



What makes the difference in people's lives when they have a mental disorder?

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Abstract

Objectives The objective of this study was to identify which environmental factors are the most responsible for the disability experienced by persons with mental disorders and whether they differ (1) from those in cardiovascular diseases, chronic respiratory conditions, diabetes, and cancer, and (2) depending on the capacity level—a proxy for the impact of health conditions on the health state of individuals.

Methods Nationally representative data from 12,265 adults in Chile collected in 2015 with the WHO Model Disability Survey was analyzed.

Results The availability of personal assistance, frequency of receiving personal assistance, and assistive devices for mobility were the most important environmental factors across mental and other non-communicable diseases. Perception of discrimination and use of health services were

also prominent factors. There was a huge overlap between the factors found relevant for mental and other non-communicable diseases, but a substantial variability depending on the intensity of difficulties in capacity.

Conclusions This study challenges the appropriateness of disease-specific approaches and suggests that considering intrinsic capacity levels is more informative than focusing on diagnosis alone when comparing needs and barriers that affect the performance in daily life of specific groups of individuals.

Keywords Environmental health · Mental health · Non-communicable disease · Disability, public health

Introduction

Mental disorders (MDs) are highly prevalent worldwide and considered one of the five most burdensome non-communicable (NCD) conditions besides diabetes, cancer, cardiovascular disease (CVD) and chronic respiratory

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diseases (Vos et al. 2013; World Health Organization 2014a). MDs have major social, human rights, and economic consequences. In terms of social determinants, there is good evidence that MDs are distributed according to a gradient of economic disadvantage across society (World Health Organization 2014a). Important systematic differences in mental health by gender, age, ethnicity, income, education, or geographic area of residence have been consistently reported (Campion et al. 2013; Patel and Kleinman 2003). On the other hand, MDs are associated with human rights violations. People with MDs lack very often basic human rights, such as shelter, food and clothing, and are discriminated in the fields of employment, education and housing. (World Health Organization 2014a). In terms of economic impact on society, MDs cause significant socio-economic costs, estimated at US\$ 2.5 trillion in 2010 and projected at 6.0 trillion US\$ for 2030 (Bloom et al. 2011). These costs are due to treatment expenditures and costs associated to loss of income, and indicate the enormous negative impact that MDs have on individuals and society.

Persons with MDs experience high levels of disability in their daily life (Alonso et al. 2013). The World Health Organization (WHO) describes disability as the outcome of the interaction between an individual with a health condition, and personal and environmental factors (EFs) (World Health Organization 2001). Disability in this sense can be also referred to as performance and encompasses not only impairments in mental functions, such as lack of energy or problems in regulating emotions, but also activities limitations and restrictions in participation, such as problems in carrying out daily chores and getting a job (Cieza et al. 2015). The extent of the disability a person experiences varies greatly depending on the accessibility to good quality treatment and other goods and services as well as on the built, political, social and attitudinal environment (Bostan et al. 2015; Sabariego et al. 2015a). The last decades are associated with some dramatic shifts in the health and demographic profiles of populations (Vos et al. 2016). People are living longer and there is an increase of disabling chronic conditions that impact on their functioning (Chatterji et al. 2015). Also, greater numbers of people survive injury and illness but remain with important limitations in functioning. In this sense, disability—how well people live in terms of functioning in daily life—is as relevant as mortality—how long people live—and a major public health priority. Health systems are challenged to respond timely and efficiently to disability and not only to mortality.

Data on the EFs that create or worsen the disability experienced by persons with MDs (World Health Organization 2014c) is scarce, and tends to focus on single health conditions and the impact of EFs in isolation. Two EFs are,

however, of acknowledged importance across MDs—discrimination and use of health services. Studies have shown that stigmatization and discrimination is common among people with MDs (Lewis et al. 2014; Thornicroft et al. 2010) and that a very low percentage of individuals with MDs receive treatment, compared to other NCDs (Alonso et al. 2007; Kessler et al. 2005; Wang et al. 2005). For instance, across Europe 74% of those with MDs receive no treatment compared to only 8% of people with diabetes (Alonso et al. 2007). The WHO has suggested that the scale of this “treatment gap” is disorder-specific and varies from 32% in schizophrenia to 78% in alcohol dependence (Kessler et al. 2005). Evidence on further EFs is still seldom.

An important and direct source of broad data on EFs acting as barriers are comprehensive disability surveys that go beyond the estimation of disability rates, such as the WHO and World Bank (WB) Model Disability Survey (MDS) (Loidl et al. 2016). MDS data of representative population samples offer an invaluable platform to study built, social and attitudinal EFs most commonly associated with MDs, to identify targets for public health interventions. These data offer the possibility to determine whether EFs associated with MDs have the same impact on other major NCDs. Since most countries focus their public health interventions on major NCDs, this information would give us a sense of the extent to which these interventions also meet the needs of people with MDs. Using data from the implementation of the MDS as a national survey in Chile, this study will focus on the following objectives:

1. to identify which factors of the environment have the greatest impact on disability experienced by persons with MDs;
2. to evaluate whether these factors are different from those most responsible for disability in persons with CVD, chronic respiratory diseases, diabetes and cancer, and
3. to examine whether these factors of the environment have a different impact depending upon the capacity level, used as a proxy of the impact of one or more health conditions on the health state of individuals.

This study is important in the context of the global burden of disease and global human rights challenges that the MDs and other NCDs are posing. MDs are one of the leading causes for years-lived-with-disability (YLDs) worldwide responsible for more than 150 million YLDs (Vos et al. 2016). Also, the world is facing a global human rights emergency in mental health: people with mental disorders very frequently do not have access to adequate treatment, and institutional care—which is usually associated with human rights violations including degrading treatment or living conditions—is still the only treatment

option in several countries (World Health Organization 2017). Disclosing factors of the environment impacting the performance of persons with MDs and NCDs is therefore extremely important for laying the grounds for interventions and policy: only by broadly understanding the built, political, social and attitudinal environment of persons with MDs and NCDs, concrete actions can be taken.

Methods

Study design and participants

The current study is a secondary data analysis of the second national disability survey of Chile (ENDISC II) carried out in 2015. ENDISC II aimed to determine the prevalence at national level, to identify the main barriers and inequalities faced by people with disability and to provide evidence for the further development of national regulations and policies, plans and programmes. The data collection was carried out between June and September 2015, with a total of 12,015 households being surveyed with the same number of adults (aged 18 years and over) being interviewed. ENDISC II was representative at national, regional, and geographic (urban/rural) levels for the adult population (> 18 years). The sampling was based on the list of households previously identified in the Survey of National Socioeconomic Characterization (Encuesta de Caracterización Socioeconómica Nacional—Casen) in 2013 (Ministerio de Desarrollo Social 2016). A two-stage sampling design stratified by communes and geographic area was used. The sample size of 12,196 households was calculated based on the national disability rate of 12.9% estimated in ENDISC I, assuming an absolute error of 0.4% and a relative error of 3.5%. In total, 11,981 households were interviewed (98% response rate), resulting in a sample size of 17,780 individuals (12,265 adults and 5515 children). This study focuses only on the results for the adult population.

ENDISC II has implemented the three core modules of the full version of the MDS: environmental factors (module 3000), functioning (module 4000), and capacity and health conditions (5000) (the MDS questionnaires are available at: <http://www.who.int/disabilities/data/mds/en/>). The MDS is a general population survey grounded in the International Classification of Functioning, Disability and Health (ICF) (World Health Organization 2001) and operationalizes an advanced concept of disability measurement, focusing on performance, i.e. the degree of execution of simple and complex actions modelled as the outcome of the interaction between a health condition and various environmental and personal factors. The MDS has a household and an individual questionnaire, filled out by a

randomly selected adult member of the household. The present study used variables from three core MDS modules. Further details on the MDS design can be found elsewhere (Sabariego et al. 2015b).

In the present study, we analyzed persons who had either a mental disorder (depression, anxiety, schizophrenia, autism, bipolar disorder, alcohol use and drug use) ($N = 2699$), a CVD (hypertension, heart or coronary disease, or heart attack) ($N = 3679$), diabetes ($N = 1581$), cancer ($N = 273$) or a chronic respiratory disease (chronic bronchitis, emphysema, asthma or allergic respiratory disease) ($N = 1244$). Comorbidities were allowed between these NCDs.

Variables

Performance and capacity

Performance targets the way people function in daily life in multiple functioning domains in the presence of health problems and taking into account all environmental barriers or facilitators that constitute their real life setting. Performance is the dependent variable in the present study. Capacity targets the level of functioning intrinsic to the individual in different functioning domains because of health problems and conditions. In this sense, capacity reflects the intrinsic health state of an individual with one or more health conditions and accounts for the presence of comorbidity.

Participants responded several questions regarding their performance and capacity in 17 functioning domains. All questions had five ordinal response options ranging from 1, no problems, to 5, extreme problems. A single metrical score, ranging from 0, no difficulties, to 100, extreme difficulties, was created—using all questions of module 4000 for performance and all capacity questions of module 5000 for capacity—by the Chilean Statistics Bureau following the WHO recommendations for the data analyses of the MDS (Sabariego et al. 2015b).

Environmental factors

Predictor variables were several EFs divided into (1) 12 hindering or facilitating factors of the general environment like health facilities, places to socialize, transportation; (2) frequency of use and need of personal assistance; (3) use of assistive devices and modifications related to mobility (crutches), seeing (glasses, lenses), hearing (hearing aid, TV with subtitles), work (elevator), education (scanner, printer), home (door handles) and public spaces (adapted public transport); (4) use of health care services or any rehabilitation service in the last 12 months; and (5) perception of discrimination in the last 12 months.

Health conditions

Health conditions were assessed based on the Self-Administered Comorbidity Questionnaire (SCQ) (Sangha et al. 2003). This tool includes a list of country-specific high prevalent or high priority health conditions. For each condition, respondents were asked “1. Do you have [DISEASE NAME]?”

Control variables

Analysis was adjusted for age, sex, education and capacity.

Statistical analyses

Random forest (RF) analysis was used to identify which EFs have the highest impact on performance. It is based on the regression tree method and serves to identify variable importance and rank predictors (Breiman 2001). The responses of the single trees were averaged to obtain an estimate of their importance in explaining variance in the dependent variable (Hothorn et al. 2006). Control variables were forced in the model. The importance of predictors was given by the variable importance measure (VIM) which represented the average of the frequency with which predictors were kept in the thousand regression trees. VIM provides unbiased rankings of the predictors according to their association with the performance metric. Higher VIM values indicate higher relevance of the variables in predicting performance.

The RF analysis was first carried out for five groups of NCDs—cancer, diabetes, CVD, respiratory diseases and MDs. Additionally, the analyses were stratified by capacity level. The levels of difficulties in capacity corresponded to cut-off points previously set based on recommendations of WHO for the MDS (Sabariego et al. 2015b). Persons with capacity scores > 44.1 had severe difficulties in capacity, persons with capacity scores between 30 and 44.1 had moderate, and individuals with capacity scores < 30 had mild or no difficulties. As we were interested only in the ranking of the importance of variables in a RF model, sampling weights were not included. After the RF analyses were performed, multiple linear regressions were applied repeatedly to determine the explained variance in performance by the independent variables with the highest VIMs. Variables were included stepwise (in descending order of importance) in a final model according to the VIM's ranking in the RF analysis. The explained variance was indicated with R^2 and adjusted R^2 . The adjusted R^2 was used as a reference to assess the percentage of variance in performance explained by the EFs with the highest importance in the RF analysis.

Descriptive statistics were obtained with SPSS, version 21 (IBM Corp 2012). RF and multiple regression analyses were performed in R Studio (Team 2015). For RF analyses, the R function ‘cforest’ was used (package ‘party’) (Team 2015).

Results

Characteristics of the study population

The majority of the sample was female (61% in CVD to 70% in cancer) and mean age ranged between 50 in MD and 61 years in CVD and diabetes (Table 1). Many participants had more than one condition: 42% of individuals with MD, for example, had also a CVD.

Impact of environmental factors on performance

The three EFs with highest VIM were the same for MD and the other NCD: use and frequency of use of personal assistance as well as assistive devices for mobility (Table 2). Further common EFs, among the ten highest, between MD and the NCDs were discrimination, hindrance level of transportation and of shops or banks. Use of health care service was only highly ranked among the top ten EFs for MDs. The starting model controlling for age, gender, level of education and capacity explained between 62 and 69% of the variance in performance across NCDs. The EFs with the highest VIMs did not contribute much to the additional explained variance, adding less than 3%.

Mild level of capacity difficulties

There were not many common EFs across the five NCD groups except the use of health services and use of personal assistance (Table 3). Use of health services was the most important EF for MDs, but discrimination was not ranked among the top ten EFs for MDs. Due to low number of people with cancer, the model had low power and only six EFs were ranked. The starting model controlling for age, gender, level of education and capacity explained between 14 and 36% of the variance in performance across the NCDs. The EFs with the highest VIMs added only 2% to the additional explained variance.

Moderate level of capacity difficulties

Discrimination was a common top ranked EF for all NCDs (Table 4). Further common EFs across NCDs were use of personal assistance and assistive devices for seeing and mobility. Use of health services was not a highly ranked EF

Table 1 Characteristics of the sample; Chile, 2016

| | Mental disorders <i>N</i> = 2699 | | Cardiovascular disorders <i>N</i> = 3679 | | Respiratory disorders <i>N</i> = 1244 | | Diabetes <i>N</i> = 1581 | | Cancer <i>N</i> = 273 | |
|---|-------------------------------------|------|---|------|--|------|-----------------------------|------|--------------------------|------|
| | <i>N</i> | % | <i>N</i> | % | <i>N</i> | % | <i>N</i> | % | <i>N</i> | % |
| Females | 1848 | 68 | 2276 | 61 | 807 | 64 | 1025 | 64 | 193 | 70 |
| Educational level | | | | | | | | | | |
| No/primary school | 916 | 34 | 1706 | 46.4 | 458 | 36.8 | 745 | 47.1 | 89 | 32.6 |
| High school | 1142 | 42.3 | 1434 | 39 | 484 | 38.9 | 616 | 39 | 121 | 44.3 |
| University degree | 639 | 23.7 | 537 | 14.6 | 301 | 24.2 | 220 | 13.9 | 63 | 23.1 |
| Comorbidities | | | | | | | | | | |
| Mental disorders | | | 1134 | 30.8 | 462 | 37.1 | 499 | 31.6 | 99 | 36.3 |
| Cardiovascular disorders | 1134 | 42 | | | 579 | 46.5 | 1060 | 67 | 120 | 44 |
| Respiratory Disorders | 462 | 17.1 | 579 | 15.7 | | | 234 | 14.8 | 47 | 17.2 |
| Diabetes | 499 | 18.5 | 1060 | 28.8 | 234 | 18.8 | | | 56 | 20.5 |
| Cancer | 99 | 3.7 | 120 | 3.3 | 47 | 3.8 | 56 | 3.5 | | |
| Persons, who have felt discriminated in the last 12 months | 698 | 26 | 576 | 15.6 | 248 | 20 | 266 | 16.8 | 55 | 20.1 |
| Persons, who have received health care in the last 12 months | 2313 | 86 | 3316 | 90.1 | 1107 | 89 | 1476 | 93.4 | 264 | 96.7 |
| Persons, who have received rehabilitation service in the last 12 months | 438 | 16.2 | 3197 | 87 | 204 | 16.4 | 222 | 14 | 67 | 24.5 |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Age | 50 | 17 | 61 | 15 | 53 | 19 | 61 | 14 | 57 | 16 |
| Performance score ^a | 46.3 | 11.4 | 42.9 | 13.8 | 43.9 | 13.6 | 43.6 | 13.5 | 46.2 | 11.8 |
| Capacity score ^b | 40.4 | 15.1 | 37.3 | 16.2 | 38.7 | 16.4 | 38.1 | 16.4 | 40.9 | 16.1 |

^aPerformance score: value ranges from 0 to 100, meaning the higher the score the greater the problems in the daily life performance

^bCapacity score: value range is from 0 to 100, meaning the higher the score the greater the difficulties experienced because of health related decrements in functioning domains

for none of the NCDs. However, use of rehabilitation services was highly ranked for both MDs and chronic respiratory conditions. The starting model controlling for age, gender, level of education and capacity explained up to 15% of the variance in performance across the NCDs. The EFs with the highest VIMs added less than 1% variance. Only in the case of cancer, the EFs added 5% additional variance.

Severe level of capacity difficulties

With the exception of diabetes, results were very similar for four NCDs (Table 5). Use and frequency of use of personal assistance as well as assistive devices for mobility had the highest impact on performance. Use of health services was not among the highly ranked EFs for any of the NCDs. The starting model explained between 33 and 48% of the variance in performance across the NCDs. The EFs with the highest VIMs contributed to the additional explained variance with less than 2%. Only in the case of cancer was there an additional variance (5%).

Discussion

Using data of the implementation of the MDS as a national survey in Chile, we identified which factors of the environment are the most responsible for the disability experienced by persons with MDs and whether these factors are different in the case of persons with four major NCDs—CVD, chronic respiratory diseases, diabetes and cancer. As expected, discrimination and use of health services were important factors for the overall performance in daily life of people with MDs. EFs not commonly associated with MDs—such as personal assistance, use of assistive devices and the hindrance level of general environment—also had a considerable impact on performance. A large overlap between the EFs found relevant for MDs and for other NCDs was observed, which suggests that public health interventions developed for major NCDs might reach people with MDs as well. EFs most responsible for disability in MDs and in other NCDs differed considerably between persons with mild, moderate and severe levels of difficulties in capacity. In this sense, public health actions

Table 2 Results from the random forest and repeated linear regression models showing the environmental factors with the highest impact on performance; Chile, 2016

| Category | Variable | Mental disorders <i>N</i> = 2699 | | Cardiovascular disorders <i>N</i> = 3679 | | Respiratory disorders <i>N</i> = 1244 | | Cancer <i>N</i> = 273 | | Diabetes <i>N</i> = 1581 | |
|---------------------|-------------------------|-------------------------------------|-------------|---|-------------|--|-------------|-----------------------|-------------|-----------------------------|-------------|
| | | VIM (Rank) | R^2_{adj} | VIM (Rank) | R^2_{adj} | VIM (Rank) | R^2_{adj} | VIM (Rank) | R^2_{adj} | VIM (Rank) | R^2_{adj} |
| Control | Age | 0.2 | 0.618 | 0.4 | 0.687 | 0.2 | 0.683 | 0.04 | 0.683 | 1.2 | 0.679 |
| | Sex | 1.3 | | 0.2 | | 4.2 | | 0.5 | | 0.5 | |
| | Level of education | 0.7 | | 0.8 | | 1.9 | | 2.3 | | 0.5 | |
| | Capacity | 74.3 | | 129.8 | | 109.7 | | 71.9 | | 115.7 | |
| General EF | Health facilities | 0.1 (19) | 0.57 | 0.3 (18) | 0.679 | 0.8 (11) | 0.678 | 0.1 (18) | 0.632 | 0.4 (16) | 0.678 |
| | Places to socialize | 1.1 (4) | 0.619 | 1.03 (8) | 0.679 | 0.5 (14) | 0.673 | 0.5 (11) | 0.684 | 1.9 (7) | 0.672 |
| | Shops/banks | 0.6 (7) | 0.619 | 1.1 (7) | 0.682 | 0.5 (15) | 0.671 | 1.1 (6) | 0.689 | 3.04 (4) | 0.675 |
| | Worship | 0.1 (29) | 0.567 | 0.3 (17) | 0.68 | 0.3 (18) | 0.682 | 0.4 (13) | 0.669 | 0.5 (15) | 0.677 |
| | Transportation | 0.8 (5) | 0.62 | 1.4 (4) | 0.686 | 0.9 (7) | 0.679 | 1.7 (5) | 0.685 | 2.5 (6) | 0.673 |
| | Dwelling | 0.5 (10) | 0.619 | 0.8 (9) | 0.679 | 0.6 (13) | 0.679 | 0.6 (10) | 0.693 | 0.8 (12) | 0.674 |
| | Terrain/climate | 0.5 (11) | 0.619 | 0.5 (14) | 0.682 | 0.8 (12) | 0.678 | 0.3 (14) | 0.668 | 0.8 (11) | 0.674 |
| | Lighting | 0.4 (13) | 0.619 | 0.4 (16) | 0.682 | 0.08 (9) | 0.677 | 0.2 (16) | 0.669 | 0.1 (18) | 0.677 |
| | Noise | 0.3 (16) | 0.571 | 0.3 (19) | 0.679 | 0.09 (21) | 0.591 | 1.1 (7) | 0.69 | 0.1 (19) | 0.677 |
| | Crowds | 0.3 (15) | 0.57 | 0.6 (12) | 0.68 | 0.4 (16) | 0.673 | 0.9 (8) | 0.694 | 0.9 (10) | 0.674 |
| | Workplace | 0.4 (14) | 0.571 | 0.2 (20) | 0.632 | 0.09 (20) | 0.589 | 0.2 (17) | 0.634 | 0.09 (20) | 0.626 |
| | Educational institution | 0.03 (23) | 0.567 | 0 (23) | 0.632 | − 0.02 (24) | 0.59 | 0 (24) | 0.617 | 0 (24) | 0.624 |
| | Pers. assistance | Personal Assistance | 3.9 (1) | 0.619 | 8.03 (1) | 0.687 | 8.0 (1) | 0.682 | 4.9 (3) | 0.685 | 10.9 (1) |
| Frequency | | 2.9 (2) | 0.619 | 7.06 (2) | 0.687 | 6.2 (2) | 0.681 | 11.2 (1) | 0.686 | 8.8 (2) | 0.679 |
| Health care | Health Service | 0.7 (6) | 0.621 | 0.1 (21) | 0.632 | − 0.03 (23) | 0.59 | 0 (22) | 0.617 | 0.2 (17) | 0.678 |
| | Rehabilitation | 0.09 (21) | 0.567 | 0.4 (15) | 0.682 | 0.3 (17) | 0.673 | 0.1 (19) | 0.628 | 0.09 (21) | 0.626 |
| Attitudes of others | Discrimination | 0.5 (9) | 0.619 | 1.2 (6) | 0.684 | 0.9 (8) | 0.678 | 0.7 (9) | 0.693 | 2.6 (5) | 0.673 |
| Assistive devices | Mobility | 2.4 (3) | 0.621 | 3.2 (3) | 0.688 | 2.8 (3) | 0.682 | 5.8 (2) | 0.686 | 3.9 (3) | 0.679 |
| | Seeing | 0.6 (8) | 0.621 | 0.5 (13) | 0.682 | 1.3 (5) | 0.682 | 0.4 (12) | 0.684 | 0.5 (13) | 0.674 |
| | Hearing | 0.2 (17) | 0.57 | 0.6 (11) | 0.679 | 0.8 (10) | 0.678 | 0.3 (15) | 0.671 | 0.5 (14) | 0.674 |
| | Work | 0.07 (22) | 0.567 | 0.05 (22) | 0.632 | 0.002 (22) | 0.591 | 0 (20) | 0.623 | 0.05 (22) | 0.625 |
| | Education | − 0.01 (24) | 0.567 | 0 (24) | 0.632 | 0.1 (19) | 0.683 | 0 (23) | 0.617 | 0 (23) | 0.624 |
| | Home | 0.5 (12) | 0.619 | 0.7 (10) | 0.679 | 0.9 (6) | 0.682 | 0.01 (21) | 0.621 | 1.02 (9) | 0.671 |
| | Public spaces | 0.2 (18) | 0.571 | 1.2 (5) | 0.686 | 1.7 (4) | 0.681 | 3.2 (4) | 0.685 | 11 (8) | 0.672 |

The most important EFs are marked in bold

VIM variable importance measures estimated with random forest regression, R^2_{adj} R^2 adjusted showing the increase in explained variance calculated with classical multiple linear regression analyses by adding the determinants stepwise in descending rank order into the model, *EF* environmental factors, *Control* all models were controlled for age, gender, level of education and capacity. For gender the reference category was male, for education—no/primary school)

tailored to MDs or other NCDs would gain in precision by considering the capacity of individuals when selecting specific needs and barriers as targets.

Absence of personal assistance and assistive devices for mobility was the most responsible factors for the disability experienced both by persons with MDs and other NCDs.

This shows that continuous and coordinated care in the community is a key element to prevent and overcome the disability level associated with MDs, particularly for persons with moderate to severe levels of capacity difficulties. While these findings sound intuitive for the rather “physical” NCDs, they are surprising for MDs. The strong

Table 3 Results from a random forest analysis showing the ten environmental factors with the highest impact on performance in people with mild levels of capacity difficulties; Chile, 2016

| Rank | Mental disorders <i>N</i> = 643 | | Cardiovascular disorders <i>N</i> = 1230 | | Respiratory disorders <i>N</i> = 374 | | Cancer <i>N</i> = 69 | | Diabetes <i>N</i> = 500 | |
|------|---|-----|---|-----|--------------------------------------|-----|-------------------------------------|-------|--|-----|
| | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM |
| 1 | Use of health services | 4.3 | Assistive devices for seeing | 1.4 | Hindrance level of health facilities | 0.6 | Assistive devices for seeing | 1.07 | Hindrance level of shops/banks | 4.8 |
| 2 | Hindrance level of public transport | 1.8 | Hindrance level of public transport | 1.2 | Hindrance level of dwelling | 0.5 | Hindrance level of shops/banks | 1.4 | Hindrance level of crowds | 2.8 |
| 3 | Hindrance level of lighting in surroundings | 0.9 | Personal assistance | 0.9 | Hindrance level of public transport | 0.5 | Hindrance level of public transport | 1.4 | Discrimination | 2.2 |
| 4 | Hindrance level of places to socialize | 0.9 | Frequency personal assistance | 0.8 | Hindrance level of workplace | 0.5 | Use of rehabilitation services | 0.3 | Personal assistance | 2.1 |
| 5 | Assistive devices for seeing | 0.4 | Hindrance level of lighting in surroundings | 0.6 | Hindrance level of places to worship | 0.2 | Discrimination | 0.01 | Hindrance level of health facilities | 1.1 |
| 6 | Personal assistance | 0.2 | Assistive devices in public spaces | 0.6 | Personal assistance | 0.2 | Hindrance level of dwelling | 0.001 | Hindrance level of places to socialize | 1.1 |
| 7 | Hindrance level of workplace | 0.1 | Discrimination | 0.4 | Hindrance level of noise | 0.1 | | | Hindrance level of terrain/climate | 0.6 |
| 8 | Hindrance level of health facilities | 0.1 | Hindrance level of noise | 0.3 | Assistive devices in public spaces | 0.1 | | | Frequency of personal assistance | 0.6 |
| 9 | Assistive devices for mobility | 0.1 | Health service | 0.3 | Assistive devices for education | 0.1 | | | Use of health services | 0.6 |
| 10 | Hindrance level of noise | 0.1 | Hindrance level of places to socialize | 0.3 | Hindrance level of shops/banks | 0.1 | | | Hindrance level of public transport | 0.4 |

research focus in MDs on clinical (severity of disease), psychological (personality, neuroticism), social (social adjustment, social support), cognitive and economic factors as determinants of disability in MDs, compared to the scant attention given to broader EFs so far (Harvey and Strassnig 2012; Rytsala et al. 2006), may explain this. Another explanation may be the very frequent presence of comorbidities with “physical” conditions.

This study, consistent with previous literature (Farrelly et al. 2014; Thornicroft et al. 2010), stresses the importance of discrimination as a determinant of the level of performance of individuals with NCDs and triggers the question whether interventions targeting stigma towards MDs could inform similar interventions for other NCDs. This study also confirms the importance of use of health care services to MDs. The percentage of persons with MDs receiving

health care was lower than in other NCDs but still very high (86%) compared to published estimates showing that between 35.5 and 85.4% of serious cases in various countries usually do not receive treatment (Demyttenaere et al. 2004). This high percentage might be associated with a high number of comorbidities in people with MDs, which might lead to an easier access to care, or simply reflect the broad coverage and accessibility of the Chilean's health system (Missoni and Solimano 2010). It is important to stress, however, that the question used to access use of health care does not differentiate the kind of treatment received. In addition, the study collected self-reported information on the use of health services.

An important finding of this study is that the EFs most responsible for disability in MDs and NCDs differ considerably between persons with mild, moderate and severe

Table 4 Results from a random forest analysis showing the ten environmental factors with the highest impact on performance in people with moderate levels of capacity difficulties; Chile, 2016

| Rank | Mental disorders <i>N</i> = 954 | | Cardiovascular disorders <i>N</i> = 1176 | | Respiratory disorders <i>N</i> = 381 | | Cancer <i>N</i> = 86 | | Diabetes <i>N</i> = 504 | |
|------|--------------------------------------|------|---|-----|---|------|--------------------------------------|------|--|------|
| | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM |
| 1 | Discrimination | 0.4 | Use of personal assistance | 0.4 | Hindrance level of terrain/climate | 0.9 | Assistive devices in public spaces | 0.6 | Hindrance level of public transport | 0.5 |
| 2 | Hindrance level of workplace | 0.3 | Frequency of personal assistance | 0.3 | Assistive devices for mobility | 0.8 | Hindrance level of crowds | 0.3 | Use of personal assistance | 0.5 |
| 3 | Assistive devices for mobility | 0.3 | Discrimination | 0.3 | Discrimination | 0.4 | Discrimination | 0.3 | Frequency of personal assistance | 0.4 |
| 4 | Assistive devices for seeing | 0.2 | Assistive devices for mobility | 0.3 | Use of rehabilitation | 0.2 | Assistive devices for mobility | 0.1 | Discrimination | 0.3 |
| 5 | Assistive devices for work | 0.1 | Assistive devices for seeing | 0.2 | Hindrance level of public transport | 0.2 | Hindrance level of workplace | 0.1 | Hindrance level of shops/banks | 0.3 |
| 6 | Hindrance level of noise | 0.05 | Hindrance level of shops/banks | 0.2 | Assistive devices in public spaces | 0.1 | Hindrance level of health facilities | 0.05 | Hindrance level of places to socialize | 0.1 |
| 7 | Hindrance level of places to worship | 0.05 | Hindrance level of public transport | 0.2 | Assistive devices for seeing | 0.1 | Assistive devices for seeing | 0.01 | Hindrance level of crowds | 0.1 |
| 8 | Hindrance level of shops/banks | 0.05 | Hindrance level of terrain/climate | 0.1 | Assistive devices for home | 0.1 | Hindrance level of dwelling | 0.01 | Hindrance level of dwelling | 0.1 |
| 9 | Hindrance level of public transport | 0.03 | Assistive devices for work | 0.1 | Hindrance level of noise | 0.03 | | | Assistive devices for mobility | 0.05 |
| 10 | Hindrance level of lighting | 0.03 | Use of rehabilitation | 0.1 | Use of health services | 0.02 | | | Use of rehabilitation | 0.05 |

levels of difficulties in capacity. Some EFs, for instance use of health services, were relevant for persons with mild or moderate levels of capacity difficulties across MDs and other NCDs, but not for severe cases, whereas personal assistance was disclosed as a highly relevant factor for persons with moderate and severe difficulties in capacity, but not for mild cases. Our results illustrate that considering capacity levels when comparing needs and barriers of specific groups of people is more accurate than focusing solely on diagnosis.

This study has to be seen in the light of some limitations. First, the diagnosis of health conditions was not based on a standardized diagnostic interview. ENDISC II used a self-reported diagnosis based on the Self-Administered Comorbidity Questionnaire (SCQ) (Sangha et al. 2003), which included a list of country-specific high prevalent or high priority health conditions and impairments. There are certain pros and cons of using a self-reported diagnosis. The main problem is the lack of accuracy. People can

experience specific symptoms or functioning limitations associated with a health condition and report a diagnosis without actually having it and vice versa. On the other hand, self-reported diagnostic tools are a cost-effective way to obtain health status information in epidemiological studies. Previous studies have showed that self-reported diagnoses were equally able to predict quality of life problems in comparison with information collected in medical records (Olomu et al. 2012). The instrument used in ENDISC II has been proven especially useful in studies based on general populations and in settings in which medical records are not available. Second, we included people with comorbidities in the analyses. Evidence shows that comorbidities across NCDs is a common phenomenon (Prince et al. 2007) and reflect the real life experience of persons with MDs and other NCDs, so that excluding them would introduce a selection bias. By basing our analysis on intrinsic capacity, we accounted for the comorbidities in the NCDs. Lastly, RF analysis, though a powerful tool for

Table 5 Results from a random forest analysis showing the ten environmental factors with the highest impact on performance in people with severe levels of capacity difficulties; Chile, 2016

| Rank | Mental disorders <i>N</i> = 1101 | | Cardiovascular disorders <i>N</i> = 1271 | | Respiratory disorders <i>N</i> = 489 | | Cancer <i>N</i> = 118 | | Diabetes <i>N</i> = 576 | |
|------|---|-----|---|-----|---|-----|--------------------------------------|------|--|-----|
| | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM | Environmental factor | VIM |
| 1 | Frequency of personal assistance | 1.8 | Frequency of personal assistance | 2.1 | Frequency of personal assistance | 2.9 | Frequency of personal assistance | 4.8 | Frequency of personal assistance | 1.8 |
| 2 | Assistive devices for mobility | 1.5 | Assistive devices for mobility | 1.8 | Assistive devices for mobility | 1.5 | Hindrance level of terrain/climate | 1.0 | Assistive devices for mobility | 1.7 |
| 3 | Use of personal assistance | 1.1 | Use of personal assistance | 1.0 | Use of personal assistance | 1.5 | Use of personal assistance | 0.9 | Hindrance level of public transport | 1.3 |
| 4 | Hindrance level of shops/banks | 0.8 | Hindrance level of shops/banks | 0.9 | Hindrance level of shops/banks | 1.1 | Assistive devices for mobility | 0.8 | Hindrance level of places to socialize | 1.0 |
| 5 | Hindrance level of places to socialize | 0.7 | Hindrance level of places to socialize | 0.7 | Discrimination | 0.7 | Hindrance level of dwelling | 0.6 | Use of personal assistance | 0.9 |
| 6 | Hindrance level of terrain/climate | 0.7 | Hindrance level of terrain/climate | 0.7 | Hindrance level of places for worship | 0.5 | Hindrance level of shops, banks | 0.4 | Hindrance level of dwelling | 0.8 |
| 7 | Hindrance level of public transport | 0.6 | Hindrance level of public transport | 0.5 | Hindrance level of public transport | 0.5 | Hindrance level of health facilities | 0.3 | Hindrance level of terrain/climate | 0.6 |
| 8 | Hindrance level of dwelling | 0.3 | Hindrance level of dwelling | 0.6 | Assistive devices for home | 0.4 | Discrimination | 0.2 | Hindrance level of places to worship | 0.5 |
| 9 | Hindrance level of lighting in surroundings | 0.4 | Hindrance level of places for worship | 0.4 | Hindrance level of places to socialize | 0.3 | Assistive devices for seeing | 0.2 | Hindrance level of crowds | 0.4 |
| 10 | Discrimination | 0.3 | Hindrance level of lighting in surroundings | 0.4 | Hindrance level of dwelling | 0.3 | Hindrance level of workplace | 0.04 | Hindrance level of shops/banks | 0.2 |

ranking EFs for the level of performance of individuals does not provide information on the direction of the association.

Two strengths should be as well mentioned. First, it is the first study to use a large general population sample to explore the role of a wide range of EFs on the disability level experienced by persons with MDs and other NCDs. The study provides clear and reliable information about potential public health intervention targets to approach disability in MDs and other NCDs and can inform the implementation of the WHO Global Disability Action Plan 2014–2021 (World Health Organization 2014b). Secondly, the present paper confirms the value of the implementation of a comprehensive general population disability survey like the MDS for generating evidence on MDs and NCDs.

Conclusions

Four key messages come out of the present study. First, adopting an unbiased, comprehensive approach that takes into account a range of EFs, encompassing the built, political, social and attitudinal environment, is very important, not only to corroborate known determinants but also to disclose other factors impacting the performance of persons with MDs. Second, our results definitely show that persons with MD are in need, not only of emotional or instrumental support, but also of physical support. Third, there is a complete overlap between MDs and NCDs in the factors most responsible for the disability experienced in day-to-day life. Taken together, this suggests that public health interventions developed for CVD, chronic respiratory diseases, diabetes and cancer may well meet, at least

partially, the needs of people with MDs. Finally, the large overlap between MDs and NCDs contrasts with the differences between persons with mild, moderate and severe levels of difficulties in capacity. This fact questions the validity of disease-specific approaches and suggests that looking at capacity levels when comparing needs and barriers of specific groups is more informative than focusing on diagnosis alone.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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