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Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans

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Synonyms

Geriatric depression; Mental well-being and aging; Neuropsychiatric disorders and aging; Old-age dementia; Psychiatric disorders and aging; Psychotropic and antidepressant medications at old age

Definition

Geriatric depression and cognition impairment, including memory loss, are common neuropsychiatric disorders at old age. Diagnosing these conditions in the context of a general population-based survey conducted by nonmental health specialists is challenging. The effect of aging on an individual's mental health is not always mirrored in the prevalence of mental disorders of the population by age. Changes over time and across cohorts, as well as survival selection, affect the comparison of individuals at different ages. Longitudinal studies that follow the same individuals over time allow a better assessment of the effect of age on mental health. The Costa Rican Longevity and Healthy Aging Study (CRELES) includes a panel of elderly people that provides a rare opportunity of documenting mental health and aging in a middle-income country.

Introduction

Worldwide populations are aging. With the exception of a few countries, most have had remarkable increases in life expectancy coupled with declining birthrates in the latter half of the twentieth century, which has led to aging populations even in low- and middle-income countries. The increase in older populations worldwide has led to increased interest in how countries can enable and ensure healthy aging.

A vital aspect of healthy aging is one's mental health, and older adults have a substantial burden of disease from mental health conditions. Worldwide, 7.5 % of all disability-adjusted life years (DALYs) for those aged 60+ are due to neuropsychiatric disorders. Alzheimer's disease and dementia are the most disabling conditions in this age group, accounting for 4.2 % of all DALYs worldwide and 2.9 % of all DALYs in low- and middle-income countries in this age group. In addition, the number of dementia cases is growing rapidly worldwide, but particularly in low- and middle-income countries (Yasamy et al. 2013). Depression is the second most disabling condition, accounting for 1.5 % of DALYs worldwide and 1.4 % of DALYs in developing countries in this age group (authors' calculations based on World Health Organization (2004)).

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Older adults face specific challenges and opportunities that may affect their mental well-being. The process of aging simultaneously includes several opposing forces with regard to mental health. Older adults are more likely to face increased isolation, declining physical health, changes in cognitive ability, and decreased income, which may lead to more mental health conditions. At the same time, having more time for engaging leisure activities and family interaction may help protect against the onset or remission of mental health conditions. In addition, studies suggest that aging increases one's positive affect because of increased emotional regulation (Mather and Carstensen 2005). These increases in positive affect may lead to a more positive outlook, keep people engaged in their daily activities, and therefore buffer against the onset of mental health conditions.

Understanding what factors are directly related to common mental health disorders in older populations is therefore difficult because researchers must disentangle competing forces. In order to better understand how a change in one factor affects changes in another, longitudinal data enable stronger and richer studies. Longitudinal study designs follow the same individual over time, which allows researchers to compare the same individuals before and after life changes, and thus account for invariant unmeasured or unobservable factors such as disposition or genetics. This possibility is particularly important for the study of mental health conditions, because imperfectly measured individual traits may predict both cognitive and physical disability, as well as mental health-related symptoms, and thus confound inferences in cross-sectional studies.

In an effort to better understand the aging process, several countries have invested in detailed, nationally representative longitudinal health and retirement surveys of their older populations. These include the United States' Health and Retirement Survey; English Longitudinal Study of Ageing; Survey of Health, Ageing and Retirement in Europe; Japanese Study of Aging and Retirement; The Irish Longitudinal Study on Ageing; China Health and Retirement Longitudinal Study; Mexican Health and Aging Study; and Korean Longitudinal Study of Aging. The Costa Rican Longevity and Healthy Aging Study (CRELES) is part of this growing set of health and retirement surveys being conducted and is a nationally representative longitudinal survey of health and life-course experiences of older Costa Ricans. Costa Rica is of particular interest to study given its high longevity: life expectancy is greater than that of the United States, despite being a middle-income country with about one-fifth the per capita income and one-tenth the per capita health spending.

In this entry, the longitudinal CRELES data are used to describe the prevalence of common geriatric mental health disorders as people age, particularly dementia and depression. To date there have been few studies that examine changes in mental health status for the elderly in middle-income countries such as Costa Rica with large aging populations, particularly the eldest of the old.

The CRELES Data

The Costa Rican Longevity and Healthy Aging Study (CRELES, or *Costa Rica Estudio de Longevidad y Envejecimiento Saludable*) is a longitudinal study of health and life-course experiences based on a national sample of residents of Costa Rica aged 60 and older in 2005, with oversampling of the oldest old. The sample was selected randomly from the 2000 census database using a multistage sampling design. This entry uses the information from three waves of interviews conducted primarily in 2005, 2007, and 2009. Documentation and public-use CRELES data are available from the National Archive of Computerized Data on Aging at the University of Michigan (Rosero-Bixby et al. 2010).

This entry exploits the longitudinal information on mental health collected within CRELES, to sort out the effect of aging from the effects of cohort, period, and survival selection that usually cloud traditional cross-sectional data by age. The focus of the analysis is on the effects of aging on mental health, and the

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entry presents estimates of the prevalence of mental health conditions by age and sex among elderly Costa Ricans from cross-sectional CRELES data, as well as of the transition (incidence and remission) rates from the longitudinal CRELES data on changes of state between waves. Then, these rates are used to simulate the pure effect of aging in hypothetical cohorts using multiple-decrement life table methods. The comparison of the age profiles of observed and simulated mental health prevalence provides not only a better picture of the effect of aging on mental health but also hints some of the changes under way in Costa Rica.

CRELES Indicators of Mental Health

Ever Diagnosed with Psychiatric Problems

Responded "yes" to the wave 1 question "Has a physician ever told you that you have a nervous or psychiatric problem such as depression?" In wave 3 the question was: "In the last 4 years, since the first time we visited you, has a physician told you that you have nervous or psychiatric problems such as depression?" Therefore, the yes responses in wave 3 are added to those of wave1; no information was available from wave 2. This variable does not allow transitions back to "never diagnosed" nor does it allow us to disentangle barriers in accessing care that would yield a diagnosis from the lack of symptoms meeting diagnostic criteria.

Impaired Cognition

The CRELES used a short version of the Mini-Mental State Examination (MMSE) questionnaire (Folstein and Folstein 1975) that had been adapted and validated for Latin America (Quiroga et al. 2004). This version has a maximum score of 15 points instead of the original 30-point MMSE test. The six cognitive domains included in this test were time orientation (4 points), primary verbal memory (three words, 3 points), attention (to repeat a five-digit number backward, 1 point), secondary verbal memory (three words, 3 points), following instructions (1 point), and reconstruction (to copy two intersected figures, 1 point). The Cronbach alpha for this series of 15 items was 0.72, indicating acceptable internal validity. The test was administered at the beginning of the interview to decide whether to use a proxy to help in responding the interview. Individuals with a score of <10 were considered to have impaired cognition (needing a proxy respondent) as were individuals who were considered by trained interviewers to be too impaired to complete the test.

Depression Screening Symptoms

The CRELES used the 15-item short-form Geriatric Depression Scale (GDS15) (Sheikh and Yesavage 1986). This instrument more accurately assesses depression in older populations because it was developed specifically for use with older adults, has a simplified yes/no response format, and contains very few items related to somatic symptoms. This scale is an instrument designed for screening purposes, and thus it may lead to an overestimate of clinical depression. A systematic review of 42 studies validating this instrument reports an average positive predictive value of only 0.32, whereas the negative predictive value is 0.95 and sensitivity and specificity are in the order of 0.8 (Wancata et al. 2006). Most studies in that review used a cutoff value of 7+ to classify an individual as depressed, which is the same cutoff value employed here in the CRELES data. The Cronbach alpha for the 15 items in CRELES data was 0.85, indicating high internal validity of the scale. Per study protocol, the CRELES did not administer the GDS15 questionnaire to approximately 25 % of participants with cognitive impairment (i.e., needing a proxy respondent).

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Taking Antidepressant Medicines

As part of the CRELES interview, participants were asked to show the interviewer all of the medicines they were currently taking. From the database of all recorded medicines, antidepressant medications were identified by brand or generic name to create indicators of whether respondents were taking antidepressants at the time of each survey wave. This indicator has the advantage of identifying those taking antidepressant medications regardless of the reason for medications; antidepressants are known to have high rates of off-label use (Radley et al. 2006). Respondents who were prescribed antidepressants but did not fill them and respondents who initiated and then discontinued antidepressant therapy between waves could not be identified.

Results

Of the 2,827 participants interviewed in the CRELES first wave, 2,369 (84 %) were interviewed in the second wave and 1,855 (79 %) in the third wave. Loss of follow-up was 6 % in wave 2 and 9 % in wave 3. The remaining 10 % and 12 % of participants died between waves, respectively.

Table 1 shows the prevalence of the four indicators of mental health by wave and sex. A simple way of using data from longitudinal studies is by taking each wave as a cross section as shown in Table 1 and looking for time trends. For example, the data for women show a reduction in the prevalence of depression symptoms from 19 % in 2005 to 17 % in 2007 and 15 % in 2009 and an increase in the proportion using antidepressant medicines from 9 % in the first wave to 11 % in second and third waves. Because this panel does not have refreshment cohorts and the effect of age was not controlled for in the analysis, these inter-wave changes could be a result of the aging of the panel, as well as from period changes. Additionally, these changes might be a result of survival selection. Disentangling these three forces – age, period, and survival selection – is a classic problem in demographic studies, as is sorting out aging from cohort effects when one compares individuals at different ages.

Table 1 also shows the results of the three waves pooled together, which yields more reliable estimates as shown by the smaller standard errors. Pooling together several waves of interviews is a simple way of taking advantage of longitudinal data, although the researcher must be careful in using only corrected estimates of the standard errors (as was done in Table 1) that take into account the clustering of data due to repeated measurements for the same individual. These estimates show that depression prevalence among women in this sample is 17 %, a figure that is more than twice that of men (8 %). The proportion of women ever diagnosed with psychiatric conditions (28 %) and the proportion taking antidepressant medicines (10 %) also more than double the proportions estimated for men. In contrast, the prevalence of cognitive impairment (17 %) is about the same for males and females.

Studying cross-sectional variation by age is a common procedure in assessing the effect of aging on mental health or other diseases. Figure 1 shows the cross-sectional age variation in the four indicators of mental health using the pooled CRELES data for the three waves. The prevalence curves in the figure were smoothed out using local regression procedures; the 95 % confidence interval for each curve is shown as a shaded area. The figure confirms that the prevalence of depression, other psychiatric disorders, and antidepressant use is higher for women, although this gender gap shrinks or disappears at advanced ages. In contrast, the indicator of cognition impairment does not differ significantly by sex at any age.

Only the prevalence of cognitive impairment shows a strong increase with age, and there seems to be no difference across sexes. Prevalence of this impairment is about 10 % at age 60 years, increasing to about 40 % by age 85 years. The other three indicators suggest that among women, depression declines with age. The result for males is mixed: depression symptoms increase with age, the proportion ever diagnosed

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Table 1 Prevalence of four mental health conditions investigated in the CRELES by wave and sex

Sex and mental		Wave 1	Wave 2	Wave 3	All waves
Health indicators		2005	2007	2009	2005–2009
Sample size		2,827	2,369	1,855	7,051
Both sexes					
Ever diagnosed psychiatric disorders	Prevalence	19.6 %	.	24.1 %	21.4 %
	(S.E.)	(0.9)	.	(1.2)	(0.9)
Cognitive impairment	Prevalence	14.2 %	20.6 %	17.3 %	17.2 %
	(S.E.)	(0.6)	(0.9)	(0.9)	(0.6)
Depression symptoms	Prevalence	14.1 %	12.3 %	11.9 %	12.9 %
	(S.E.)	(0.9)	(0.9)	(1.0)	(0.7)
Taking antidepressants	Prevalence	6.6 %	7.9 %	7.8 %	7.4 %
	(S.E.)	(0.5)	(0.6)	(0.7)	(0.5)
Males					
Ever diagnosed psychiatric disorders	Prevalence	13.0 %	.	15.0 %	13.8 %
	(S.E.)	(1.2)	.	(1.5)	(1.2)
Cognitive impairment	Prevalence	13.3 %	20.6 %	17.7 %	16.9 %
	(S.E.)	(0.9)	(1.3)	(1.4)	(1.0)
Depression symptoms	Prevalence	9.1 %	7.1 %	8.6 %	8.3 %
	(S.E.)	(1.1)	(1.0)	(1.2)	(0.8)
Taking antidepressants	Prevalence	3.8 %	4.6 %	4.0 %	4.1 %
	(S.E.)	(0.6)	(0.8)	(0.7)	(0.5)
Females					
Ever diagnosed psychiatric disorders	Prevalence	25.6 %	.	32.1 %	28.2 %
	(S.E.)	(1.4)	.	(1.7)	(1.4)
Cognitive impairment	Prevalence	15.0 %	20.6 %	17.0 %	17.4 %
	(S.E.)	(0.9)	(1.1)	(1.2)	(0.8)
Depression symptoms	Prevalence	18.8 %	16.9 %	14.9 %	17.1 %
	(S.E.)	(1.4)	(1.4)	(1.4)	(1.1)
Taking antidepressants	Prevalence	9.2 %	10.9 %	11.3 %	10.3 %
	(S.E.)	(0.9)	(1.0)	(1.2)	(0.8)

S.E. binomial standard error of the proportion per 100

is essentially flat, and the proportion taking antidepressant medicines increases until about age 85 and diminishes afterward.

The age profile of cross-sectional curves, such as those in Fig. 1, is certainly driven by age effects, but cohort and period effects may also exert influence. For example, the higher prevalence of depression among younger women might occur because the disease is less common as a woman get older, but also because, in a generational change, younger cohorts of women are more affected by this disease or because, in a period change, the disease has become more widely recognized. A fourth source of variation by age is survival selection. For example, age declines in the curve of prevalence of depression could occur if women suffering depression die at substantially higher rates. Longitudinal data allow assessing pure aging effects. It is rare to have long-running longitudinal studies that observe a cohort of, say, 60-year-old individuals at baseline until their death after four or five decades. In the case of CRELES, the longitudinal observation was only during 4 years. During that period, longitudinal transition rates were determined with the data, and then hypothetical cohorts were constructed with those rates using multiple-decrement life table techniques (Wachter 2014). Table 2 shows the transition rates – incidence and

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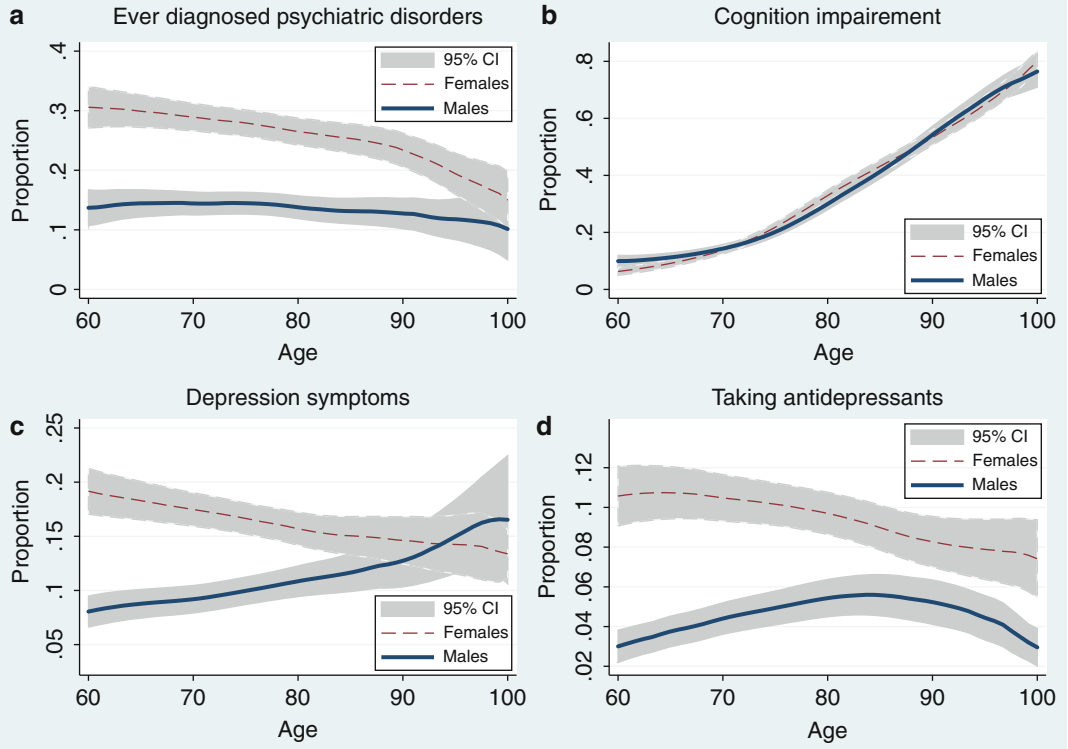

Fig. 1 Prevalence of four mental health conditions by age (locally weighted smoothing functions)

Table 2 Annual transition (incidence and remission) rates for the four mental health conditions by sex

Mental health indicator	Males		Females	
Ever diagnosed psychiatric disorders				
Incidence rate	0.012		0.023	
(S.E.)	(0.002)		(0.002)	
Cognitive impairment				
Incidence rate	0.019	• 1.081^{x}	0.019	• 1.081^{x}
(S.E.)	(0.002)	(0.005)	(0.002)	(0.005)
Remission rate	0.373	• 0.946^{x}	0.373	• 0.946^{x}
(S.E.)	(0.043)	(0.006)	(0.043)	(0.006)
Depression symptoms				
Incidence rate	0.021	• 1.028^{x}	0.067	• 0.979^{x}
(S.E.)	(0.004)	(0.014)	(0.010)	(0.011)
Remission rate	0.279		0.279	
(S.E.)	(0.014)		(0.014)	
Taking antidepressants				
Incidence rate	0.011	• 1.032^{x}	0.039	• 0.991^{x}
(S.E.)	(0.003)	(0.011)	(0.006)	(0.009)
Remission rate	0.335		0.278	
(S.E.)	(0.027)		(0.020)	

x = age – 60
Standard errors in parentheses

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remission – estimated from the data and then used to simulate the hypothetical cohorts. Both are annual rates, which are estimated using Poisson regression models with exposure equal to the time (in years) between waves. Because of the log-linear specification of Poisson regression models, the effect of age is multiplicative, and age is an exponent. In models where age showed non-statistically significant effects, age is excluded as a control variable, i.e., the rates are then modeled as constant for all ages. In models where the effect of gender was not significant, the same age coefficients were assumed in each sex.

The condition "ever diagnosed" has no remission by definition. Its incidence rate does not vary significantly with age. The incidence rate of 0.023 for women means that, in a year, 23 women are newly diagnosed out of 1,000 not yet diagnosed. The rate for women is about double that for men.

The transition rates for depression symptoms and for taking antidepressant medicines behave similarly. The incidence rate at age 60 years is about three times higher for women than for men (0.067 compared to 0.021 for depression symptoms). Then, while among men the incidence rate increases by 3 % per year, among women it decreases by 2 % per year for depression symptoms and 1 % for taking antidepressant medicines. By age 85 or 90 years, the incidence rates of men and women are about the same. The remission rates for the two conditions are very high at all ages: close to 30 % of ill individuals leave the disease state every year.

Figure 2 shows the simulated prevalence in the four conditions under study. The simulations created hypothetical cohorts using as inputs the incidence and remission rates shown in Table 2 and initial prevalence at age 60 similar to that observed in Fig. 1. The simulated curves show the expected age profile of prevalence if aging is the only change that takes place, i.e., if cohort and period effects are absent.

The observed and simulated curves of prevalence of cognition impairment are similar, which suggests that this population has not been subject to meaningful changes in this condition over time nor across

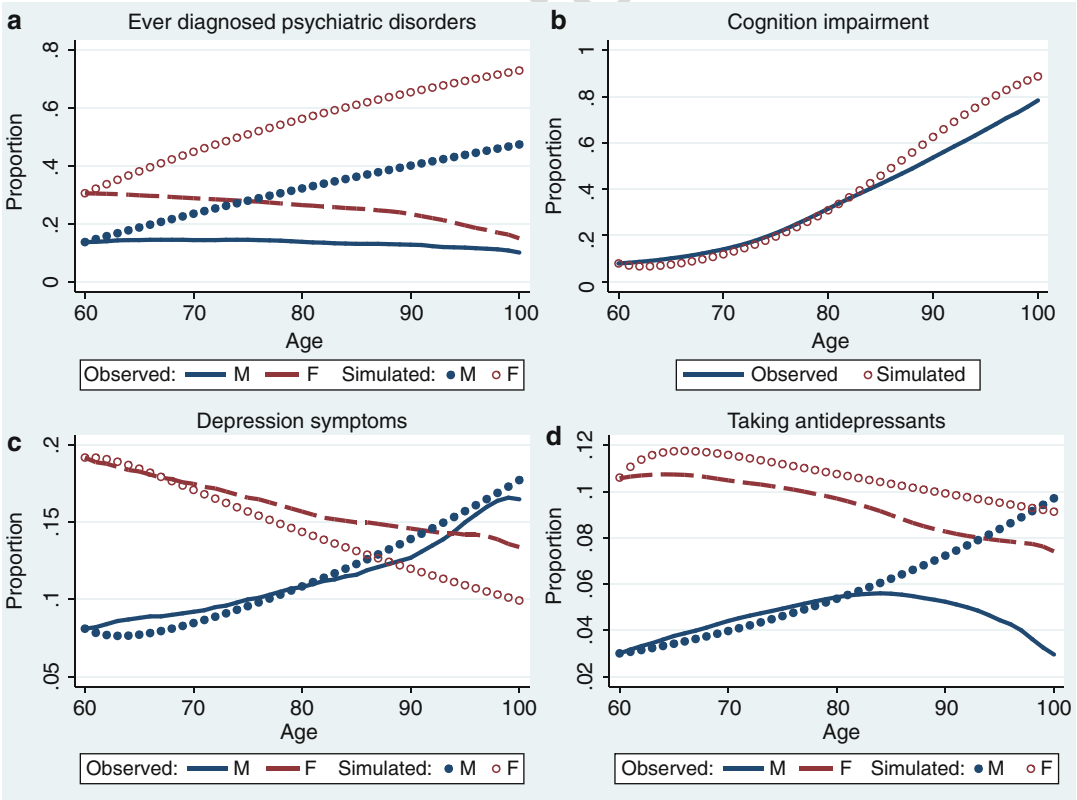

Fig. 2 Hypothetical cohort simulations and observed prevalence of four mental health conditions by age

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generations. The same can be said about the prevalence of depression symptoms, whose observed and simulated curves differ little, especially for men. For women, the simulated curve suggests that the age slope of decline in observed prevalence should be steeper. A potentially important confounder of this curve is the fact that about 50 % of the sample aged 80 years or more were not administered the depression screener because they required a proxy for responding (a more complex analysis could also include the simulation of a third state in the model: requiring a proxy.)

The simulated curves for the proportion taking antidepressant medicines are not that different from the observed prevalence curves either, except in two aspects: (1) The simulation for women results in a systematically higher than observed curve, which would be consistent with a recent increase in prescription of antidepressant medicines to women. (2) The simulation for men older than 80 years results in a growing curve compared to the flat or even declining observed curve. This discrepancy may result from survival selection as noted below.

By contrast, the indicator "Ever diagnosed with psychiatric disorders" differs markedly between the observed and simulated aging curves in Fig. 2, panel A. Being cumulative, the cohort proportion of ever diagnosed psychiatric conditions should increase monotonically with age, as it does in the simulated curves. In this case, the decline in the observed curve with age is highly misleading if interpreted as a pure aging effect; instead, this likely reflects cohort or period increases in these diagnoses or else elevated mortality among people suffering from psychiatric impairments.

The simulations shown so far assumed that mortality is similar among prevalent and non-prevalent individuals. To illustrate the effect of removing this assumption, Fig. 3 shows simulations assuming that mortality among individuals with mental illnesses doubles the mortality of the general population, which is an extreme assumption of over-mortality of people with mental health problems. Mortality for the general population is assumed to follow a Gompertz distribution with the parameters estimated for Costa Rica elsewhere (Rosero-Bixby et al. 2014).

The new simulations for ever diagnosed depression confirm that the flat or declining prevalence curves by age observed in this sample might originate in survival selection, given that the simulation curves that included differential mortality stopped growing by age 77 among men and age 80 among women and decreased afterward. This is speculative, however, pending further longitudinal analysis to more precisely estimate the mortality differences by psychiatric indicator.

Figure 3, panel C, also shows that the new simulations with differential mortality produce simulated prevalence values that are quite close to the observed values, especially for older men. Again, this indicates that differential mortality is plausibly important in driving the observed age curves of the proportion taking antidepressant medicines, especially for older men.

Simulations with differential mortality of the proportions with depression symptoms (plot B in Figure 3) result in curves lower than those simulated with no differential mortality and, therefore, further away of the observed curves, especially at older ages. This suggests that differential mortality by depression status may be less extreme than it is for the other indicators.

For cognitive impairment, simulations with differential mortality (not shown in Fig. 3) result in even closer observed and simulated curves than those already similar in Fig. 2, especially after about age 80.

Discussion

The data from the CRELES study is a valuable first step in assessing the prevalence of mental health problems among elderly Costa Ricans. About 28 % of Costa Rican women aged 60 or more reported being ever diagnosed with psychiatric disorders, about 17 % were screened as suffering cognitive impairment or geriatric depression, and 10 % were found taking antidepressant medicines.

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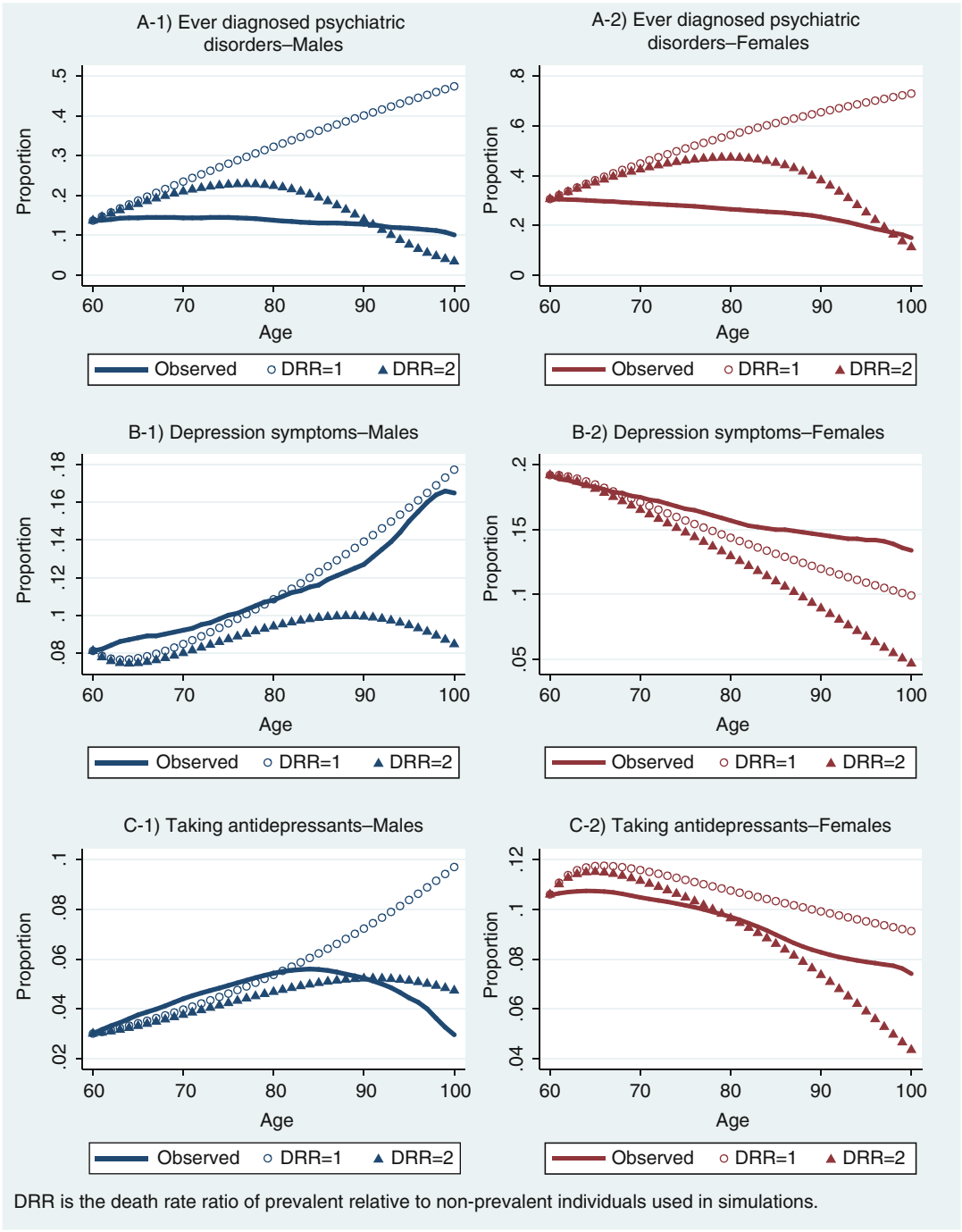

Fig. 3 Hypothetical cohort simulations with differential mortality and observed prevalence of three mental health conditions by age and sex

These female proportions are twice the rates of males except for cognitive impairment, a condition that does not differ by gender.

The longitudinal information in CRELES allow researchers to disentangle the age, cohort, and mortality patterns in mental health rather than simply observing cross-sectional patterns by age. There is a clear increase with aging in cognitive impairment for both sexes, as well as for depression symptoms for males. In contrast, depression symptoms decrease with age among women, and this trend is not an

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artifact of period-cohort effects nor survival selection. The aging effects on depression symptoms – increasing for males and decreasing for females – are consistent with similar profiles in the curves of the proportion taking antidepressants, and these are confirmed by the simulations enabled by the longitudinal data.

The cross-sectional pattern for the proportion ever diagnosed with psychiatric disorders is more complex and on its own would provide a misleading description of aging effects. The flat and decreasing cross-sectional patterns by age are likely a result of survival selection or of recent increases in diagnosis among younger cohorts; the simulated age profiles enabled by the longitudinal data instead reveal strongly increasing rates with aging.

An important limitation of two of the indicators used (ever diagnosed psychiatric disorders and taking antidepressant medicines) is that they are sensitive to access to care – those meeting depression criteria but who have poor access to physician care would not report diagnosis nor would they be taking medicines. In addition, since the wording of the survey question specifically asks for diagnoses from physicians, respondents may not report diagnoses received by other mental health specialists, such as psychologists, nurse practitioners, or social workers, thus potentially understanding lifetime diagnosed prevalence.

It is also helpful to compare the different indicators of depression or psychiatric history, as the indicators are better understood in their contrasts. Self-reported psychiatric history could cover psychiatric conditions beyond depression, such as anxiety or psychotic disorders, as well as conditions that are no longer symptomatic, such as childhood or early adult disorders. This measure could undercount depression, however, if there is perceived stigma in reporting conditions or if respondents experienced barriers to care. The depression screener will detect current symptoms, but not prior history. Respondents who are untreated or inadequately treated, for example, might meet current symptom criteria but not have a prior history of diagnosis. The depression screener also has the limitation that it cannot be easily administered to individuals with cognitive limitations requiring a proxy to respond, who are an important group at older ages, close to 50 % at 85 or more years. Finally, receipt of antidepressant medication indicates current use of medication for either depression or other conditions. Persons who are adequately treated by antidepressants would no longer exhibit psychiatric symptoms and may or may not report a prior psychiatric history. The discordance among these measures in the CRELES is further described elsewhere (Domino et al. 2014).

Conclusion

Many factors suggest that mental health conditions merit increasing attention in aging populations, and this is likely to be particularly true in lower- and middle-income countries that have traditionally devoted fewer resources to mental health. Epidemiological surveillance surveys have drawn attention to an increasing mental health disease burden, but documenting this burden via periodic cross-sectional surveys is only a first step in understanding and planning for likely future patterns. Using the CRELES longitudinal survey, this analysis has illustrated the crucial importance of true panel data in order to disentangle aging effects from period and cohort influences. In addition, the analysis highlights the importance of longitudinal mortality follow-ups in order to better estimate the role of differential mortality selection in shaping these age patterns. Beyond the scope of this contribution, there is of course a long tradition of further uses of longitudinal data in strengthening causal inference, which would be relevant, for example, in evaluating the effects of mental health policies and interventions implemented in low-resource settings. Although only the longitudinal CRELES data was introduced in this entry, there are increasing efforts to collect comparable data in other lower- and middle-income settings so as to enable further cross-national comparisons over time as well.

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Cross-References

- ▶ Aging and Psychological Well-Being
- ▶ Cognition
- ▶ Depression
- ▶ English Longitudinal Study of Aging (ELSA)
- ▶ Health and Retirement longitudinal study (HRS)
- ▶ Korean Longitudinal Study of Ageing (KLoSA)
- ▶ Mental Health and Aging
- ▶ The China Health and Retirement Longitudinal Study
- ▶ The Irish Longitudinal Study on Ageing (TILDA)

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