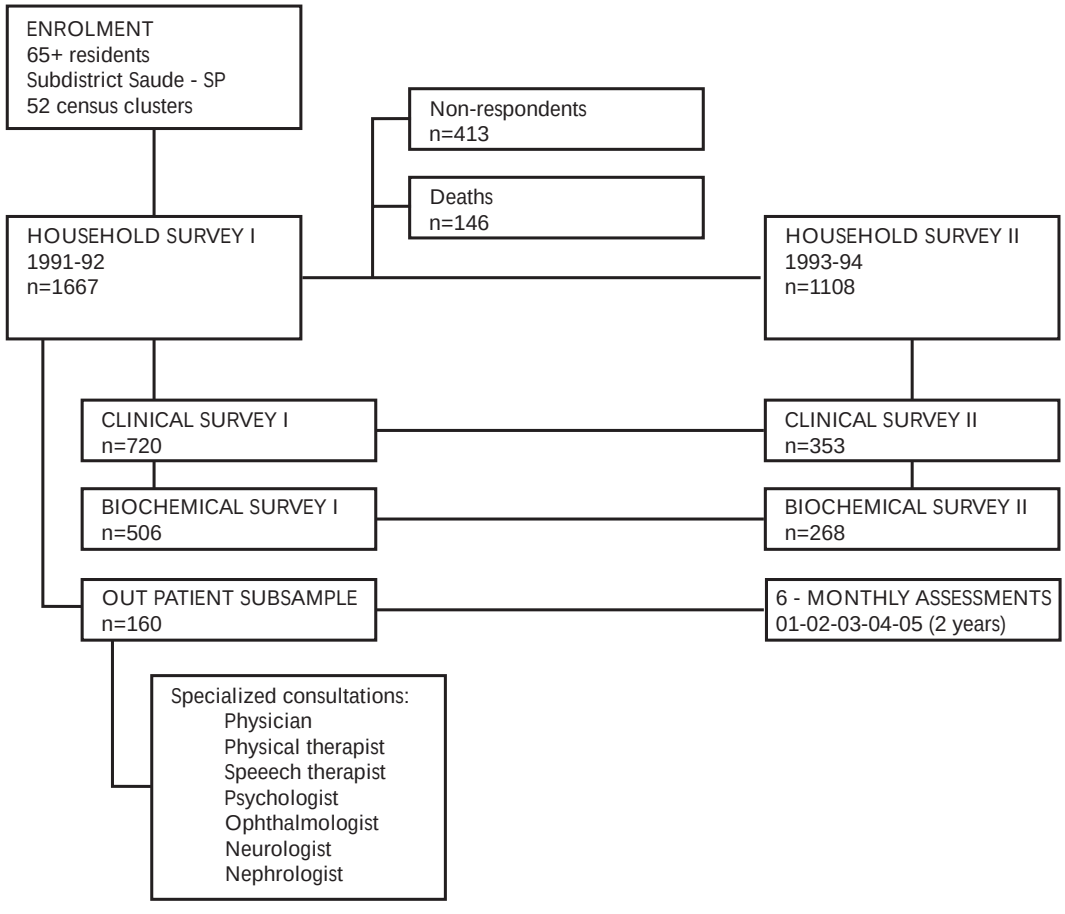

Figure 1 - Schematic view of the study design.

Study Area

The district *Saúde* is one of the 55 districts of the city of S. Paulo. According to a previous stratification of the city into three socioeconomic strata[25], the district in question, has a total population around 300,000 people. The study area was the catchment area of the CSA, with an estimated total population of 30,000 people. It was a residential area that, apart from the convenience of being close to the coordinating center, was chosen for having a relatively stable population, with no significant migration in or out, and for representing a middle class population. Differently from previous studies[23,27], the very poor areas on the outskirts as well as very wealthy areas from the central of the city were excluded from the study.

Study Population

Everyone aged 65 and over living in the study area was eligible for the study. A comprehensive enrollment was performed in the area, comprising 52 census clusters. A door-to-door screening survey was carried out by trained personnel - census workers or market researchers - experienced in tracing people living in the community and doing home interviews.

A list of all the persons aged 65 and over enrolled in the area, enabled each interviewer to go out for the home interview with a list of names, addresses and referred ages of those supposed to be interviewed. The interviewers were instructed to check the ID of the subjects, to get the correct dates of birth - sometimes the age given at the enrollment was inaccurate, and the subject was excluded for not having completed 65 years at the time of the interview. When the subject was not found at the address, the interviewer had instructions to return three times, on different days of the week and at different times of the day, before considering it a missing case. Those who refused the interview were also considered missing cases only after four visits, always with a different interviewer at the last attempt, usually a man if the previous two were made by a woman and vice-versa.

The first household survey was conducted between December 12, 1991 and December 22, 1992, and the second between February 20, 1994 and May 31, 1995, both followed by the clinical and biochemical surveys. The average length of follow-up was 24 months (minimum of 18 and maximum of 38). Only those participating in the household survey were invited for the clinical survey, as also only those attending the clinical survey were scheduled for the biochemical survey.

Household Interview

The household surveys followed a structured questionnaire - BOMFAQ (Brazilian OARS Multidimensional Functional Assessment Questionnaire) that had been adapted from the OARS questionnaire[9] and previously utilized in cross-sectional studies with elderly residents in S. Paulo[23,24,27]. The instrument yielded information on sociodemographic characteristics, informal support, independence in daily living, chronic illnesses, mental health status, cognitive status and self-perception of health. Some key variables were selected to give a general profile regarding the main dimensions of interest in the global assessment: a) the sociodemographic variables selected were age, gender, civil state, level of education, and per capita income in the household (U$$/month); b) for a proxy of informal support available, the household structure, a variable that has been shown to be strongly associated with the functional capacity of the elderly[24] was chosen, thus identifying those living alone or with others, and expressed in terms of the number of generations cohabiting - none (alone), one (spouse, next of kin), two (children), and three (grandchildren); c) independence in daily living was analyzed based on the number of activities of daily living (ADLs) requiring assistance to be performed, from a checklist of 15 ADLs (shopping, getting public transport, caring for the finances, taking medicines, walking a short distance, remaining continent, dressing, going to the toilet, grooming, cutting toe nails, bathing, eating, getting in and out of bed), using a previously validated hierarchical model of the ADLs[26]; d) chronic illnesses were expressed by an ordinary score of the referred health problems out of a checklist of 10 (rheumatism; asthma; high blood pressure; varicose veins; diabetes; obesity; stroke history; urinary incontinence; constipation; sleeping problems; cataract; back pain); e) mental health was evaluated based on a screening, that has been validated for use among elderly residents in S. Paulo[5], that identifies probable cases of psychiatric disturbance; e) cognitive status was assessed by the Mini Mental State Examination (MMSE)[12], an instrument widely used for this purpose with a standard cut-off point of 24 points (a score of 23 or less will indicate cognitive impairment)[6]; f) finally, the elderly's self perception of health was based on the question "how would you rate your own health?" (excellent/good/poor/bad) (Figure 2a).

Clinical Exams

After each household interview, the elderly were invited to a scheduled clinical exam in the CSA - they were given a choice of two days in the week when the exams were conducted - following the home interview. Those who attended answered a nutritional survey based on a 24-hour recall inquiry, applied by a trained nutritionist, and had blood pressure and anthropometric measurements (weight, height, knee height, skin fold), as well as an Electrocardiogram (EKG), taken by medical students specially trained for the survey (Figure 2b).

Blood Samples

After the clinical survey, those who had attended it were re-scheduled to have a blood sample for fasting blood glucose, serum lipid profile (total cholesterol, HDL, LDL), blood cell count, creatinine and Blood Urca Nitrogen. The

blood samples were drawn by a trained technician and sent to the laboratory of the teaching hospital of the university. A sample of serum was separated and stored at -4ºC at the CSA for future analysis (Figure 2c).

RESULTS

Analysis of the Data

Data were analyzed using the software Statistical Package for Social Sciences (SPSS) for Windows, version 6.1. A comparison of the cohort as at time 1 and time 2 is underway, and the risk factors for dying in the period as well as the factors associated with remaining healthy at the end of the study are being fitted into a logistic regression model. For the purposes of this article, a univariate analysis, using the Qui-square test, of the selected variables by gender, with data from the first household survey, will be presented.

HOUSEHOLD SURVEY:
MULTIDIMENSIONAL FUNCTIONAL ASSESSMENT QUESTIONNAIRE
Sociodemographic
Activities of daily living
Cognitive status
Emotional status
Chronic diseases
Self-rated health
Use of services
Use of medicines

Figure 2a - Household instrument.

CLINIC SURVEY:
Risk factors for CVD
Blood pressure
Weight
Height
Knee-height
EKG

Figure 2b - Clinical variables.

BIOCHEMICAL SURVEY:
Risk factors for CVD
Blood cell count
Total cholesterol
LDL and HDL
Fasting blood glucose
Uric acid
Creatine
Serum storage

Figure 2c - Biochemical variables.

In a follow-up study it is vital to keep nonresponse to the follow-up as low as possible, to avoid bias. A univariate analysis was conducted, using the same selected variables as for the profile of the initial cohort, to evaluate the effects, if any, of the drop-outs on the cohort characteristics and understand the possible causes for such losses.

Profile of the Study Population

All the elderly aged 65 and over living in the study area were enrolled in the study. A total of 1,167 people met the age criterion and were successfully interviewed. Table 1 shows the frequency distribution of the main socio-demographic and health related variables by gender, in this initial cohort. The majority

Table 1 - Profile of the cohort of community elderly residents (65+) in S. Paulo, Brazil base line (1991-1992).

Variable	Male%	Female%	Total%	p<value
Age				n.s.
65-69	28.7	29.6	29.3	
70-74	25.9	24.5	25.0	
75-79	23.5	23.1	23.2	
80 +	21.9	22.8	22.5	
Education				0.00001
Illiterate	1.6	6.0	4.5	
Read/write	13.6	19.3	17.3	
Primary	29.3	35.5	33.4	
High	16.0	17.3	16.9	
Coll/univ	39.5	21.8	27.9	
Income US$/Month				0.04
< 50	10.0	13.5	12.3	
50 - 99	17.5	20.4	19.4	
100 - 199	28.4	28.0	28.2	
> 200	44.0	38.0	40.1	
Civil State				0.00001
Single	4.7	11.4	9.1	
Married	80.7	35.3	51.0	
Widowed	12.3	49.3	36.5	
Separated	2.3	4.0	3.4	
Household				0.00001
Alone	5.7	17.6	13.5	
1 generation	44.3	32.1	36.4	
2 generations	35.3	29.7	31.6	
3 generations	14.6	20.6	18.5	
Total	34.5	65.5	100.0	
	N=575	N=1,092	N=1,667	

Table 1 (continuation).

Variable	Male %	Female%	Total %	p<value
ADL				0.00001
Independent	45.2	27.4	33.6	
1-3	32.7	34.2	33.7	
4-6	10.2	20.1	16.7	
7+	11.8	18.2	16.0	
Chronic diseases				0.00001
None	10.1	3.2	5.6	
1-2	36.3	24.6	28.7	
3-4	33.4	32.1	32.5	
5+	20.1	40.2	33.2	
Mental health				0.00001
Case	13.3	23.2	19.8	
Non-case	86.7	76.8	80.2	
MMSE				0.00001
<24	23.0	34.0	30.2	
24+	77.0	66.0	69.8	
Self-rated				0.00001
Excellent	15.6	14.6	14.9	
Good	62.2	50.6	54.6	
Poor	18.9	29.6	25.9	
Very bad	3.3	5.3	4.6	
Total	34.5	6.5	100.0	
	N=575	N=1,092	N=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

were of female gender (65%). Almost half the cohort (46%) was in the older age group (75+), and almost a quarter of the cohort (23%) was in the very old group (80+). There were no significant differences by gender in the age distribution (Table 1).

Only 5% were actually illiterate, but another 17% should be considered as almost illiterate as they learnt how to read and write but have not completed primary school. Women had a significantly higher proportion of very poorly educated persons (25%) as compared to men (15%), whereas the opposite was true regarding higher education - people obtaining a high school or university degree were 40% men and 22% women. Income distribution was less biased but still men seemed to be better off. While the cohort as a whole had 68% with a per capita monthly income of US$ 100 or more, among women this proportion decreased to 56% and increased to 72% among men (Table 1).

The majority of the cohort was either married (51%) or widowed (37%), but there were very significant gender differences. The overwhelming majority of men were married (80%), only 12% being widowed and 5% single, whereas women were mostly widows (49%) with a sizeable proportion of singles (11%). In terms of living arrangements, only 14% were living alone while half the cohort (50%) were sharing the household with the next generations - children (32%) and grandchildren (18%) – thus participating in multigenerational households. There was a significant tendency to find women either living alone (18%) or with married children and grandchildren (in three-generational households). Men, on the other hand, were much more likely to be married living with the spouse only (44%) or with spouse and some unmarried child (35%) (in two-generational households) (Table 1).

In terms of independence in daily living, a 15-task scale was presented, asking whether the person could perform the activity unaided or whether some help is needed (including those requiring total assistance).Only one-third of the cohort were totally independent (34%), with a significantly higher proportion among men (45%) as compared to women (27%). A sizeable minority were already requiring some kind of help to perform at least seven of the activities of daily living, which included instrumental as well as personal activities. Women were much more likely to be in this highly dependent group than men (18% and 12% respectively) (Table 1).

Physical health was assessed by a checklist of common chronic problems affecting the elderly. Only 6% considered themselves free of any of the above mentioned conditions, men more so than women (10% and 3% respectively). One third of the cohort referred to at least 5 of the chronic conditions, and women showed twice as much people than men, in proportional terms, in this chronically ill group (40% and 20% respectively) (Table 1).

Mental health was assessed by a 15-item screening with a cut-off at 5 positive answers defining a possible psychiatric problem. Overall, 20% of the cohort appeared to have some psychiatric problem, with a significantly higher proportion among women (23% as compared to 13% of men (Table 1).

Using the Mini Mental State Examination (MMSE) as a screening for cognitive impairment, and using the standard cut-off at 24 of 30 correct answers to define good cognitive status, almost one-third of the cohort showed some degree of cognitive impairment (29%), again with a significantly higher proportion among women (33%) as compared to men (22%) (Table 1).

Self-perception of health seemed good for the majority of the cohort. Only 31% rated their own health as poor or very bad, but women seemed less optimistic than men, as 35% rated their health as poor/very bad as opposed to only 22% of the men (Table 1).

Analysis of the Nonrespondents

Of the initial cohort interviewed in the first household survey (n=1,667), 720 (43%) attended the first clinical exam, and of these, 506 (70%) returned for the blood testing. After two years, 413 became non-respondents to the second household survey, due to refusal, change of address, and lack of contact after 4 attempts (25%). Three-quarters of the cohort were a followed-up - two-thirds (66%) were reinterviewed at home (n=1,108) and 146 (9%) had died. Of those reinterviewed, who had attended the first clinical exam, 47% attended the second clinical exam. Three-quarters of those examined (76%), returned for the blood tests a second time (Figure 3).

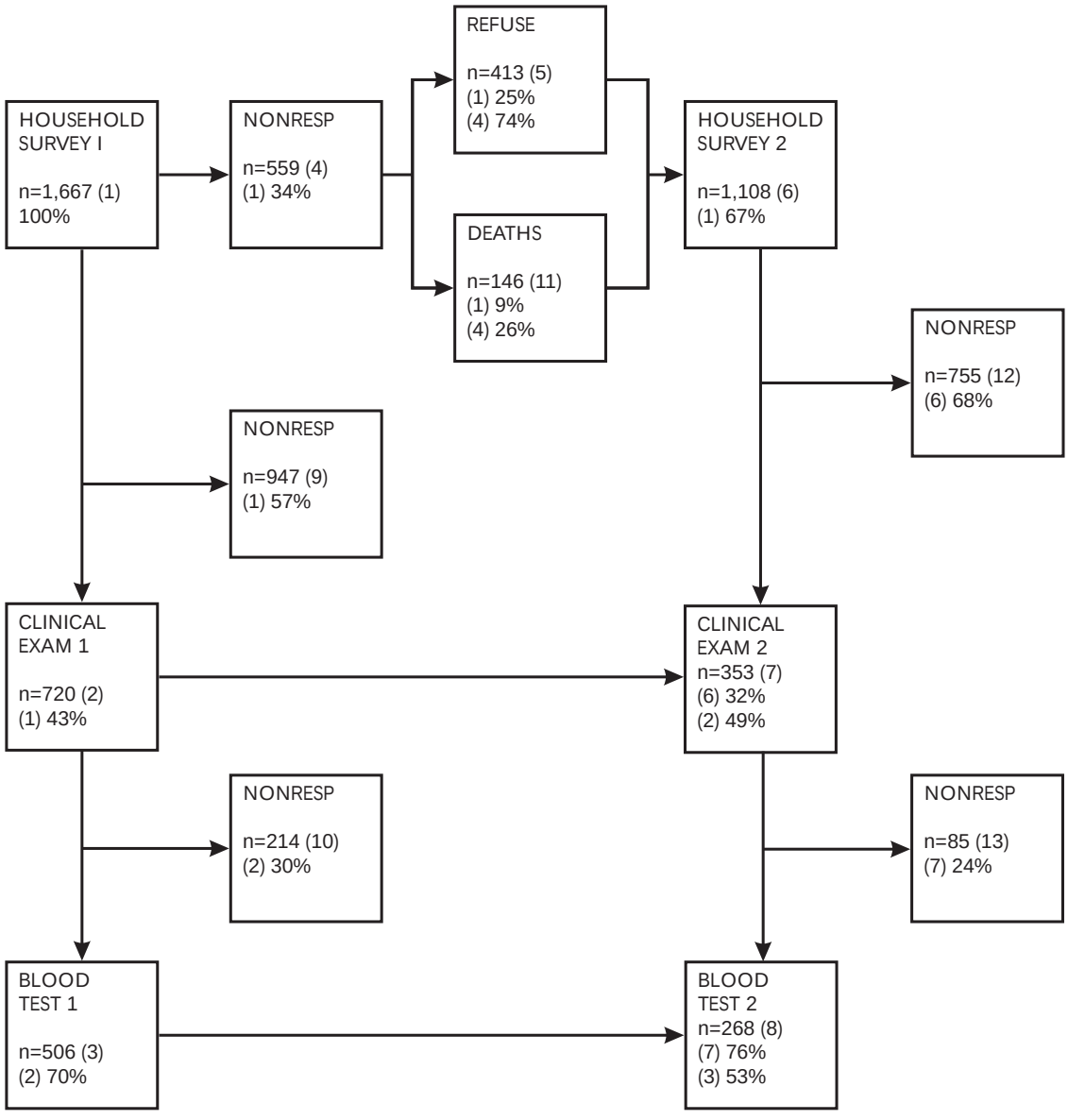

Figure 3 - Schematic view of response and nonresponse in the epidoso study.

The comparison between the nonrespondents to the second home interview, and the respondents, suggests that age and functional capacity played a major role in the follow-up of the home interview. A higher proportion of very old, highly dependent, and cognitively impaired elderly was verified among the nonrespondents. However, if we consider those who died in the period (9%), as respondents, as this was one of the outcome variables of the study, the situation changes entirely. When the nonrespondents were restricted to those who refused to give the interview, or had moved away from the study area, or could not be contacted after four attempts, all the previous differences with the respondents disappeared (Table 2).

Table 2 - Comparison between nonrespondents (refusal/ change address/absence) and nonrespondents to household survey 2 (including deaths in the period) 1991-92 to 1993-94.

Variable	Respon-dent	Non-respondent	Total	p value
Sex				n.s.
Male	34.5	33.9	34.4	
Female	65.5	66.1	65.6	
Age				n.s.
65-69	30.7	24.9	29.3	
70-74	24.9	25.4	25.0	
75-79	22.6	25.2	23.2	
80+	21.9	24.5	22.5	
Education				n.s.
Illiterate	4.3	5.1	4.5	
Read/write	17.4	17.2	17.3	
Primary	33.4	33.4	33.4	
High	16.8	16.9	16.9	
Coll/univ	28.1	27.4	27.4	
Income (US$)				n.s.
< 50	12.6	11.5	12.3	
50-99	20.1	17.3	19.4	
100-199	28.4	27.5	28.2	
> 200	38.9	43.8	40.1	
Household				n.s.
Alone	12.5	16.5	13.5	
One gen	36.7	35.4	36.4	
Two gen	32.1	30.0	31.6	
Three gen	18.7	18.2	18.5	
ADL				n.s.
Zero	33.4	34.2	33.6	
1-3	34.1	32.2	33.7	
4-6	15.8	19.7	16.7	
7+	16.7	13.7	16.0	
MMSE Score				n.s.
< 24	28.0	32.2	29.1	
24+	72.0	67.8	70.9	
Total	75.2 n=1,254	24.8 n=413	100.0 n=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

Table 3 - Comparison between nonrespondents (refusal) and respondents to the first clinical survey (attended the clinic) 1991-92.

Variable	Respon-dent	Non-respondent	Total	p value
Sex				n.s.
Male	35.0	33.9	34.5	
Female	65.0	66.1	65.6	
Age				p<0.0002
65-69	33.2	26.3	29.3	
70-74	27.1	23.4	25.0	
75-79	22.5	23.8	23.2	
80+	17.2	26.5	22.5	
Education				n.s.
Illiterate	4.2	4.8	4.5	
Read/write	17.2	1.4	17.3	
Primary	36.2	31.3	33.4	
High	17.0	16.8	16.9	
Coll/univ	25.5	29.8	27.4	
Income(US$)				n.s.
< 50	11.1	13.3	13.5	
50-99	20.3	18.7	19.4	
100-199	30.8	26.1	28.2	
> 200	37.8	41.9	40.1	
Household				n.s.
Alone	13.8	13.3	12.3	
One gen	35.6	37.0	36.4	
Two gen	30.6	32.4	31.6	
Three gen	20.1	17.3	18.5	
ADL				0.0003
zero	37.6	30.5	33.6	
1-3	35.0	32.7	33.7	
4-6	16.0	17.3	16.7	
7+	11.4	19.5	16.0	
MMSE Score				p<0.0001
< 24	23.8	33.2	29.1	
24+	76.2	66.8	70.9	
Total	43.8 n=720	56.2 n=947	100.0 n=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

On the other hand, the nonrespondents to clinical exams and blood tests, showed some significant differences from the respondents. The nonrespondents were significantly older, more disabled and less cognitively intact. That is to say, those who attended the clinical exam and the blood tests, both in the first and in the second wave of the study were younger and had a better functional capacity than those who did not (Tables 3, 4, 5, 6).

DISCUSSION

In general, the initial cohort showed a similar profile to previous cross- sectional samples in S. Paulo[23,24,26,27]. There was a predominance of women,

Table 4 - Comparison between nonrespondents (refusal) and respondents to the Second Clinical Survey (attended the clinic) 1993-94.

Variable	Respon-dent	Nonrespondent domic2	domic1	Total	p value
Sex					n.s.
Male	33.1	33.1	36.9	34.5	
Female	66.9	66.9	63.1	65.6	
Age					p<0.00001
65-69	35.4	32.2	21.5	29.3	
70-74	29.7	23.6	24.0	25.0	
75-79	23.2	22.6	24.0	23.2	
80+	11.6	21.6	30.6	22.5	
Education					n.s.
Illiterate	4.5	3.8	5.4	4.5	
Read/write	17.8	16.0	18.8	17.3	
Primary	34.6	32.5	33.9	33.4	
High	17.8	16.6	16.7	16.9	
Coll/univ	25.2	31.1	25.3	27.4	
Income (US$)					n.s.
< 50	9.5	13.9	12.0	12.3	
50-99	20.9	19.0	18.0	19.4	
100-199	30.1	26.8	28.8	28.2	
> 200	39.5	39.6	41.2	40.1	
Household					n.s.
Alone	15.3	11.8	14.7	13.5	
One gen	32.9	38.3	36.0	36.4	
Two gen	31.4	32.8	30.1	31.6	
Three gen	20.4	17.1	19.3	18.5	
ADL					p<0.00001
Zero	39.1	34.9	28.3	33.6	
1-3	40.3	33.9	29.2	33.7	
4-6	15.4	15.5	19.3	16.7	
7+	5.1	15.7	23.3	16.0	
MMSE Score					p<0.00001
< 24	19.0	28.3	36.3	29.1	
24+	80.5	71.7	63.7	70.9	
Total	21.2	45.3	33.5	100.0	
	n=353	n=755	n=559	n=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

Table 5 - Comparison between nonrespondents (refusal) and respondents to the first blood sampling (attended the clinic second time) 1991-92.

Variable	Respon-dent	Nonrespondent clinic1	domic1	Total	p value
Sex					n.s.
Male	36.2	32.2	33.9	34.5	
Female	63.8	67.8	66.1	65.6	
Age					p<0.00001
65-69	36.8	24.8	26.3	29.3	
70-74	25.7	30.4	23.4	25.0	
75-79	22.1	23.4	23.8	23.2	
80+	15.4	21.5	26.5	22.5	
Education					n.s.
Illiterate	3.6	5.6	4.8	4.5	
Read/write	15.4	21.6	17.4	17.3	
Primary	36.6	35.2	31.3	33.4	
High	16.6	1.8	16.8	16.9	
Coll/univ	27.9	19.7	29.8	27.4	
Income(US$)					n.s.
< 50	10.1	13.4	13.3	12.3	
50-99	20.0	21.1	18.7	19.4	
100-199	30.1	32.5	26.1	28.2	
> 200	39.8	33.0	41.9	40.1	
Household					n.s.
Alone	13.2	15.0	13.3	13.5	
One gen	34.6	37.9	37.0	36.4	
Two gen	31.0	29.4	32.4	31.6	
Three gen	21.1	17.8	17.3	18.5	
ADL					p<0.0002
Zero	40.4	30.8	30.5	33.6	
1-3	35.0	35.1	32.7	33.7	
4-6	14.9	18.8	17.3	16.7	
7+	9.7	15.4	19.5	16.0	
MMSE Score					p<0.001
< 24	23.3	25.0	33.2	29.1	
24+	76.7	75.0	66.8	70.9	
Total	30.4	12.8	56.8	100.0	
	n=506	n=214	n=947	n=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

mostly widows, living in multigenerational households, and a high prevalence of chronic illnesses, psychiatric disturbances, and physical disability expressed by the inability to perform unaided the activities of daily living. Differently from previous studies, however, this cohort represented a middle class, reasonably wealthy area, compared with the city as a whole. In other words, there was a much lower proportion of illiterate people than in previous studies and a much higher proportion of people who had reached college and university levels. Also the income distribution was skewed to the higher income groups although the average income was still rather low by international standards.

Table 6 - Comparison between nonrespondents (refusal) and respondents to the second blood sampling (attended the clinic second time) 1993-94.

Variable	Respon-dent	Nonrespondent clinic2	Nonrespondent domic2	Total	p value
Sex					n.s.
Male	34.7	28.2	34.7	34.5	
Female	65.3	71.8	65.3	65.6	
Age					p<0.00001
65-69	36.2	32.9	27.6	29.3	
70-74	28.4	34.1	23.7	25.0	
75-79	23.5	22.4	23.2	23.2	
80+	11.9	10.6	25.4	22.5	
Education					n.s.
Illiterate	4.1	5.9	4.5	4.5	
Read/write	18.7	15.3	17.2	17.3	
Primary	35.8	30.6	33.1	33.4	
High	16.8	21.2	16.6	16.9	
Coll/univ	24.6	27.1	28.6	27.4	
Income (US$)					n.s.
< 50	9.4	9.5	13.1	12.3	
50-99	20.4	22.6	19.0	19.4	
100-199	27.4	39.3	27.6	28.2	
> 200	43.0	28.6	40.3	40.1	
Household					p<0.05
Alone	13.1	22.4	13.0	13.5	
One gen	32.1	35.3	37.3	36.4	
Two gen	35.4	18.8	31.7	31.6	
Three gen	19.4	23.5	18.0	18.5	
ADL					p<0.00001
Zero	40.8	34.1	32.1	33.6	
1-3	38.1	47.1	31.9	33.7	
4-6	16.2	12.9	17.1	16.7	
7+	4.9	5.9	18.9	16.0	
MMSE Score					p<0.001
< 24	20.9	15.3	31.7	29.1	
24+	79.1	84.7	68.3	70.9	
Total	16.1	5.1	78.8	100.0	
	n=268	n=85	n=1,314	n=1,667	

ADL - Activities of daily living.
MMSE - Mini Mental State Examination.

The prevalence of cognitive deficit (30%), as assessed by the MMSE, was comparable with results from a survey in Canada[10], in which 33% of a sample of elderly residents presented some degree of cognitive impairment. For the purpose of the present study it was decided to use a standard cut-off at 24 points, although there is controversy in the literature as to whether different cut-offs should be used for different educational levels[4,17,19,35]. Given the relatively high level of education of this cohort, the prevalence of cognitive impairment might not be the same in a less educated sample, as education seems to be a risk factor for more rapid and more severe cognitive decline in old age[1,7,33].

Although more than 90% of the elderly referred to some chronic disease, and more than 60% had some degree of physical disability, the majority gave a fairly positive evaluation of their own health status. The proportion perceiving their health as poor or very bad was similar to the prevalence of a high degree of dependence in daily life, or of probable psychiatric disturbance, or of cognitive impairment. That might reflect the fact that a chronic disease in itself is not so important as its possible impact on the functional capacity of the elderly person. In this regard, mental health seems to play a deceptive role in the maintenance of good functional capacity in old age.

Despite all the difficulties inherent in a follow-up study, there was an acceptable nonresponse rate (25%) concerning the second household survey. The lack of significant differences between respondents and non-respondents, warrants an unbiased longitudinal analysis using data from the two household surveys. The same does not apply to the clinical and blood sampling surveys, where the respondents tended to be younger and less disabled than the nonrespondents, limiting the use of the clinical and laboratorial data to longitudinal analysis aimed at a healthier cohort.

These differences seem to be a reasonable explanation in themselves for the level of nonresponse. Differently from the household interview, where the elderly had only to agree to receive the interviewer at home, the two other stages of the study involved active compliance, and a journey to the center, all the more difficult for those

who were older, dependent on others to move and disoriented in cognitive terms. It is worth mentioning, however, that there were no significant differences between respondents and nonrespondents, regarding sex, educational level, household arrangement and level of income, in all the different surveys. This means to say that gender, intellectual background, type of family support, and economic means, were not important determinants of nonresponse, as is often the case.

REFERENCES

1. ALBERT, M. S. How does education affect cognitive function? *Ann. Epidemiol.*, **5:**76-8, 1995.

2. ANDINO, R. M.; CONDE-SANTIAGO, J. G.; MENDOZA, M. M. Functional disability and mental impairment as predictors of mortality in community-dwelling elderly Puerto Ricans. *Puerto Rico Health Sci. J.*, **14:**285-7, 1995.

3. BERKMAN, L. F. & SYME, L. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda county residents. *Am. J. Epidemiol.*, **109:**186-204, 1979.

4. BERTOLUCCI, P.; BRUCKI, S.; CAMPACCI, S.; JULIANO, Y. The mini-mental state examination in an outpatient population: influence of literacy. *Arq. Neuropsiq.*, **52:**1-7, 1994.

5. BLAY, S.; RAMOS, L. R.; MARI, J. Validity of a Brazilian version of the older Americans resources and services (OARS) mental health screening questionnaire. *J. Am. Geriat. Soc.*, **36:**687-92, 1988.

6. BRAEKHUS, A.; LAAKE, K.; ENGEDAL, K. The mini-mental state examination: identifying the most efficient variables for detecting cognitive impairment in the elderly. *JAGS*, **40:**1139-45, 1992.

7. CALLAHAN, C. M.; KATHLEEN, S. H.; HUI, S. I.; MUSICK, B. S.; UNVERZAGT, F. W.; HENDRIE, H. C. Relationship of age, education, and occupation with dementia among a community-based sample of African Americans. *Arch. Neurol.*, **53:**134-40, 1996.

8. CORNONI-HUNTLEY, J.C.; FOLEY, D. J.; WHITE, L. R.; SUZMAN, R.; BERKMAN, L. F.; EVANS, D. A.; WALLACE, R. B. Epidemiology of disability in the oldest old: methodological issues and preliminary findings. *Milbank Mem. Fund. Quart.*, **63 :**351-76, 1985.

9. DUKE UNIVERSITY CENTER FOR THE STUDY OF AGING AND HUMAN DEVELOPMENT. *Multidimensional functional assessment: the OARS methodology*. Durhan, 1978.

10. EBLY, E. M.; HOGAN, D. B.; PARHAD, I. M. Cognitive impairment in the nondemented elderly: results from the Canadian Study of Health and Aging. *Arch. Neurol.*, **52:**612-9, 1995.

11. FERRUCI, L.; GURALNIK, J. M.; BARONI, A.; TESI, G.; ANTONINI, E.; MARCHIONNI, N. Value of combined assessment of physical health and functional status in community-dwelling aged:a prospective study in Florence, Italy. *J. Gerontol.*, **46:**M52-6, 1991.

12. FOLSTEIN, M. F.; FOLSTEIN, S. E.; MCHUGH, P. R. 'Mini-Mental State: a practical method for grading the cognitive state of patients for the clinician. *J. Psychiatric Res.*, **12:**189-98, 1975.

13. GREINER, P. A.; SNOWDON, D. A.; GREINER, L. H. The relationship of self-rated function and self-rated health to concurrent functional ability, functional decline, and mortality: findings from the Nun Study. *J. Gerontol.*, **51B**(5)**:**S234-S241, 1996.

14. HO, S. C. Health and social predictors of mortality in an elderly Chinise cohort. *Am. J. Epidemiol.*, **133:**907-21, 1991.

15. IDLER, E. L. & ANGEL, R. J. Self-rated health and mortality in the NHANES-1 Epidemiologic follow-up study. *AJPH*, **80:**446-52, 1990.

16. JAGGER, C.; SPIERS, N. A.; CLARKE, M. Factors associated with decline in function, institutionalization and mortality of elderly people. *Age Ageing*, **22:**190-7, 1993.

17. JORM, A. F.; SCOTT, R.; HENDERSON, A. S.; KAY, W. K. Educational level differences on the mini-mental state: the role of test bias. *Psychol. Med.*, **18:**7272-31, 1988.

18. KELMAN, H. R.; THOMAS, C.; KENNEDY, G. J.; CHENG, J. Cognitive impairment and mortality in older community residents. *AJPH*, **84:**1255-60, 1994.

19. KITTNER, S. J.; WHITE, L. R.; FARMER, M. E.; WOLZ, M.; KAPLAN, E.; MOES, E.; BRODY, J. A.; FEINLEIB, M. Methodological issues in screening for dementia: the problem of education adjustment. *J. Chron. Dis.*, **39:**163-70, 1986.

20. MANTON, K. G. A longitudinal study of functional change and mortality in the US. *J. Gerontol.*, **43:**5153-61, 1988.

21. MOSSEY, J. M. & SHAPIRO, E. Self-rated health: a predictor of mortality among the elderly. *AJPH*, **72:**800-8, 1982.

22. NATIONAL CENTER FOR HEALTH STATISTICS. *The national health survey design, 1973-1984*. Washington, DC, DHSS, 1985.

23. RAMOS, L. R. Growing old in Sao Paulo, Brazil: assessment of health status and family support of the elderly of different socioeconomic strata living in the community. [Umpublished Ph.D. thesis: University of London, 1987].

24. RAMOS, L. R. Family support for the elderly in Sao Paulo, Brazil. In: Kendig, H.; Hashimoto, A.; Coppard, L. ed. Family support for the elderly: the international experience. Oxford, Oxford University Press, 1992.

25. RAMOS, L. R. & GOIHMAN, S. Geographic stratification by socio-economic status: methodology from a household survey with elderly people in S. Paulo, Brazil. *Rev. Saúde Pública,* **23:**478-92, 1989.

26. RAMOS, L. R.; PERRACINI, M.; ROSA, T. E. C.; KALACHE, A. Significance and management of disability among urban elderly residents in Brazil. *J. Cross Cultural Gerontol.,* **8:**313-23, 1993.

27. RAMOS, L. R.; ROSA, T. E. C.; OLIVEIRA, Z.; MEDINA, M. C.; SANTOS, F. R. G. Profile of the elderly residents in S. Paulo, Brazil: results from a household survey. *Rev. Saúde Pública,* **27:**87-94, 1

29. REUBEN, D. B.; SIU, A. L.; KIMPAU, S. The predictive validity of self-report and performance-based measures of function and health. *J. Gerontol.,* **47:**M106-10, 1992.

30. SCHOENBACH, V. J.; KAPLAN, B. H.; FREDMAN, L.; KLEINBAUM, D. Social ties and mortality in Evans county, Georgia. *Am. J. Epidemiol.,* **123:**577-91, 1986.

31. SHAHTAHMASEBI, S.; DAVIES, R.; WENGER, G.C. A longitudinal analysis of factors related to survival in old age. *Gerontologist,* **32:**404-13, 1992.

32. J. P.; FREEBORN, D. K.; POPE, C. R. Gender differences in the relationship between social network support and mortality: a longitudinal study of an elderly cohort. *Soc. Sci. Med.,* **41:**935-47, 1995.

33. SNOWDOW, D. A.; KEMPER, S. J.; MORTIMER, J. A.; GREINER, L. H.; WEKSTEIN, D. R.; MARKESBERY, W. R. Linguistic ability in early life and cognitive function and Alzheimer's disease in late life. *JAMA,* **275:**528-32, 1996.

34. TSUJI, I.; MINAMI, Y.; KEYL, P. M.; KEYL, P. M.; HISAMICHI, S.; ASANO, H.; SATO, M.; SHINODA, K. The predictive power of self-rated health, activities of daily living, and ambulatory activity for cause-specific mortality among the elderly: a three-year follow-up in urban Japan. *JAGS,* **42:**153-6, 1994.

35. UHLMANN, R. F. & LARSON, E. B. Effect of education on the mini-mental state examination as a screening test for dementia. *JAGS,* **39:**876-80, 1991.