Labor Market, Financial, Insurance and Disability Outcomes among Near Elderly Americans with Depression and Pain

Haijun Tian,[1*] Rebecca L. Robinson,[2] Roland Sturm[3]

[1]*M. Phil, Pardee RAND Graduate School, Santa Monica, CA, USA*
[2]*MS, Research Scientist, US Medical Division, Indianapolis, IN, USA*
[3]*Ph. D, Senior Economist, RAND Corporation, Santa Monica, CA, USA*

Abstract

Background: The economic burden of depression has been documented, but the role of comorbid conditions is unclear. Depression and comorbid pain are particularly common, are associated with worse clinical outcomes and require different care than ''pure'' depression. Does this comorbidity account for a large share of the adverse social outcomes attributed to depression?

Aims of Study: We analyzed the relationship between depression and comorbid pain, and labor market, financial, insurance and disability outcomes among Americans aged 55-65.

Methods: Cross-sectional data were used from Wave 3 of the Health and Retirement Survey, a nationally representative sample of individuals aged 55-65 surveyed in 1996. Multivariate regression analyses, controlling for socio-demographics and chronic health conditions, estimated the associations between depression and pain, and economic outcomes. Outcomes included: employment and retirement status, household income, total medical expenditures, government health insurance, social security, limitations in activities of daily living (ADLs), and health limitations affecting work. Primary explanatory variables included the presence of severe pain, mild/moderate pain, or absence of pain, with or without depression.

Results: Compared to depression alone, depression and comorbid pain was associated with worse labor market (non-employment, retirement), financial (total medical expenditures), insurance (government insurance, social security) and disability outcomes (limitations in ADLs, health limitations affecting work), after covariate adjustment (p ≤ 0.01, except retirement with p < 0.1). Findings were even more disparate as level of pain severity increased. The simulated results showed that the magnitudes of the adverse effects were attributed disproportionally to individuals with comorbid pain and depression versus ''pure'' depression. Of those with depression, 51% had comorbid pain. Yet, this subgroup of depressed individuals accounted for 59% of those not employed, 61% of those with government health insurance, 79% of those with limitations in ADLs, and 72% of those with health limitations affecting work.

Discussion and Limitation: Depression with comorbid pain, not depression alone was responsible for a large part of the higher economic burden associated with depression. The study is limited by self-reported measures of pain, depression, and outcomes. It is cross-sectional and cannot identify causal effects of depression with pain. These findings may not be generalizable to other age groups.

Implications for Health Care Provision and Use: The depressed with comorbid pain appear to experience greater burden through increased costs and worse functioning and may require different management than those with depression alone. The depressed with comorbid pain may benefit from treatment practices and guidelines that address the duality of these conditions throughout the process of care.

Implication for Health Policies: The depressed with comorbid pain were more likely to receive government support than depression alone. Given the central role of employer-sponsored health insurance in the U.S., they may have worse access to health care because they leave employment or retire earlier. With the evolving state of Medicare, broad formulary access to mental health treatments might be considered.

Implications for Further Research: Further research should focus on causality of depression and comorbid pain on economic outcomes. Depression research should consider the heterogeneity of this disorder in outcomes assessment.

Introduction

Depression has received much attention in recent decades, partly as a consequence of research that has shown the substantially strong adverse effects on functioning and quality of life,[1-5] and partly because a wider range of effective treatments became available. Many economic studies have analyzed the adverse economic outcomes of depression,[6-9] however there is substantial heterogeneity among individuals with depression, raising the question whether the adverse economic outcomes of depression are concentrated among clinical subgroups, for example, those with comorbid conditions. Clinical studies have shown that depression with pain, a particularly common comorbidity, is associated with far worse clinical outcomes than either condition alone.[10-14] In specific clinical samples, patients

* **Correspondence to:** Haijun Tian, 1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138, USA.
Tel.: +1-310. 393. 0411 x 7140
Fax: +1-310-260-8151
E-mail: tian@rand.org

with depression and pain also had more functional limitations and higher health-care utilization and costs than patients with either pain or depression alone.[12,15-17] Could it be that the large economic burden of depression stems primarily from this subgroup? Clinical studies rarely measure labor market related outcomes. Clinical trials also poorly represent the broad range of individuals with depression in the general population. For example, individuals with chronic comorbid conditions or those not seeking treatment are often excluded from clinical trials. Despite a 50% increase in treatment rates in the last 15 years, depression still goes untreated in the majority of cases.[18] There exist many health economics studies on labor market and financial outcomes of depression or other mental illness,[19-28] but with few exceptions they do not specifically consider the issue of comorbidities.[29,30]

In this study, we consider the interaction between depression and pain, and analyze their associations with labor market, financial, insurance and disability outcomes among near elderly Americans. The presence of pain is common among the depressed and complicates the recognition and treatment of depression.[31] Manifestations of pain among depressed patients have been characterized as frequently nonspecific complaints[32,33] and were often unrelated to a known organic disease process.[34] The significant public health concern depression with pain poses extends to individuals experiencing these conditions later in life. Although the prevalence of major depressive disorder tends to decrease in those over age 60,[18] the presence of depressive symptoms and chronic pain are still high among elderly patients.[35-37]

Methods

Data and Variables

This study used wave 3 (1996 round) of the Health and Retirement Survey (HRS) with individuals aged 55-65. HRS is a longitudinal national survey initiated in 1992 to track national trends biennially in health and economic well-being among retired and near-retired Americans. Individuals and proxy respondents with missing depression and pain data were excluded,* leaving a study sample of 7350 individuals with an average age of about 60 years.

Wave 3 was chosen because it was the only time when two depression measures were assessed. These measures included the short form (8 items) of the Center for Epidemiologic Studies Depression Scale (CES-D) and the Short Form Composite International Diagnostic Interview (CIDI-SF).[38,40] The shortened CES-D ranges from 0 to 8 and asks

---

* About 20% of individuals were missing depression and/or pain items. Males, nonwhites, married, and less educated individuals were more likely to be missing data. Our results may be biased due to the nonrandomness of missing values. Our analysis used complete data, rather than trying to impute depression and pain status, which raises its own set of limitations. There were still substantial observations left and we believe the reduction in power due to missing values was not consequential.

respondents to evaluate the following symptoms experienced over the past seven days either all or most of the time: depression, everything is an effort, sleep is restless, felt alone, felt sad, could not get going, felt happy (reverse-coded), and enjoyed life (reverse-coded). Sensitivity and specificity analysis comparing short form, eight-item CES-D of HRS to the full twenty-item CES-D used by another study (i.e. National Longitudinal Survey of Mature Women) showed that a cutoff point of 4 or higher has a sensitivity of 90.2 percent and specificity of 97.4 percent when compared to the full, twenty-item CES-D with a cutoff of 16 or higher.[39] On the CIDI-SF, a cutoff point of 3 or more symptoms on the zero to seven scale indicates a diagnosis of clinical depression most comparable to the full CIDI.[39,41] We used the short form CES-D classification as our primary measure and the CIDI-SF classification for sensitivity analyses.

To measure pain status, respondents were asked whether or not they often experienced pain without reference to physical pathology (yes/no), and their degree of pain (mild, moderate, or severe). Since our sensitivity analyses indicated that the association of depression, pain and outcome variables was different for severe pain compared to mild or moderate pain, we categorized measure of pain into three levels: no pain, mild/moderate pain, and severe pain.

The independent variable was constructed by combining the dichotomous measure of depression with the 3-level measure of pain deriving 6 mutually exclusive groups: neither depression nor pain, depression only (no pain), mild/moderate pain only (no depression), mild/moderate pain with depression, severe pain only (no depression), severe pain with depression.

To assess labor market, financial, insurance and disability outcomes by the six groups, we examined the following self-reported dependent variables:

(i) Labor market
   a. Employment: not employed versus employed.
   b. Retirement: retired versus not retired.
(ii) Financial
   a. Annual household income: Sum (in nominal dollars) of all income categories including earnings, employer pension or annuity, government support and transfers, and any other source.
   b. Total medical expenditures: All costs (in nominal dollars) for health care utilization over the previous two years including hospitalizations, nursing home stays, special facilities or services, and outpatient care including physician and dentist visits.
(iii) Insurance
   a. Governmental health insurance plan coverage: Recipients of Medicare, Medicaid and VA/CHAMPUS versus non-recipients.
   b. Social Security: Recipients of social security earnings (Old Age Survivor and Disability Insurance (OASDI)) versus non-recipients.
(iv) Disability
   a. Limitations in Activities of Daily Living (ADLs): presence or absence of difficulties performing any of

220

H. TIAN ET AL.

the five tasks including walking across a room, bathing, eating, dressing, and getting in and out of bed.

    b. Health limitations affecting work: presence or absence of impairments or health problems that limit the kind or amount of paid work respondents could do.

Data Analytic Procedures

We descriptively compared the six groups across sociodemographics, health conditions, and outcome variables. Chi-square tests were conducted for categorical variables and bivariate regressions were conducted for continuous variables. All analyses were weighted by sampling weights, if possible.

    Multivariate regression analyses were then conducted to adjust for observed confounding factors. Logistic regression models were used for dichotomous outcome variables (employment and retirement status, government health insurance, social security, limitations in ADLs, health limitations affecting work) and median regression models for continuous outcome variables (annual household income and total medical expenditures). Median regression is more robust to outliers than ordinary least squares regression, although it measures the median effects, not the mean. Standard errors in logistic regression models were corrected by the Huber/White/Sandwich' robust variance estimators. We treated neither depression nor pain as the reference group and used 5 dummy variables to indicate each of the other five groups as explanatory variables. Control variables included socio-demographics including age (years), gender, ethnicity (white vs. nonwhite), marital status (married or not), education (years), smoking (currently smoking or not), and number of persons in the household. We also included a count of number of chronic health conditions (diabetes, hypertension, cancer, stroke, heart disease, lung disease, and arthritis) diagnosed by a doctor.

    Our analyses specifically addressed differences between ''pure'' depression and depression with comorbid pain (mild/moderate pain, or severe pain). Post hoc Wald tests were used to test these contrasts. To illustrate the effects of comorbid pain on depression, we provided predicted values of outcomes by running simulations on the study sample for four groups: neither depression nor pain, depression alone, depression with mild/moderate pain, and depression with severe pain. These predicted values were based on the multivariate regressions models above, adjusting for socio-demographics and physical health conditions; and were weighted to be nationally representative.

    To further illustrate the adverse effects of comorbid pain on depression, we provided the prevalence of comorbid pain (mild/moderate pain or severe pain) among the depressed; and calculated the share of comorbid pain on some adverse economic outcomes attributed to depression, adjusting for socio demographics and chronic health conditions. These outcomes included non-employment, government health insurance, limitations in ADLs, and health limitations affecting work. All these values were weighted to be nationally representative.

Results

Descriptive Statistics

The results of the descriptive analyses are reported in **Table 1**. There were 7,350 individuals in the study sample, among which 5,239 (72.3%) had neither depression nor pain, 459 (5.7%) had depression only, 1042 (14.5%) had mild/moderate pain only, 382 (4.8%) had depression and mild/moderate pain, 124 (1.5%) had severe pain only, and 104 (1.2%) had depression and severe pain.

    Relative to those with neither condition or those with depression alone, individuals with depression and comorbid pain univariately reported worse outcomes (all $p \leq 0.01$). However, there also were large differences in the social-demographics and chronic health conditions across the six groups. Individuals with depression and comorbid pain were most likely to be female, nonwhite, smokers, unmarried, have less education, and have more chronic health conditions.

Main Results

As shown in **Table 2** and **Table 3**, depression with comorbid pain (either mild/moderate pain or severe pain) was strongly associated with the worse labor market, financial, insurance and disability outcomes compared to neither condition, after adjusting for socio demographics and chronic health conditions ($p < 0.01$ in each model except $p = 0.03$ for depression and severe pain on retirement, $p = 0.22$ for depression and severe pain on household income). Depression with comorbid pain fared worse than depression alone in all adjusted models (at $p < 0.01$) except for nonsignificant differences in outcomes of retirement and annual household income. Compared to depression with mild/moderate pain, depression with severe pain was associated with higher rates of non-employment ($p < 0.05$), limitations in ADLs ($p < 0.01$), and total medical expenditures ($p < 0.01$).

    Table 4 showed predicted values of outcomes of depression with comorbid pain (either mild/moderate pain or severe pain) in comparison with depression alone and neither condition. The predicted probability of non-employment was highest in the depression with severe pain group relative to depression alone (72.1% vs. 44.1%; $\chi^2 = 19.77$, df = 1, $p < 0.01$) and depression with mild/moderate pain (72.1% vs 58.6%; $\chi^2 = 4.28$, df = 1, $p < 0.05$). Depression with mild/moderate pain also significantly increased the risk of non-employment compared to depression alone (58.6% vs. 44.1%; $\chi^2 = 18.07$, df = 1, $p < 0.01$). Depression with severe pain (34.9%; $\chi^2 = 3.69$, df = 1, $p = 0.05$) and depression with mild/moderate pain (32.2%; $\chi^2 = 3.29$, df = 1, $p = 0.07$) marginally increased the likelihood to be retired compared to depression alone (26.6%), but the magnitudes of differences were not substantially large.

    Depression and severe pain was associated with the highest medical expenditures (median = $6142), relative to depression alone (median = $2054; $\chi^2 = 223.43$, df = 1, $p <$

Table 1. Characteristics of Near Elderly Americans in Health and Retirement Survey Wave 3 (1996), by Depression and Pain Status

Variables	Whole Sample	Neither Depression nor pain	Depression only	Mild/moderate pain only	Depression and mild/moderate pain	Severe pain only	Depression and severe pain
	(N = 7,350)* (100%)*	(N = 5,239) (72.3%)	(N = 459) (5.7%)	(N = 1,042) (14.5%)	(N = 382) (4.8%)	(N = 124) (1.5%)	(N = 104) (1.2%)
Outcome Variables							
Not employed (%)***	42.2	36.7	48.8	51.7	69.5	68.4	82.5
Retired (%)***	27.3	24.8	27.6	34.0	37.5	39.8	43.0
Median household income ($)[1]***	34879	39066	21917	31089	15939	21124	12279
Median Medical Expenditures ($)[2]***	1788	1520	1574	3711	4471	4471	7154
Governmental health insurance (%)***	18.8	14.3	23.1	27.8	39.6	36.6	54.8
Receive Social Security (%)***	27.8	24.2	31.4	35.1	43.6	47.1	56.8
Limitations in ADLs (%)***	10.1	3.1	10.7	24.3	46.5	44.9	64.6
Health Limitations affecting work (%)***	25.2	13.9	29.0	53.7	77.4	66.2	82.5
Other Socio-demographic Variables							
Mean Age (years)***	59.8	59.9	59.7	59.8	59.5	59.8	59.4
(SD)	(0.04)	(0.05)	(0.15)	(0.10)	(0.17)	(0.28)	(0.31)
Female (%)***	56.0	52.7	65.1	60.8	71.7	70.3	69.2
Non-White (%)***	13.4	12.9	18.3	10.1	16.4	21.8	36.9
Married (%)***	75.7	78.3	60.8	75.8	57.5	71.8	63.5
Education (years)***	12.5	12.8	11.3	12.3	10.8	11.4	9.7
(SD)	(0.03)	(0.04)	(0.16)	(0.09)	(0.16)	(0.30)	(0.35)
Smoking (%)[a]***	21.3	19.8	27.5	21.7	32.5	23.5	33.2
Mean Number of persons in Household	2.4	2.4	2.3	2.3	2.3	2.4	2.6
(SD)	(0.01)	(0.02)	(0.06)	(0.03)	(0.07)	(0.09)	(0.13)
Health Variables							
Mean Number of chronic health conditions	1.1	1.1	1.7	2.0	2.8	2.1	3.1
(SD)***	(0.02)	(0.02)	(0.07)	(0.04)	(0.08)	(0.12)	(0.18)

Note: we report mean and standard deviation (in parenthesis) for continuous variables, and percentage for categorical variables. ***p < 0.01, **p < 0.05 *p < 0.1.
* Number of observations and corresponding percentage (weighted).
[1] Range of annual household income is from $0 to $2,830,203.
[2] Range of total medical expenditures is from $0 to $ 894,200.
[a] Based on 7078 observations (272 are missing smoking status).

Table 2. Multivariate Estimates of Dichotomous Outcomes (Logistic Regression Models)*

	Not Employed	Retired	Government Health Insurance	Receive Social Security	Limitations in ADLs	Health limitations affecting work
Depression only	1.28[1,2]	1.07[a,o]	1.26[1,2]	1.39[1,2]	2.71[1,2]	1.56[1,2]
	(0.02)	(0.56)	(0.07)	(0.02)	(0.00)	(0.00)
Mild/moderate pain only	1.54	1.41	1.85	1.76	7.21	5.22
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Depression and Mild/moderate Pain	2.55[3]	1.47	2.23	2.38	13.3[3]	9.18
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Severe Pain only	2.94	1.77	2.87	3.43	18.8	8.38
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Depression and Severe Pain	5.12	1.69	3.17	3.91	24.7	9.29
	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Age	1.19	1.28	1.19	1.64	1.04	1.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.29)
Female	2.05	1.00	.72	1.12	0.76	0.76
	(0.00)	(0.96)	(0.00)	(0.09)	(0.00)	(0.00)
Nonwhite	1.04	1.15	1.58	1.15	1.54	1.18
	(0.49)	(0.06)	(0.00)	(0.12)	(0.00)	(0.05)
Married	1.32	1.16	.59	.76	.74	.80
	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
Education	0.91	1.00	.93	.92	.90	.91
	(0.00)	(0.98)	(0.00)	(0.00)	(0.00)	(0.00)
Smoking	1.15	1.15	1.27	1.14	1.10	1.31
	(0.03)	(0.05)	(0.00)	(0.11)	(0.35)	(0.00)
Smoking_missing	1.58	2.11	1.13	1.63	0.96	1.63
	(0.03)	(0.00)	(0.42)	(0.00)	(0.84)	(0.00)
Number of persons in the Household	0.96	.89	1.03	1.00	1.00	.93
	(0.06)	(0.00)	(0.34)	(0.99)	(0.92)	(0.02)
Number of chronic health conditions	1.33	1.26	1.43	1.36	1.49	1.95
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

* ''No depression or pain'' is the reference group for all analyses. Estimates of odds ratio and correspondent p-values (in the bracket) are reported.
[1] Difference between depression with mild/moderate pain and depression only is statistically significant at $p < 0.01$.
[2] Difference between depression with severe pain and depression only is statistically significant at $p < 0.01$.
[3] Difference between depression with severe pain and depression with mild/moderate pain is statistically significant at $p < 0.05$.
[a] Difference between depression with mild/moderate pain and depression only is statistically significant at $p < 0.1$.
[o] Difference between depression with severe pain and depression only is statistically significant at $p < 0.1$.

0.01) and depression with mild/moderate pain (median = $3817; $\chi^2 = 70.82$, df = 1, p < 0.01). Depression with mild/moderate pain also had higher medical expenditures compared to depression alone ($\chi^2 = 101.19$, df = 1, p < 0.01). However, the association of depression with comorbid pain (mild/moderate or severe) and annual household income was not statistically different from depression alone.

The depression with severe pain group had a higher probability of being covered by government health insurance (34.7% vs. 19.3%; $\chi^2 = 11.83$, df = 1, p<0.01) and receiving social security (44.7% vs 29.5%; $\chi^2 = 7.02$, df = 1, p < 0.01) than depression alone. Likewise, depression with mild/moderate pain was worse than depression alone on these outcomes (28.2% vs. 19.3% for governmental health insurance; $\chi^2 = 12.96$, df = 1, p < 0.01; and 37.2% vs

29.5% for social security; $\chi^2 = 10.40$, df = 1, p < 0.01).

The depression with severe pain group was significantly associated with greater limitations in ADLs relative to depression alone (43.6% vs. 9.4%; $\chi^2 = 62.58$, df = 1, p < 0.01), and relative to depression with mild/moderate pain (43.6% vs. 30.7%; $\chi^2 = 5.38$, df = 1, p = 0.02). Depression with mild/moderate pain also was associated with higher probabilities of limitations in ADLs compared depression alone (30.7% vs. 9.4%; $\chi^2 = 73.44$, df = 1, p < 0.01). Depression with severe pain (56.9% vs. 23.0%; $\chi^2 = 29.28$, df = 1, p < 0.01) and depression with mild/moderate pain (56.6% vs. 23.0%; $\chi^2 = 95.16$, df = 1, p < 0.01) had higher probabilities of reporting health limitations affecting work compared to depression alone.

Finally, **Figure 1** illustrated the prevalence of mild/

Table 3. Multivariate Estimates of Continuous Outcomes (Median Regression Models)*

	Annual Household Income	Medical Expenditure in the past two years
Depression only	−2765	−87[1,2]
	(0.04)	(0.48)
Mild/moderate pain only	−2758	1210
	(0.00)	(0.00)
Depression and Mild/moderate Pain	−5770	1676
	(0.01)	(0.00)
Severe Pain only	−8342	1624
	(0.00)	(0.00)
Depression and Severe Pain	−3332	4001[3]
	(0.22)	(0.00)
Age	−977	−0
	(0.00)	(0.98)
Female	−7005	28
	(0.00)	(0.64)
Nonwhite	−5781	−86
	(0.00)	(.27)
Married	16679	148
	(0.00)	(0.04)
Education	3316	85
	(0.00)	(0.00)
Smoking	−3468	−209
	(0.00)	(0.00)
Smoking_missing	−3239	3
	(0.00)	(0.98)
Number of persons in the Household	601	−13
	(0.03)	(0.64)
Number of chronic health conditions	−1622	1066
	(0.00)	(0.00)

* ''No depression or pain'' is the reference group for all analyses. Estimates of coefficients and correspondent p-values (in the bracket) are reported.
[1] Difference between depression with mild/moderate pain and depression only is statistically significant at $p < 0.01$.
[2] Difference between depression with severe pain and depression only is statistically significant at $p < 0.01$.
[3] Difference between depression with severe pain and depression with mild/moderate pain is statistically significant at $p < 0.05$.

Table 4. Predicted Values of Outcomes across Depression/Pain Subgroups in HRS, 1996

	Neither Depression Nor Pain	Depression Only	Depression with Mild/moderate Pain	Depression with Severe Pain
Not Employed (%)[†1,2,3]	39.0	44.1	58.6	72.1
Retired (%)[†ao]	25.4	26.6	32.2	34.9
Median Annual Household Income ($)*	40460	37695	34691	37128
Median Medical Expenditure ($)*[1,2,3]	2141	2054	3817	6142
Covered by Government Health Insurance (%)[†1,2]	16.3	19.3	28.2	34.7
Receive Social Security (%)[†1,2]	25.2	29.5	37.2	44.7
Limitations in ADLs (%)[†1,2,3]	3.9	9.4	30.7	43.6
Health limitations affecting work (%)[†1,2]	17.1	23.0	56.6	56.9

† Predicted probabilities of outcomes across depression/pain subgroups, based on multivariate regression logistic regression of table 2.
* Estimated values of outcomes across depression/pain subgroups, based on multivariate median regressions of table 3.
[1] Difference between depression with mild/moderate pain and depression only is statistically significant at $p < 0.01$.
[2] Difference between depression with severe pain and depression only is statistically significant at $p < 0.01$.
[3] Difference between depression with severe pain and depression with mild/moderate pain is statistically significant at $p < 0.05$.
[a] Difference between depression with mild/moderate pain and depression only is statistically significant at $p < 0.1$.
[o] Difference between depression with severe pain and depression only is statistically significant at $p < 0.1$.
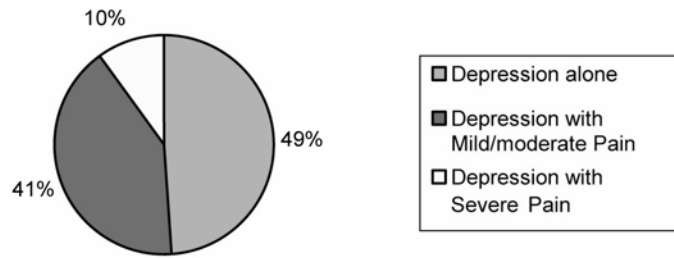
H. TIAN *ET AL.*

Figure 1. Among the Depressed Near Elderly Americans: 1/2 Have ''Pure'' Depression, 1/2 Have Depression with Pain.
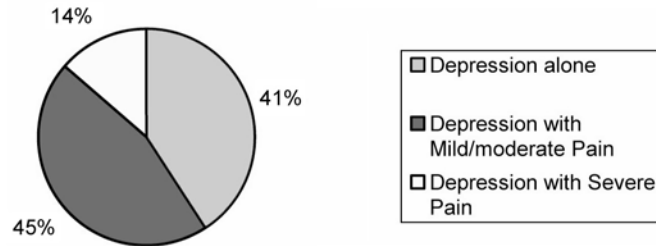

Figure 2. Non-employment: 2/5 is Attributable to ''Pure'' Depression, 3/5 is Attributable to Depression with Pain.
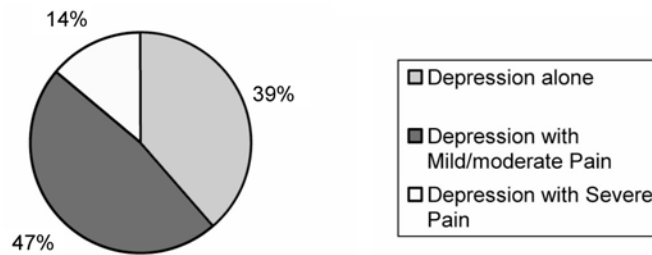

Figure 3. Government Helath Insurance: 2/5 is Attributable to ''Pure'' Depression, 3/5 is Attributable to Depression with Pain.
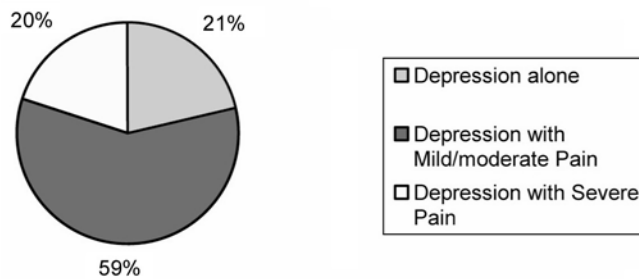

Figure 4. Limitations in ADLs: 1/5 is Attributable to ''Pure'' Depression, 4/5 is Attributable to Depression with Pain.
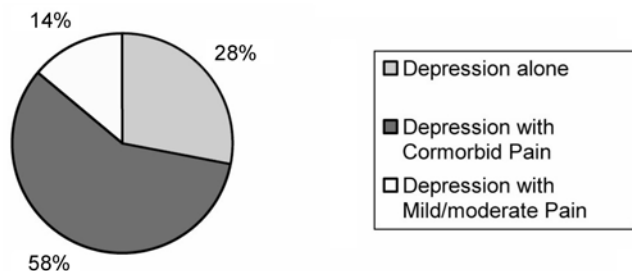

Figure 5. Health Limitations Affecting Work: 1/4 is Attributable to ''Pure'' Depression, 3/4 is Attributable to Depression with Pain.

moderate pain and severe pain among the depressed; **Figure 2**, **Figure 3**, **Figure 4** and **Figure 5** illustrated the share of comorbid pain (mild/moderated pain, or severe pain) among the depressed on outcomes including non-employment, government health insurance, limitations in ADLs, and health limitations affecting work, respectively. Half of the near elderly Americans of individuals who had depression also had comorbid pain (51%). Among those with depression, the depression with pain group accounted for 3/5 of those who were not employed (59%), 3/5 of those with government health insurance (61%), 4/5 of those with limitations in ADLs (79%), and 3/4 of those with health limitations affecting work (72%). The effect of ''pure'' depression is relatively smaller. In addition, although severe pain only accounted for a small portion among the depressed (10%), their relative adverse effects were large. They accounted for 14% of the depressed who were not employed, 14% of those with government health insurance, 20% of those with limitations in ADLs, and 14% of those with health limitations affecting work.

Sensitivity Analysis

Using CIDI-SF to measure depression gave very similar results (data not shown), except that the association of depression with pain was slightly stronger for some outcomes (i.e. government health insurance, social security). This indicated that our results were robust to the measure of depression.

Discussion

This study compared the associations of depression and comorbid pain versus depression alone or neither condition on labor market, financial, insurance, and disability outcomes in a nationally representative cross-section of near elderly Americans. Depression with comorbid pain was associated with worse outcomes compared to depression alone or neither condition, after controlling for socio-demographics and other chronic health conditions. The simulated results showed that magnitudes of the adverse effects of comorbid pain on depression were substantial. The study suggests that individuals with depression were not homogenous. The effect of depression might be overestimated without considering the effect of comorbid pain and programs focused on depression in general may not achieve policy goal for the depressed with comorbid pain. Furthermore, our study found that although severe pain only account for a small portion in the depressed, it is associated with worst social outcomes and its relative adverse effect should not be ignored.

Although the economic burden of depression has been well documented, data and studies on the social costs of depression and comorbid pain are rare. Existing studies are limited to claims data or patient data from selected employers or practices.[29] Our study enriched the literature by simultaneously studying the association between depression

and comorbid pain, and labor market, financial, insurance and disability outcomes in nationally representative survey data. Numerous studies have examined the economical and disability outcomes of depression, however our study demonstrated that depression with comorbid pain, not just ''pure'' depression, might especially drive these adverse outcomes.

The study also demonstrated that near elderly Americans with depression and comorbid pain were particularly vulnerable. They were at a higher risk of disability and the negative influences disability may have on household income. Since depression with pain was negatively associated with employment and therefore employment-based insurance, these individuals may have reduced access to care. With limited household income, near elderly Americans with depression and comorbid pain may be more likely to find health care unaffordable before they make the transition into Medicare. This, in turn, leads to even greater progression of worsening health status for them.[42,43]

Worse economic and disability outcomes and large social costs conversely imply a high economic return for policies that aid in the identification and treatment of depression and comorbid pain. Our data were collected through interviews and self-report of pain, which may reflect symptoms, but not necessarily physical pathology. In fact, symptoms like pain, stiffness, lack of energy, cramps account for more than half of outpatient encounters in the United States and more than a third of such symptoms lack an adequate physical explanation, but these symptoms increase health care costs and remain an obvious source of ill health.[44,45] Although pain is often measured broadly in research, treatment data usually focuses on a specific condition. This makes application of evidence based medicine challenging. Despite the high percentage of depressed patients that present soley with unexplained pain, there is little data about the best practices for treating this population.[31,46] Most current studies focus on treating one condition in the presence of another, and some also suggest treating both conditions will improve overall outcomes.[31,47,48] Although our study provided no information on the adequacy of care for depression and pain, it suggested that public health and policy should target clinical practice guidelines for depression and pain and identify more adequate and efficient care (either pain management, depression management, or both). Our study on the other hand suggested that reduced access to care due to loss of insurance and poor economic situation is a probable reason for some patients with depression and pain to have lack of care or inadequate care. With the evolving state of Medicare (particularly its Medicare Modernization Act provisions) and in Medicaid with states that have mental health exemptions for psychotropic drugs, broad formulary access to mental health treatments might be considered. Attempts to improve the quality of health coverage on these government health insurance plans and social security programs may be very beneficial for some of those who are eligible.

226

H. TIAN *ET AL.*

Limitations

Though this study expands knowledge on the association of depression and pain, our indicators of depression and pain were based on self-reported subjective measures. Previous literature suggested that subjective measures of health may biases estimates in both directions.[49] The lack of comparability of subjective depression or pain across respondents is likely to underestimate their effects on labor market outcomes due to measurement error. The problem is heightened when continuous variables, such as depression and pain, are categorized into dichotomous variables. The endogeneity of self-reported depression and pain (for example, individual may mention depression or pain to rationalize their not working or retirement behavior) will overestimate estimates. Though there is a tendency to cancel out the opposite directions of biases, this study does not quantify the real direction and magnitude of biases. Biases in our estimations of depression or pain on outcomes may also lead to biases on coefficients of other variables that were correlated with depression or pain.

Another limitation of the study relates to endogeneity inherent in cross-sectional studies. We studied effects of depression and pain on outcomes, however these outcomes might also have effect on depression and pain. Our study did not address the potential reverse causality issue. Additionally, there may exist other unmeasured variables that were correlated with depression, pain and outcomes that were not included in the analyses. For example, we were unable to control for personality traits. If individuals predisposed to depressive episodes have negative preference for labor participation, then our estimates for depression on labor market outcomes would be overestimated. Similar arguments may apply to other variables as unmeasured education, life circumstances, economic environment and so on. Finally, the study was limited in the age range as the HRS Wave 3 only includes primary respondents between the ages of 55 to 65. The results may not be generalizable to other age groups.

Despite these limitations, depression with pain, not depression alone may be responsible for a large part of the higher economic burden associated with depression. Depressed patients with pain may benefit from educational and treatment practices that acknowledge both depressive and painful symptoms.

References

1. Wells KB, Sturm R, Sherbourne CD, Meredith LS. *Caring for Depression*. Cambridge, Mass, Harvard University Press. 1996.
2. Wells KB, Stewart A, Hays RD, Burnam MA, Rogers W, Daniels M, Berry S, Greenfield S, Ware J. The functioning and well-being of depressed patients: results from the Medical Outcomes Study. *JAMA* 1989; **262**: 914-919.
3. Blazer DG, Kessler RC, McGonagle KA, Swartz MS. The prevalence and distribution of major depression in a national community sample: the national comorbidity study. *Am JPsychiatry* 1994; **151** (7): 979-986.
4. Frerichs RR, Aneshensel CS, Yokopenic PA, Clark VA. Physical health and depression: an epidemiologic survey. *Prev Med*. 1982; **11**(6): 639-646.
5. Craig TJ, Van Natta PA. Disability and depressive symptoms in two communities. *Am J Psychiatry* 1983; **140**(5): 598-601.
6. Greenberg PE, Kessler RC, Birnbaum HG, Leong SA, Lowe SW, Berglund PA, Corey-Lisle PK. The economic burden of depression in the United States: how did it change between 1990 and 2000? *J Clin Psychiatry* 2003; **64**: 1465-1475.
7. Greenberg PE, Stiglin LE, Finkelstein SN, Berndt ER. The economic burden of depression in 1990. *J Clin Psychiatry* 1993; **54**: 405-418.
8. Berto P, D'Ilario D, Ruffo P, Di VR, Rizzo F. Depression: cost-of-illness studies in the international literature. A review. *J Ment Health Policy Econ* 2000; **3**: 3-10.
9. Stoudemire A, Frank R, Hedemark N, Kamlet M, Blazer D. The economic burden of depression. *Gen Hosp Psychiatry* 1986; **8**(6): 387-394.
10. Von Korff M, Dworkin SF, Resche L, Kurger A. An epidemiologic comparison of pain complaints. *Pain* 1988; **32**: 173-183.
11. Bair MJ, Robinson RL, Eckert GJ, Stang PE, Croghan TW, Kroenke K. Impact of pain on depression treatment response in primary care. *Psychosom Med* 2004; **66**(1): 17-22.
12. Bertrus PA, Elmore Sk, Hamilton PA. Women and somatization: unrecognized depression. *Health Care Women Int* 1995; **16**: 287-297.
13. Gureje O, Simon GE, Von Korff M. A cross-national study of the course of persistent pain in primary care. *Pain* 2001; **92**: 195-200.
14. Salerno SM, Browning R, Jackson JL. The effect of antidepressant treatment on chronic back pain: a meta-analysis. *Arch Intern Med* 2002: **162**: 19-24.
15. Lamb SE, Guralnik JM, Buchner DM, Ferrucci LM, Hochberg MC, Simonsick EM, Fried LP. Factors that modify the association between knee pain and mobility limitation in older women: the Women's Health and Aging study. *Ann Rheum Dis* 2000; **59**: 331-337.
16. Engel CC, Von Korff M, Katon WJ. Back pain in primary care: predictors of high health-care costs. *Pain* 1996; **65**: 197-204.
17. Katz PP, Yelin EH. Life activities of persons with rheumatoid arthritis with and without depressive symptoms. *Arthritis Care Res* 1994; **7**(2): 69-77.
18. Kessler RC, Berglund P, Demler O, Jin R, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005; **62**: 593-602.
19. Bartel A, Taubman P. Health and labor market success: the role of various diseases. *Rev Econ Stat* 1979; **61**(1): 1-8.
20. Mitchell JM, Anderson KH. Mental health and the labor market participation of older workers. *Inquiry* 1989; **26**: 262-271.
21. Frank R, Gertler P. An assessment of measurement error bias for estimating the effect of mental distress on income. *J Hum Resour* 1991; **26**(1): 154-164.
22. Ettner SL, Frank RG, Kessler RC. The impact of psychiatric disorders on labor market outcomes. *Ind Labor Relat Rev* 1997. **51**(1): 64-81.
23. Kessler RC, Frank RG. The impact of psychiatric disorders on work loss days, *Psychological Medicine*. 1997; **27**(4): 861-873.
24. French MT, Zarkin GA. Mental health, absenteeism and earnings at a large manufacturing worksite. *J Ment Health Policy Econ* 1998; **1**(4): 161-172.
25. Hamilton VH, Merrigan P, Dufresne E. Down and out: estimating the relationship between mental health and unemployment. *Health Econ* 1997; **6**(4): 397-406.
26. Alexandre PK, French MT. Labor supply of poor residents in metropolitan Miami, Florida: The role of depression and co-morbid effects of substance use. *J Ment Health Policy Econ* 2001; **4**(4): 161-173.
27. Gresenz CR, Sturm R. New dimensions of economic well being among people with mental illness: evidence from Healthcare for Communities. *Health Serv Res* 2000; **35** (5, Part III): 32-42.
28. Marcotte DE, Wilcox-Gök V. Estimating earning losses due to mental illness: a quantile regression approach. *J Ment Health Policy Econ* 2003; **6**(3): 123-134.
29. Greenberg PE, Leong SA, Birnbaum HG, Robinson RL. The economic burden of depression with painful symptoms. *J Clin Psychiatry* 2003; **64** (suppl 7): 17-23.
30. Emptage NE, Sturm R, Robinson RL. Depression and comorbid pain as predictors of disability, employment, insurance status, and health care costs. *Psychiatr Serv* 2005; **56**: 468-474.
31. Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity. *Arch Intern Med* 2003; **163**: 2433-2445.
32. Kirmayer LJ, Robbins JM. Three forms of somatization in primary care:

prevalence, co-occurrence, and socidemographic characteristics. *J Nerv Mental Dis* 1991; **179**: 647-655.

33. Pearson SD, Katzelnick DJ, Simon GE, Manning W, Helstad CP, Henk JJ. Depression among high utilizers of medical care. *J Gen Intern Med* 1999; **14**: 461-468.

34. Kroenke K. Studying symptoms: sampling and measurement issues. *Ann Intern Med* 2001; **134**: 844-853.

35. Blazer D, Hughes DC, George LK. The epidemiology of depression in an elderly community population. *Gerontologist* 1987; **27**: 281-287.

36. Montano CB. Primary care issues related to the treatment of depression in elderly patients. *J Clin Psychiatry* 1999; **60** (suppl 20): 45-51.

37. Clark JD. Chronic pain prevalence and analgesic prescribing in a general medical population. *J Pain Symptom Manage* 2002; **23**: 131-137.

38. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977; **1**(3): 385-401.

39. Steffick DE. *Documentation of Affective Functioning Measures in the Health and Retirement Study.* Report DR-005, Survey Research Center, University of Michigan, Ann Arbor, MI 2000.

40. Kessler RC , Andrews G, Mroczek D, Ustun B, and Wittchen HU. The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF). *Int J Methods Psychiatr Res* 1998; **7**(4): 171-185.

41. Walters EE, Kessler RC, Nelson CB, Mroczek D. *Scoring the WHO Composite Diagnostic Interview Short Form* (CIDI-SF; v1.1 Dec 2002 [online]. Available: http://www3.who.int/cidi/cidisf.htm.

42. Baker DW, Sudano JJ, Albert JM, Borawski EA, Dor A. Lack of health insurance and decline in overall health in late middle age. *N Engl J Med* 2001; **345**: 1106-1112.

43. Heisler M, Langa KM, Eby EL, Mark FA, Kabeto MU, Piette JD. The health effects of restricting prescription medication use because of cost. *Med Care* 2004; **42**: 626-634.

44. Kroenke K, Mangelsdorff AD. Common symptoms in ambulatory care: incidence, evaluation, therapy, and outcome. *Am J Med* 1989; **86**(3): 262-266.

45. Kroenke K, Price RK. Symptoms in the community, prevalence, classification, and psychiatric comorbidity. *Arch Intern Med* 1993; **153**: 2474-2480.

46. Rost K. Depression and Pain. The road to evidence-based care. *Arch Int Med* 2003; **163**:2415-2416.

47. Campbell LC, Clauw DJ, Keefe FJ. Persistent pain and depression: A biopsychosocial perspective. *Biol Psychiatry* 2003; **54**: 399-409.

48. Fava M. Depression with physical symptoms: treating to remission. *J Clin Psychiatry* 2003; **64** (suppl 7): 24-28.

49. Bound J. Self-reported versus objective measures of health in retirement models. *J Hum Resour* 1991; **26** (1): 106-138.