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Socioeconomic determinants of disability in Chile

Pedro Zitko Melo, M.D., M.Sc.[a,*], and Báltica Cabieses Valdes, M.Sc.[b]

[a]*Unidad de Estudios Asistenciales, Complejo Asistencial Barros Luco, Servicio de Salud Metropolitano Sur de Chile, Santiago, Chile*
[b]*Facultad de Medicina, Universidad del Desarrollo, Santiago, Chile*

Abstract

Background: Disability is a worldwide public health priority. A shift from a biomedical perspective of dysfunction to a broader social understanding of disability has been proposed. Among many different social factors described in the past, socioeconomic position remains as a key multidimensional determinant of health. The study goal was to analyze the relationship between disability and different domains of socioeconomic position in Chile.

Methods: Cross-sectional analysis of an anonymized population-based survey conducted in Chile in 2006. Any disability (dichotomous variable) and 6 different types of disability were analyzed on the bases of their relationship with income quintiles, occupational status, educational level, and material living standards (quality of the housing, overcrowding rate and sanitary conditions). Confounding and interaction effects were explored using R statistical program.

Results: Income, education, occupation, and material measures of socioeconomic position, along with some sociodemographic characteristics of the population, were independently associated with the chance of being disabled in Chile. Interestingly, classic measures of socioeconomic position (income, education, and occupation) were consistently associated with any disability in Chile, whereas material living conditions were partially confounded by these classic measures. In addition to this, each type of disability showed a particular pattern of related social determinants, which also varied by age group.

Conclusions: This study contributed to the understanding of disability in Chile and how different domains of socioeconomic position might be associated with this prevalent condition. Disability remains a complex multidimensional public health problem in Chile that requires the inclusion of a wide range of risk factors, of which socioeconomic position is particularly relevant.

Keywords: Disability; Socioeconomic position; Developing country; Survey

Social determinants of health have been defined as the social conditions in which people live and work that affect their health; in other words, the social characteristics within which life has place [1-7]. The model of the social determinants of health has been widely used in the literature and in the field of public health policies, particularly over the past 20 years. It has become a relevant framework for understanding the complex relationship between a wide range of individual, relational, and societal factors and health, and the growing international evidence on these relationships have been a step forward in understanding and protecting health.

One social determinant of health that has become particularly relevant is socioeconomic position. This complex and multidimensional variable has been widely recognized as a key determinant of health and well-being by many social researchers all over the world [8, 9]. For example, it has been found that having a low socioeconomic status in a hierarchical society is strongly related to poor health outcomes [10-12]. Health inequalities would therefore be a consequence of unequal societies, partly as a chronic response to a lifetime of stress among those living in the lower levels of the social scale [13, 14].

Socioeconomic position has frequently been measured by income, education, and occupation (ie, classic measures of socioeconomic position) [15-18]. These measures of socioeconomic position are related to health both directly and indirectly, through a range of mechanisms. Level of income has been associated with better access to health care, ability to obtain a house of good quality, reduced exposure to environmental pollutants, a better diet and working conditions, and better social services, among others [19-23]. Education has proved to be a useful indicator of socioeconomic position, as it is strongly associated with lifestyle, risk behaviors and prevention of ill health, the ability to solve problems related to health, and social values such as people's perceived importance of looking after their own health [24-26]. Occupation has been

* Corresponding author: Gran Avenida J.M. Carrera, 3204 San Miguel, Santiago, Región Metropolitana.
E-mail address: pedrozitko@yahoo.com (P. Zitko Melo).

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associated with differential exposure to physical and psychological risk factors that tend to determine poor health (chemicals or stress at work, for example), the presence of rewards from peers and authorities, occupational safety, personal control in the working environment, access to health care, and the ability to obtain good housing, among others [27-30].

Material living standards have also been recognized as a reliable measure of wealth and social position, in particular in developing countries [19, 20]. With regard to the *material conditions*, a large number of studies conducted in developed countries and some in developing countries support the existence of a so-called materialist model [31-34]. As stated by Bartley [35], much of the evidence for direct material causes of health inequalities has come from studies which show that health is worse and life expectancy is lower among people who live in poor material conditions. These are directly related to absolute income, housing quality, and assets [32-34, 36], in contrast to the indirect psychosocial dimension of social position.

Overall, extensive data on the effects of classic socioeconomic position measures on health have been presented for developed countries, but less is known of the comparative effect of these and material living standards on health among developing countries like Chile [37, 38]. This could have important implications for health policy interventions in this country. Chile is a middle-income South American country with just over 16 million habitants and GDP per capita US$14,982 in 2010 (based on purchasing-power-parity [PPP] [39]). From a political-administrative point of view, the country is divided into 351 counties within 15 regions.

The health care system in Chile is mixed. The public and private sectors coexist in terms of both provision of services and insurance, with little interaction between them. Over 70% of the total population is entitled to the public system that covers 100% of the costs from those living in the poorest strata and a variable proportion of the total cost among those with better socioeconomic position, depending on their salary [40-42]. The public sector has a wide primary health care system spread almost over all the territory. Therein occurs the first contact with health system, previous to access to specialized attention in disability. The country has a still incipient net of community-based rehabilitation. Chile has experienced profound economic, demographic, and epidemiological changes in the past two decades. There has been economic growth and improvement of the health status of the population, a decline in infant and general mortality, and an increase in life expectancy [42]. However, not all socioeconomic groups have benefited from these developments to the same extent. There are inequalities, for example, in access to health care and geographical variations in health among particular subgroups of the population, including those in socioeconomic disadvantage [43, 44].

One prevalent health outcome in Chile is *disability*. Disability is a worldwide public health priority [45]. The *International Classification of Functioning, Disability and Health (ICF)* has recently proposed a shift from a biomedical perspective of dysfunction to a broader social understanding of disability. By including contextual factors in classification, ICF allows the impact of the environment on a person's functioning to be recorded [45, 46]. Social determinants of health, in this sense, have emerged as a significant aspect of current debates on the role of disability as a barrier to addressing health inequalities within a generation in Chile, and achieving health for all [47]. Therefore, the aim of this study was to analyze the relationship between disability and different domains of socioeconomic position: both the classic measures (income, occupation, and education) and material living standards in Chile.

Methods

Population and sample

We conducted a cross-sectional analysis of a nationally representative survey conducted in Chile in 2006 (CASEN) [48]. This anonymous population-based survey has been carried out by the Chilean Ministry of Planning every 3 years since 1987 [27]. It describes the socioeconomic situation, as well as the impact of social programs on living conditions, for the Chilean population [37, 49].

The CASEN survey used multistage probabilistic sampling with 2 phases (county and household), stratified by urban and rural area. The sampling frame included every region in Chile. The inclusion criteria for selection of counties were (1) all urban counties with over 40,000 inhabitants, (2) all rural counties irrespective of the number of inhabitants, and (3) a random selection of a small proportion of counties with less than 40,000 inhabitants. Hard-to-access counties were excluded, because of their very difficult geographical access (overall exclusion of 20 counties, from a total of 605 counties). Within each county, households were randomly selected for data collection. Sampling included people living in transient camps living in any of these counties, who represent less than 1% of the total population. No institutionalized people were interviewed.

The final sample for the analysis consisted of 268,873 people who belonged to a random sample of 73,720 households (44,854 urban and 28,866 rural ones), representing 95.4% of the total Chilean territory [50]. This probabilistic sample had a final absolute sample error of 0.36% at the household level, assuming a confidence level of 95% and maximum variance [51]. The mean number of households included in the CASEN per region was representative of the total population within each region and also representative of the population in each urban and rural setting from each region [51, 52].

Data collection was via face-to-face interview by trained interviewers, using a questionnaire previously validated [51]. The preferred respondent was the head of household, followed by their spouse, or if neither of these were present,

then a household member over 18 years of age. Information was collected on all members of the household. This study uses data on the total population of the CASEN survey, including both adults and children. The response rate of the 2006 CASEN survey was 84.8% [51].

Outcome measures: disability

1. Any disability: dichotomous variable indicating the presence of one or more disabling conditions or no disabilities from 6 alternatives.
2. Type of disability: dichotomous variable indicating the presence of each of the 6 possible disabling conditions: visual, hearing, speaking, physical, cognitive, and psychiatric disability.

The question asked by the interviewer was: Do you or any of the people who live in the household have any of the following long-term health conditions?

a. Blindness or difficulty to see even when using lenses? (visual disability)
b. Deafness or difficulty to hear even when using headphones? (hearing disability)
c. Muteness of speaking difficulties (speaking disability)
d. Physical or mobility impairment (physical disability)
e. Cognitive or learning difficulties (cognitive disability)
f. Mental or psychiatric difficulties (psychiatric disability)

Explanatory factors: different domains of socioeconomic position

1. *Classic* measures of socioeconomic position [52, 53]:
   a. Relative income: obtained from household income per capita in the past month and converted to USD purchasing power parity for 2006 (PPP) [39]. This variable was then transformed into relative income by dividing it into quintiles, the first quintile being the wealthiest group and the fifth quintile the poorest.
   b. Educational level: was reported as the highest level achieved for each member of the household: university, technical, high-school, primary school, or no education.
   c. Type of occupation: categorized as collected by the CASEN survey [48]. Each person interviewed was asked to provide information about the *current* occupational situation of each member of the household:
      i. *Active group*: including manager, self-employed, employee, and nonpaid family worker.
      ii. *Unemployed group*: including those at working age and interested in working but without a job at the moment of the interview. No information about prior occupation or length of unemployment was collected from the CASEN survey.
      iii. *Inactive group*: including those at working age but not currently interested in working (ie, students, people with a long-term illness, housewives, and retirees)
2. Socioeconomic position measured by *material living standards*: were measured using three self-reported variables as recommended by the Chilean Ministry of Planning [48]:
   a. Housing quality: was measured by an index that included the quality of the walls, floor, and ceiling. Housing quality was then categorized as high (constructed of solid materials), regular (poor quality but all enduring materials) and poor (constructed of one or more non-enduring materials such as plastic or cardboard, which is frequently used by those living in transient camps in Chile).
   b. Sanitary systems: were measured as the presence of both or the absence of both a clean public water supply and a public sewage system. An adequate sanitary system, irrespective of urban/rural location, was defined as 0, and a deficient sanitary system was labeled as 1. Deficient was when at least one of the measures were absent. According to the Chilean Ministry of Planning, no geographical setting in Chile would justify the consideration of septic systems as adequate [48].
   c. Overcrowding: was measured as the ratio of the number of people living in the household to the number of bedrooms. This was then categorized as no (<2.5), intermediate (2.5-4.9), and severe overcrowding (>4.9).
3. Sociodemographic control variables included age (continuous and categorical by 3 age groups: under 15/15-64/over 64), sex, marital status, and living in a rural area (*rurality*).

Data analysis

Descriptive statistics for each variable under study are reported as means for continuous variables and proportions for categorical variables (Table 1). Any and each type of disability was also stratified by age groups. Crude and age-adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were estimated by simple and multivariable logistic regression models. These models estimated the prevalence of any and each type of disability by sets of the a priori selected covariates (sociodemographics, classic socioeconomic position measures, and material living standards) of the Chilean population. A final model included all variables.

Confounding analysis and multiplicative interaction analyses were also explored, throughout multiple logistic regressions [54-57]. We studied the confounding effect by

Table 1
Description of the sample: demographics prevalence of disability (any and 6 different types of disability), social position and material conditions in Chile, CASEN 2006 survey

	%, mean	LCI	UCI	n
Sociodemographic variables				
Age (mean)	33.0	32.8	33.1	…
Sex (% female)	51.3	51.0	51.7	8,281,523
Zone (% rural)	12.9	12.7	13.0	2,074,414
Marital status (% married or cohabitant)	40.8	40.5	41.1	6,578,117
Marital status (% divorced)	4.6	4.4	4.7	735,562
Marital status (% widow)	4.1	4.0	4.2	656,521
Marital status (% single)	50.6	50.3	50.9	8,160,543
Social position variables				
Education (% university or more)	9.9	9.6	10.1	1,590,491
Education (% technical)	5.7	5.5	5.8	914,613
Education (% high school)	38.5	38.2	38.8	6,213,562
Education (% primary school)	38.2	37.8	38.5	6,153,878
Education (% not formal)	7.4	7.2	7.6	1,192,062
Mean Income household per capita U$ PPP, Quintile 5th[a]	1,487	1,460	1,513	…
Mean Income household per capita U$ PPP, Quintile 4th	477	475	478	…
Mean Income household per capita U$ PPP, Quintile 3st	299	299	300	…
Mean Income household per capita U$ PPP, Quintile 2nd	197	197	198	…
Mean Income household per capita U$ PPP, Quintile 1st	104	104	105	…
Occupation (% chief)	1.3	1.2	1.3	201,634
Occupation (% independent)	8.3	8.1	8.5	1,337,239
Occupation (%employee)	30.9	30.6	31.2	4,979,560
Occupation (% nonpaid family work)	0.4	0.3	0.4	61,297
Unemployed (%)	3.5	3.4	3.6	559,737
Inactive (%)	37.9	37.6	38.2	6,116,778
Without occupation (because <12 years old, %)	17.8	17.6	18.1	2,874,498
Material living standard variables				
High quality house (%)	61.6	61.3	61.9	9,941,377
Regular quality house (%)	37.5	37.2	37.8	6,042,576
Poor quality house (%)	0.9	0.9	1.0	146,790
Deficient sanitary system (%)	7.4	7.3	7.5	1,196,901
No overcrowding (%)	98.9	98.9	99.0	15,959,757
Moderate overcrowding (%)	1.0	0.9	1.1	159,694
Severe overcrowding (%)	0.1	0.1	0.1	11,292
Any disability				
Any disability and all years old	6.9	6.8	7.1	1,119,474
< 15 years old	2.5	2.2	2.7	…
15-64 years old	6.0	5.8	6.2	…
> 64 years old	25.3	24.4	26.1	…
Type of disability				
1. Visual	3.2	3.1	3.3	511,345
< 15 years old	0.9	0.7	1.0	…
15-64 years old	2.8	2.6	2.9	…
> 64 years old	11.9	11.2	12.5	…
2. Hearing	1.2	1.2	1.3	196,795
< 15 years old	0.3	0.2	0.4	…
15-64 years old	0.8	0.7	0.8	…
> 64 years old	7.0	6.5	7.5	…
3. Speaking	0.3	0.3	0.4	51,618
< 15 years old	0.4	0.3	0.4	…
15-64 years old	0.3	0.2	0.3	…
> 64 years old	0.7	0.6	0.8	…
4. Physical	2.2	2.1	2.2	346,811
< 15 years old	0.5	0.4	0.6	…
15-64 years old	1.7	1.6	1.8	…
> 64 years old	9.8	9.3	10.4	…
5. Cognitive	0.9	0.8	0.9	138,724
< 15 years old	0.8	0.6	0.9	…
15-64 years old	0.8	0.8	0.9	…
> 64 years old	1.4	1.2	1.7	…
6. Psychiatric	0.4	0.4	0.5	66,136
< 15 years old	0.1	0.1	0.2	…
15-64 years old	0.5	0.4	0.5	…
> 64 years old	0.5	0.4	0.7	…
Sample				
Sample size of individuals	…	…	…	268,873
Population size (weighted)	…	…	…	16,130,743

[a] U$ PPP: US dollars Per Purchasing Parity for September, 2006 (source: IMF).

using its classic epidemiologic definition. A confounder is a distortion in the estimated exposure effect that results from differences in risk between the exposed and unexposed that are not due to exposure [58, 59]. Confounding then occurs when an observed association is in fact due to a mixing of the exposure, the disease, and a third factor [60]. Therefore, we compared the crude OR and 95% CI of the relationship between to variables with the adjusted OR and 95% CI estimated after including a third potential confounding variable in the relationship of interest (ie, the association between classic measures of socioeconomic position and disability adjusted by material conditions). It was considered the presence of confounding, when the CIs of the unadjusted OR were not overlapped with the confidence intervals of the adjusted OR.

We also tested the statistical signification of the trends of ''OR'' of the socioeconomic variables. For this, we created vectors of random numbers with normal distribution using the regression coefficient and its standard errors from each strata of socioeconomic position indicators. A Spearman correlation test was implemented (statistical significance when p-value $<.05$). For exploring the possible intercorrelation between the classic measures of socioeconomic position, we performed a polychoric correlation and an exploratory factor analysis, using the method of principal factor.

Data analyses were conducted with the R 2.8.1 statistical software package and estimations were weighted with R Survey package 3.11 to take into account the complex multistage sampling strategy of the survey and to attain population-based estimations [61]. The polychoric correlation and the exploratory factor analysis were conducted using Stata 10.0.

Results

Sample description and prevalence of any disability in Chile

Characteristics of population are presented in Table 1. The mean age was 33.0 years old (SD = 0.14). Fifty-one percent of the population were male and most were either single (50.6%) or married (40.8%). Only 12.9% of the population were living in a rural area. Over 70% of the population reported having primary and high school level education, compared to less than 10% with a university degree. The average income of the wealthiest quintile was 14.3 times higher than the average income of the poorest quintile, and most of the sample were either not working (3.5% unemployed, 37.9% inactive) or employees (30.9%). The CASEN survey assumes that those under 12 years old do not work (17.8%). Over a third of the population lived in regular housing quality, and 7.4% reported having a deficient sanitary system.

The prevalence of any disability in the sample was 6.9% (CI = 6.8-7.1). Of all the 6 types of disability, visual (3.2%, CI = 0.04-3.3) and physical (2.2%, CI = 2.1-2.2) were the most prevalent ones. Among the total disabled population, 64.4% were the only person with this condition in their households (the remaining percentage shared a household with some other disabled person). On the other hand, 21.4% of the total households in Chile include a disabled person (17.1% included one person with disability; the rest included two or more) (data not shown).

Sociodemographic determinants of any disability in Chile

Crude and adjusted ORs of having any disability in Chile are presented in Table 2. Age showed a positive association with disability in both the crude and adjusted models (OR 1.05, see Models 1-4, Table 2). Women had a higher crude prevalence of disability compared to men, but this association was confounded by age (women are older than men) and inversely confounded by occupation (crude OR = 1.15, see Models 1 and 2, Table 2), because most of those with disability and occupationally inactive (mostly housewives) were women (50%). Being divorced and widowed were positively associated with the chance of having a disability, nonetheless being widowed was confounded by age and socioeconomic variables (see Models 1 and 4, Table 2). Being single was a protective factors for disability (crude OR = 0.48, see Model 1 and Table 2), but it was inversely confounded by age (see Models 2-4, Table 2). Finally, in the unadjusted analysis, living in a rural area was associated with a higher chance of reporting any disability (crude OR = 1.13, see Model 1, Table 2), but this association was inversely confounded for age, classic measures of socioeconomic position, and material conditions. In the full model, living in a rural area was associated with a significantly reduced chance of disability (adjusted OR = 0.80, see Model 4, Table 2).

Classic socioeconomic position measures and their association with any disability in Chile

We found a clear and statistically significant gradient of disability by educational level in the crude model, which was maintained in the adjusted analyses (Models 2 and 4 in Table 2). However, the observed gradients in the adjusted models were less steep than in the crude model (Model 1, Table 2), and this was mainly attributable to the effect of controlling by age, suggesting a cohort effect in the relationship between educational level and disability. Crude analysis showed a lower risk of disability in the wealthiest household compared with the other quintiles (see Model 1, Table 2). Nevertheless, a clear statistically significant gradient was observed in the OR of the household income after controlling for age and other variables (see Model 2, Table 2). Interestingly, the association between the household income and any disability was not confounded by other classic measures of socioeconomic position or material living standards (Model 4, Table 2). In terms of occupation, after controlling for sociodemographic variables, the unemployed group appeared to have a significant higher chance of any disability (see Model 2, Table 2). However, the association between any disability and occupation was modified by the other classic variables used to measure socioeconomic position (Models 2 and 4, Table 2). In this sense, a large group of inactive people simultaneously belonged to the poorest income quintile and to the lowest educational strata.

Besides, the polychoric correlations between the 3 classic measures of socioeconomic position were relatively small (education and quintile of income: 0.34; education and occupation: 0.12; quintile of income and occupation: 0.28). Explicatory factor analysis suggested only one significant factor, but with high values of uniqueness for each variable (education: 83.1%; quintile of income: 74.5%; occupation: 89.0%).

Material socioeconomic determinants of any disability in Chile

For quality of housing, there was a clear crude and adjusted gradient with any disability (crude ORs: 1.32 regular and 1.92 poor quality of the housing, respectively, see Model 1, Table 2). Interestingly, income and education partially confounded the relationship between housing quality and disability; which remained significant after adjustment (adjusted ORs: 1.07 regular and 1.27 poor quality of the housing, respectively, see Model 4, Table 2). Having a deficient sanitary system was also associated with any disability (crude OR 1.19, Model 1, Table 2), but this association was confounded by the quality of housing and education (adjusted OR 0.98, non significant, Model 4 Table 2). Despite the fact that overcrowding was only reported by 2% of the population, a significant gradient was found in relation to any disability (crude

Table 2
Crude and adjusted odds ratios (ORs) of having any disability in Chile with its 95% confidence intervals (CI) from CASEN, 2006

	Model 1 (crude analysis)			Model 2 (Sociodemographic variables + Social Position Variables)			Model 3 (Sociodemographic variables + Material Living Standard Variables)			Model 4 (Sociodemographic variables + Social Position variables + Material Living Standard Variables)		
	Univariate			Multivariate			Multivariate			Multivariate		
	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS
Age	1.04	1.04	1.04	1.05	1.04	1.05	1.05	1.05	1.05	1.05	1.04	1.05
Sex	1.15	1.09	1.21	0.84	0.79	0.89	1	0.95	1.06	0.84	0.79	0.89
Zone (reference is urban)	1.13	1.09	1.18	0.81	0.77	0.85	0.89	0.84	0.94	0.8	0.75	0.85
Marital status (married or cohabitant)	1	…	…	1	…	…	1	…	…	1	…	…
Marital status (divorced)	1.49	1.34	1.66	1.6	1.42	1.8	1.46	1.3	1.63	1.6	1.42	1.8
Marital status (widow)	3.94	3.64	4.26	1.05	0.96	1.15	1.3	1.19	1.42	1.05	0.96	1.15
Marital status (single)	0.58	0.55	0.61	1.72	1.59	1.86	2.18	2.03	2.33	1.7	1.58	1.84
Education (university or more)	1	…	…	1	…	…	…	…	…	1	…	…
Education (technical)	0.94	0.76	1.17	1.05	0.84	1.31	…	…	…	1.04	0.83	1.3
Education (high school)	1.56	1.36	1.78	1.23	1.07	1.42	…	…	…	1.21	1.05	1.4
Education (primary school)	2.46	2.16	2.81	1.65	1.42	1.91	…	…	…	1.62	1.39	1.87
Education (not formal)	3.05	2.65	3.52	2.48	2.08	2.94	…	…	…	2.43	2.04	2.89
Income Quintile 1 (wealthiest)	1	…	…	1	…	…	…	…	…	1	…	…
Income Quintile 2	1.44	1.31	1.59	1.25	1.13	1.39	…	…	…	1.25	1.13	1.39
Income Quintile 3	1.65	1.51	1.81	1.36	1.23	1.51	…	…	…	1.34	1.21	1.49
Income Quintile 4	1.67	1.52	1.82	1.44	1.3	1.6	…	…	…	1.41	1.27	1.57
Income Quintile 5 (poorest)	1.52	1.39	1.67	1.58	1.42	1.76	…	…	…	1.54	1.38	1.72
Occupation (Executive/chief)	1	…	…	1	…	…	…	…	…	1	…	…
Occupation (Independent/self employed)	1.62	1.19	2.21	1.25	0.91	1.73	…	…	…	1.24	0.9	1.71
Occupation (Employee)	0.81	0.6	1.1	0.88	0.65	1.21	…	…	…	0.88	0.64	1.21
Occupation (Nonpaid/family work)	1.53	0.98	2.4	1.48	0.93	2.36	…	…	…	1.48	0.93	2.36
Unemployed	1.26	0.9	1.76	1.44	1.01	2.05	…	…	…	1.44	1.01	2.04
Inactive	2.84	2.11	3.83	2.07	1.51	2.82	…	…	…	2.07	1.52	2.82
High quality house	1	…	…	…	…	…	1	…	…	1	…	…
Regular quality house	1.32	1.25	1.39	…	…	…	1.26	1.19	1.33	1.07	1.01	1.13
Poor quality house	1.94	1.67	2.26	…	…	…	1.63	1.38	1.93	1.27	1.07	1.51
Deficient sanitary system	1.19	1.12	1.26	…	…	…	1.12	1.03	1.22	0.98	0.9	1.07
No overcrowding	1	…	…	…	…	…	1	…	…	1	…	…
Moderate overcrowding	2.6	2.19	3.1	…	…	…	0.89	0.74	1.06	1.05	0.87	1.26
Severe overcrowding	4.25	2.58	7	…	…	…	1.37	0.81	2.33	2.02	1.14	3.55

ORs: 2.60 moderate and 4.25 severe overcrowding, respectively, Model 1 in Table 2). This gradient was not affected by other measures of material conditions but was confounded by age. This finding might suggest that those with disability in older age groups have more chance of living in overcrowding households. Nonetheless, in the fully adjusted model, only severe overcrowding maintained a significant association with any disability (Model 4, Table 2).

Any disability in Chile by different age groups, fully adjusted models

Adjusted ORs of presenting any disability in Chile by age group are presented in Table 3. Age and being in the poorest income quintile were both significantly associated to a higher chance of any disability across all age groups. In the middle-age group (15-64 years old, representing the active labor force in the country), other covariates were significantly associated to any disability, such as being male (OR = 0.73 for female), rurality (OR = 0.75), being single or divorced (OR = 1.95 and 1.82, respectively), being occupationally inactive (OR = 2.26), having poor quality housing (OR = 1.37,with significant trend), and severe overcrowding (OR = 2.64, with significant trend). Additionally, both educational level and household income showed a statistically significant gradient with any disability. Finally, in the oldest age group (over 64 years old), the only covariates significantly associated with disability were rurality (OR = 0.88), single marital status (OR = 1.33), income (again, with a statistically significant gradient) and being unemployed (OR = 2.56), or inactive (OR = 2.75). No material conditions were significantly related to any disability in this age group.

Types of disability by different age groups, fully adjusted models

The estimated ORs of having each type of disability in Chile, adjusted by sociodemographics, classic socioeconomic position measures, and material living standards are presented in Table 4. Age, gender, and having a primary education level were all significantly associated with

Table 3
Adjusted odds ratios (ORs) of having any disability in Chile by age group with 95% confidence intervals (CI) deom CASEN, 2006

	Model 1 (Sociodemographic variables + Social Position variables + Material Living Standard Variables)			Model 2 (Sociodemographic variables + Social Position variables + Material Living Standard Variables)			Model 3 (Sociodemographic variables + Social Position variables + Material Living Standard Variables)		
	Population < 15 years old			Population 15-64 years old			Population > 64 years old		
	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS
Age	1.09	1.07	1.12	1.05	1.05	1.06	1.05	1.05	1.06
Sex	0.93	0.77	1.12	0.73	0.67	0.79	0.92	0.83	1.02
Zone (reference is urban)	0.70	0.57	0.86	0.75	0.70	0.82	0.88	0.79	0.97
Marital status (married or cohabitant)	…	…	…	1.00	…	…	1.00	…	…
Marital status (divorced)	…	…	…	1.82	1.58	2.09	1.15	0.93	1.43
Marital status (widow)	…	…	…	1.06	0.89	1.28	1.10	0.98	1.24
Marital status (single)	…	…	…	1.95	1.77	2.14	1.33	1.12	1.58
Education (university or more)	…	…	…	1.00	…	…	1.00	…	…
Education (technical)	…	…	…	1.11	0.87	1.42	0.80	0.41	1.58
Education (high school)	…	…	…	1.27	1.08	1.50	1.14	0.81	1.60
Education (primary school)	…	…	…	1.87	1.57	2.23	1.26	0.90	1.76
Education (not formal)	…	…	…	6.08	4.92	7.53	1.23	0.86	1.76
Income Quintile 1 (wealthiest)	1.00	…	…	1.00	…	…	1.00	…	…
Income Quintile 2	1.02	0.68	1.54	1.24	1.08	1.43	1.36	1.13	1.63
Income Quintile 3	1.22	0.83	1.81	1.35	1.18	1.55	1.39	1.15	1.66
Income Quintile 4	1.64	1.13	2.37	1.35	1.18	1.56	1.44	1.19	1.73
Income Quintile 5 (poorest)	1.93	1.35	2.78	1.45	1.25	1.68	1.47	1.19	1.82
Occupation (Executive/Chief)	…	…	…	1.00	…	…	1.00	…	…
Occupation (Independent/self employed)	…	…	…	1.09	0.76	1.55	1.92	1.04	3.55
Occupation (Employee)	…	…	…	0.81	0.57	1.15	1.25	0.66	2.38
Occupation (Nonpaid/family work)	…	…	…	1.56	0.93	2.62	1.63	0.57	4.68
Unemployed	…	…	…	1.36	0.92	2.00	2.56	1.06	6.21
Inactive	…	…	…	2.26	1.60	3.20	2.75	1.52	4.98
High quality house	1.00	…	…	1.00	…	…	1.00	…	…
Regular quality house	1.05	0.85	1.29	1.06	0.98	1.15	1.10	0.99	1.22
Poor quality house	0.69	0.38	1.28	1.37	1.10	1.70	1.28	0.96	1.69
Deficient sanitary system	1.10	0.81	1.49	1.00	0.89	1.12	0.90	0.79	1.03
No overcrowding	1.00	…	…	1.00	…	…	1.00	…	…
Moderate overcrowding	1.35	0.22	8.19	1.08	0.81	1.43	1.05	0.82	1.34
Severe overcrowding	…	…	…	2.64	1.13	6.21	1.37	0.70	2.67

Table 4
Odds ratios (ORs) of having each type of disability in Chile with 95% confidence intervals (CI) from CASEN 2006

	Visual Disability[a]			Hearing Disability[a]			Speaking Disability[a]			Physical Disability[a]			Cognitive Disability[a]			Psyathric Disability[a]		
	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS	OR	L-CI	U-CS
Age	1.04	1.04	1.05	1.06	1.06	1.06	1.03	1.03	1.04	1.05	1.05	1.05	1.02	1.02	1.03	1.02	1.02	1.03
Sex	1.16	1.06	1.26	0.67	0.59	0.76	0.51	0.41	0.64	0.81	0.74	0.90	0.69	0.59	0.82	0.96	0.77	1.20
Zone (reference is urban)	0.72	0.65	0.79	0.84	0.75	0.95	0.72	0.57	0.91	0.92	0.85	1.01	0.91	0.78	1.06	0.48	0.38	0.61
Marital status (married or cohabitant)	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Marital status (divorced)	1.33	1.14	1.56	1.01	0.79	1.29	1.45	0.72	2.95	1.75	1.45	2.10	1.73	1.06	2.84	4.14	2.79	6.14
Marital status (widow)	0.94	0.83	1.06	1.12	0.96	1.32	0.89	0.60	1.32	1.08	0.95	1.23	1.52	1.07	2.16	0.84	0.52	1.34
Marital status (single)	1.09	0.97	1.22	1.29	1.09	1.54	2.51	1.79	3.54	1.59	1.40	1.81	8.00	6.31	10.15	2.56	1.89	3.46
Education (university or more)	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Education (technical)	0.78	0.58	1.05	0.70	0.38	1.31	2.05	0.53	7.86	1.43	0.93	2.20	1.81	0.53	6.12	0.72	0.35	1.51
Education (high school)	1.18	0.98	1.43	1.36	0.93	2.00	1.98	0.85	4.65	1.21	0.90	1.61	2.90	1.37	6.13	0.69	0.43	1.11
Education (primary school)	1.24	1.02	1.51	1.84	1.25	2.69	3.16	1.37	7.31	1.52	1.14	2.04	9.91	4.75	20.69	0.85	0.53	1.34
Education (not formal)	1.04	0.83	1.32	2.31	1.51	3.51	9.50	3.95	22.85	1.87	1.35	2.59	58.20	27.05	125.22	1.13	0.62	2.04
Income Quintile 1 (wealthiest)	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Income Quintile 2	1.22	1.06	1.41	1.28	1.03	1.60	0.99	0.62	1.56	1.48	1.24	1.77	0.97	0.68	1.38	0.89	0.56	1.41
Income Quintile 3	1.31	1.13	1.51	1.24	1.00	1.55	1.12	0.73	1.72	1.59	1.33	1.90	0.99	0.71	1.39	1.59	1.02	2.49
Income Quintile 4	1.48	1.27	1.71	1.26	1.02	1.57	1.39	0.91	2.13	1.51	1.26	1.80	0.97	0.70	1.34	1.68	1.07	2.62
Income Quintile 5 (poorest)	1.55	1.32	1.82	1.16	0.92	1.46	1.50	0.96	2.37	1.86	1.54	2.25	1.07	0.77	1.49	1.94	1.21	3.10
Occupation (Executive/chief)	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Occupation (Independent/self employed)	1.44	0.94	2.21	1.40	0.79	2.48	0.42	0.05	3.24	0.81	0.46	1.41	14.89	1.98	111.93	3.61	1.18	11.02
Occupation (Employee)	1.05	0.69	1.60	1.35	0.78	2.36	0.28	0.04	2.00	0.49	0.28	0.86	9.96	1.34	73.83	1.69	0.56	5.05
Occupation (Nonpaid/family work)	1.14	0.60	2.17	2.09	0.86	5.07	0.86	0.06	11.57	0.76	0.31	1.85	46.10	5.85	363.12	16.12	4.04	64.32
Unemployed	1.54	0.95	2.48	2.43	1.25	4.72	0.34	0.04	2.78	0.75	0.39	1.46	22.17	2.85	172.37	5.27	1.65	16.85
Inactive	1.57	1.04	2.38	2.41	1.40	4.15	0.90	0.13	6.46	1.70	0.98	2.96	59.86	8.26	433.83	5.64	1.91	16.69
High quality house	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Regular quality house	1.06	0.97	1.15	1.08	0.96	1.22	1.08	0.83	1.42	1.17	1.06	1.28	1.01	0.84	1.20	0.91	0.73	1.14
Poor quality house	1.37	1.06	1.78	1.24	0.88	1.75	1.02	0.53	1.95	1.19	0.93	1.54	1.74	1.17	2.58	0.97	0.46	2.06
Deficient sanitary system	0.96	0.83	1.11	0.98	0.84	1.14	1.03	0.77	1.36	0.99	0.89	1.11	0.91	0.75	1.11	0.99	0.71	1.39
No overcrowding	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…	1.00	…	…
Moderate overcrowding	1.23	0.97	1.57	1.32	0.95	1.83	1.02	0.38	2.77	1.11	0.82	1.51	0.72	0.34	1.51	0.73	0.31	1.71
Severe overcrowding	1.70	0.79	3.66	0.82	0.21	3.12	0.00	0.00	0.00	3.87	2.01	7.47	2.34	0.31	17.82	1.25	0.29	5.35

[a] All models adjusted by sociodemographics + social position + material living standard variables.

different types of disability, except for psychiatric disability. For most types of disabilities, there was a higher chance of being either single or divorced (eg, OR = 1.59 and 1.75, respectively, for physical disability type). Rurality did not affect physical and cognitive disability, but it did affect the other 4 types. Educational level showed a gradient with all types of disability, except speaking disability. Income showed the same gradient for visual, speaking and psychiatric disabilities only.

Employed people had a significantly lower chance of having a physical, cognitive, and psychiatric disability. Moreover, people with either cognitive or psychiatric disability had a significant higher chance of being self-employed, unemployed, and inactive, and of working with a family member. Otherwise, those with visual and hearing disability had a higher chance of being inactive. Finally, only visual, physical, and cognitive disabilities had any association with material living standards.

Discussion

Summary of key findings

In our knowledge this is the first study exploring the relationship between disability (any and each type of disability) and socioeconomic position in Chile. Income, education, occupation, and material measures of socioeconomic position, along with some sociodemographic characteristics of the population, were independently associated with the chance of being disabled in Chile. Interestingly, each classic measures of socioeconomic position (income, education, and occupation) were independently and consistently associated with any disability in Chile. The small magnitudes of the polychoric correlation and the high uniqueness of the three classic measures of socioeconomic position in the exploratory factor analysis support the independency of these variables. Material living conditions were partially confounded by the classic measures, remaining a residual association with quality of household and overcrowding. In addition to this, each type of disability showed a particular pattern of related social determinants, which also varied by age group.

Altogether, these findings suggest that there may be no single best measure of socioeconomic position and that the best indicator of socioeconomic inequalities depends on the defined outcome and the target population (eg, by age groups). In this study, different measures of socioeconomic position may influence people's risk of having a disability in different ways: (1) directly (material mechanisms), (2) indirectly (eg, psychosocial), (3) due to selection (ie, having a disability may cause people to experience a fall in their socioeconomic position), (4) there may be an unmeasured underlying factor that affects both socioeconomic position and disability (eg, cultural, behavioral, life-course factors).

No significant modifying or multiplicative interaction effect was found in the study. Multiple potential confounding variables were assessed for each model (data not shown). Age was the most important confounding variable in some of the relationships found between different measurements of socioeconomic position and disability. Three possible reasons exist to explain this effect: (1) It showed a cohort effect in the lower education level (eg, in our data 77.5% of people aged 30-40 years had up to high school education level compared to 41.0%, among those aged 60-70 years old). (2) People living in the relatively poorer households were younger than those living in the wealthier households (this hypothesis was highly improbable, because the mean age of people who lived in poorest income quintile was significantly older than people who live in the wealthiest one). (3) The unemployed group was younger (mean age: 32.5 years) than the employed group (mean age: 39.1 years). In addition, the confounding analysis showed that sanitary system was confounded mainly by quality of housing and education, but not for other variables like income (data not shown). Stratified analysis showed a clear association of disability by age groups, mainly in hearing, visual, and physical disability, also the more prevalent. In addition, men had a higher chance of being disabled than women for all types of disability, except for visual disability. Similar findings have been reported in the international literature [62, 63].

Comparison with other studies

As reported previously in the literature, the multiple indicators of socioeconomic position used in this study were not necessarily interchangeable [64]. Moreover, significant variations in their association with different health conditions have been found in comparative studies of these indicators [65-71]. In this sense, it has been recognized in the international literature that there is no unique or optimal way to measure socioeconomic position (in other words, there is no gold standard) [21-23]. Rather, its measurement varies with the research question, and takes into consideration the theory being used, the population of interest, the outcome of interest and, in some cases, the data available.

Some descriptive findings on the prevalence of any and each type of disability were consistent with those reported in the past in Chile [72]. However, no other study exploring the relationship between disability and socioeconomic position in this country was found at the time this study was conducted. International studies have found a gradient in disability by income, education, occupation, and material living standards [11, 35, 73-75]. Results from these international studies were consistent with findings from the present study. In addition, many other studies have analysed a particular type of disability or the relationship of disability with a specific domain of socioeconomic position [76-79]. This study, in contrast, has provided a broad understanding of a wide range of disabilities and their relationship with different key components of socioeconomic position, including the classic measures (income, education, and occupation) and material living standards.

Strengths and limitations

The data used in our study belonged to a large national representative cross-sectional survey from Chile. However, due to the cross-sectional design used in this study, we cannot determine whether socioeconomic position is a cause or a consequence of disability [80-82]. Besides, there are very few prospective studies in this particular matter [83, 84], but the discussion regarding temporality in the relationship between socioeconomic position and a variety of health outcomes has been widely discussed. In this sense, it has been suggested the ex ante importance of socioeconomic position [85], as many cross-sectional and prospective studies conducted all over the world have been coherent in reporting the strong effect of socioeconomic position on many health outcomes among different populations over time [14, 36, 73, 74, 86].

In terms of potential self-report bias, although some limitations have been recognized, self-reported health status remains an important measure widely promoted by international health organizations [52, 87, 88]. Nevertheless, this could explain why people living in rural areas present less adjusted risk of disability, because they may have lower standard of well-being, biasing the self-report.

Finally, self-reported disability used in this study did not allow a clear distinction between the conceptual domains of *capacity* (referring to achieving tasks in a uniform environment) and *performance* (referring to achieving tasks in the real environment) [45, 88]. Consequently, it is difficult to elucidate if self-reported disability reflects physiological and/or structural disorders, or rather environmental factors that have limited participant's development of daily activities.

Implications and further research challenges

Our study reflects the complexity of the construct of socioeconomic position [21-23] and the need to consider the local *ecosocial* context when defining it and measuring it [4, 5]. Despite these limitations, findings from our study contribute to the understanding of disability in Chile and how socioeconomic position, both its classic components and material conditions, affect this prevalent condition. These findings might be useful for policy aim in the country, in order to protect and improve the living conditions of people living with any disability in Chile. Their socioeconomic position and material living standards should receive particular attention and should be addressed simultaneously.

Disability remains as a complex multidimensional public health problem, not only in Chile but also in many other developing and developed countries. The possible correlation between the classic measures of socioeconomic position and material conditions should be further analyzed, along with the existing interactions between different social determinants of health that were not included in this study (eg, ethnicity, geographical location, access to health care, among others). We highlight the need for more studies to be conducted, testing the different instruments used to measure disability, ideally prospectively, and combining the classic socioeconomic position measures with material living standards and relevant psychosocial factors. Factors like stress, social support, trust, self-perception of occupational control and autonomy, labor opportunities, social benefits among disabled people in Chile, etc, should be considered in future studies on disability [35, 89-94].

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