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# Association between the Center for Epidemiologic Studies Depression Scale (CES-D) and mortality in a community sample: An artifact of the somatic complaints factor?[1]

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**ABSTRACT.** Most previous studies of the depression-mortality association have not examined distinct depressive symptom clusters. This *ex post facto* study examined which aspects of depression may account for its association with mortality. The Center for Epidemiologic Studies Depression Scale (CES-D) was administered to 3,867 community dwelling adults. Cox proportional hazards procedures estimated the risk of mortality as a function of depression status and each of 4 CES-D factor scores. Depressed participants (CES-D ≥ 16) had a 1.23-fold higher risk of mortality (95% *CI* 1.03-1.49), adjusting for sociodemographics. *Somatic Complaints* (SC) was the only factor to predict mortality (*HR* 1.19, 95% *CI* 1.03-1.38). After excluding SC, CES-D scores no longer predicted mortality (*HR* .98, 95% *CI* .79-1.21). The association between CES-D depressive symptoms and mortality appears to be a function of the SC factor. The association

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between non-somatic depressive symptoms and mortality may not be as robust as past findings suggest.

**KEYWORDS**. CES-D. Depressive symptomatology. Mortality. Somatic complaints. *Ex post facto* study.

**RESUMEN**. La mayoría de las investigaciones sobre la asociación entre la depresión y la mortalidad no han examinado distintos grupos de síntomas depresivos. Este estudio *ex post facto* examinó que aspectos de la depresión explican su asociación con la mortalidad. La Escala de Depresión del Centro de Estudios Epidemiológicos (CES-D) fue administrada a 3.867 residentes comunitarios. El riesgo de mortalidad como función del estado depresivo y de cada uno de los 4 factores de la CES-D fue estimado con el modelo de azar proporcional de Cox. Los participantes deprimidos (CES-D $\geq$ 16) tuvieron un riesgo elevado de mortalidad (*HR* 1,23, 95% *CI* 1,03-1,49) después de la corrección de variables sociodemográficos. *Quejas somáticas* fue el único factor que predijo la mortalidad (*HR* 1,19, 95% *CI* 1,03-1,38). Después de excluir *Quejas somáticas*, la CES-D no predijo la mortalidad (*HR* 0,98, 95% *CI* 0,79-1,21). La asociación entre los síntomas depresivos de la CES-D y la mortalidad parece ser una función del factor *Quejas somáticas*. Es posible que la asociación entre los síntomas depresivos no somáticos y la mortalidad no sea tan robusta como indican los hallazgos anteriores.

**PALABRAS CLAVE.** CES-D. Sintomatología depresiva. Mortalidad. Quejas somáticas. Estudio *ex post facto*.

In recent years, efforts have been directed toward examination of the relationship between depressive symptoms and mortality. Compelling evidence supports the notion that depressive symptoms associate with increased risk of death (*e.g*., Black and Markides, 1998; Bruce, Leaf, Rozal, Florio, and Hoff, 1994; Cuijpers and Smit, 2002; Kinder, Bradley, Katon, Ludman, McDonnel, and Bryson, 2008; Murphy, Monson, Olivier, Sobol, and Leighton, 1987; Pulska, Pahkala, Laipalla, and Kivela, 1998; Wulsin, Vaillant, and Wells, 1999). Unfortunately, many investigations did not adequately control for confounds or examine links between types of depressive symptoms and mortality. Moreover, a number of studies failed to replicate the association (Everson-Rose, House, and Mero, 2004; Fredman, Magaziner, Hebel, Hawkes, and Zimmerman, 1999; Hybels, Pieper, and Blazer, 2002; Roberts, Kaplan, and Camacho, 1990; Thomas, Kelman, Kennedy, Ahn, and Yang, 1992). As a result, uncertainties still exist with regard to the relation between depressive symptoms and mortality.

These mixed findings highlight the complexity of the association between depressive symptoms and mortality (Schulz, Drayer, and Rollman, 2002). Given bidirectional relations between depression and physical health (*e.g*., Everson, Roberts, Goldberg, and Caplan, 1998; Frasure-Smith and Lesperance, 2005; Kinzie, Lewinsohn, Maricle, and Teri, 1986; Maricle, Kinzie, and Lewinsohn, 1988; Meesters and Appels, 1996; Murphy *et al.,* 1987; Pettit, Grover, and Lewinsohn, 2007; Rugulies, 2002), the question has been raised as to whether depression serves as a risk factor for mortality beyond its association

with poor health and sociodemographic factors. A number of investigations indicate that depression does indeed uniquely predict mortality (Black and Markides, 1998; Penninx *et al.* 1999; Pulska *et al.,* 1998), but it remains unclear how and under what circumstances this happens. In the present study, we address that question in part by investigating prospective associations between scores on a commonly used measure of depressive symptoms, the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), and mortality in a large community sample of adults. In particular, we examine depressive symptom clusters that may account for an association between CES-D scores and mortality.

The CES-D is the most commonly used self-report depressive symptom measure in mortality studies (Cuijpers and Smit, 2002). A frequent approach has been to assign depression status based on a CES-D cut-off (usually $\geq$ 16), and then observe which participants die over follow-up periods. Several studies report a positive predictive effect of CES-D status on mortality (Black and Markides, 1998; Fuhrer *et al.,* 1999; Li, He, and Zhang, 2002). A recent meta-analysis of four studies using CES-D scores among approximately 18,000 community participants reported a significant hazard ratio of 1.66 among those identified as depressed (Cuijpers and Smit, 2002). However, others have failed to demonstrate an association between CES-D scores and mortality. For example, after controlling for demographic and health variables, multiple studies have found negligible effects of CES-D scores on mortality (Blazer, Hybels, and Pieper, 2001; Everson-Rose *et al.,* 2004; Fredman *et al.,* 1999; Fu, Lee, and Chen, 2003; Hybels *et al.* 2002; Thomas *et al.,* 1992).

As this brief review indicates, evidence linking CES-D scores to mortality in community samples is quite mixed. The discrepant findings highlight the importance of controlling for potential confounds. Even after controlling for demographic variables, however, another important aspect of the CES-D-mortality association has largely been ignored. Namely, most studies have not examined associations between CES-D factor scales and mortality. This represents a failure to address what aspects of CES-D depressive symptoms might account for its association with mortality, which may in turn promote misleading conclusions. The PA (*Positive Affect*) and DA (*Depressive Affect*) factors characterize the cognitive and emotional aspects of depression, and the IP (*Interpersonal)* factor represents the social functioning component of depression. In contrast, the SC (*Somatic Complaint*) factor reflects physiological symptoms and retarded activity associated with depression (Radloff, 1977). As such, it may overlap unduly with other health-related conditions and behaviors. To more accurately evaluate the link between depressive symptoms and subsequent mortality, the relationships of the CES-D factors to mortality must be examined.

To our knowledge, only two studies have investigated the associations between CES-D factor scores and mortality. In a study that addressed one CES-D factor, Penninx *et al.* (1999) reported that CES-D scores significantly predicted mortality among men (but not women) over a 4-year follow-up after deleting SC items. Using a modified version of the CES-D, Blazer and Hybels (2004) found that after controlling for potential confounds, only PA significantly predicted mortality over a 10-year follow-up of older African American and European American adults. While providing interesting initial findings, the investigation was limited by a modified CES-D that coded symptoms as

present or absent, rather than assessing their frequency of occurrence. Such a procedure may not adequately address the issue of depressive symptom severity.

In the present *ex post facto* (Montero and León, 2007; Ramos-Alvarez, Valdés-Conroy, and Catena, 2006). study, we replicate and extend those approaches by examining the association between CES-D scores and mortality in a large community sample of adults. The purposes of this study are three-fold: a) to replicate the previously reported association between CES-D scores and mortality; b) to examine which, if any, of the four CES-D factors predict mortality, controlling for each other; and c) to examine if the CES-D and/or CES-D factors significantly predict mortality after controlling for relevant demographic variables.

We make several hypotheses. First, based on established links between depressive symptoms and mortality, we predict that total CES-D depressive symptom scores $\geq 16$ (Radloff, 1977) will be associated with higher mortality rates. Second, we hypothesize that CES-D SC will predict increased mortality, even controlling for the other CES-D factors. We make this hypothesis based upon the notion that SC taps into a variety of health problems and symptoms relevant to mortality. In contrast, none of the other factors are expected to predict mortality, after controlling for SC. Finally, we predict that the associations between mortality and total CES-D scores will be reduced to nonsignificance when CES-D SC is excluded. Here again, we make this hypothesis based on the notion that the connections between depression and mortality may be influenced largely by the somatic features of depression.

## Method

*Participants*

Complete data were available for 3,867 adults who participated in three community samples in Western Oregon -Sample 1 = 509 (343 women; 68.60%); Sample 2 = 2,529 (1,530 women, 60.50%)-; Sample 3 = 829 (480 women, 57.90%). Participation was solicited through mail announcements. Individuals who agreed were sent a questionnaire that included the CES-D. Participants who agreed to participate but did not return the questionnaire within 1 month were reminded with follow-up letters and telephone calls.

For Sample 1, 20,000 adults randomly selected from the county voter-registration list (approximately 80% of adults) were informed of the study; 2,000 (10%) expressed interest in participating. Of these, 1,213 (61%) completed and returned the questionnaire between March and July 1978, and 618 attended a diagnostic interview. Of the 618, complete data all variables of interest were available for 509 (82%). No significant differences emerged between participants for whom death certificates searches were and were not conducted (inability to search for death certificates resulted from missing birth date or social security number). For Sample 2, a complete listing of local licensed drivers over age 50 was obtained from the Department of Motor Vehicles (more than 90% of adults have valid licenses, including individuals who no longer drive). All of these individuals ($N$ = 34,644) were informed of the study, and 3,297 (10%) expressed interest. Of these, 2,729 (83%) returned the questionnaire between November 1979 and January 1980. Complete data on all variables of interest were available for 2,529 (93%).

Men were more likely than women to be included in the death certificate search (96% vs. 93%, $\chi^2_{(1, 2728)} = 9.1$, $p < .01$), but other demographic variables did not differ by search status. For Sample 3, letters were sent to 4,133 randomly selected individuals from lists of licensed drivers over age 50 years, informing them about the study and telling them that they would be individually contacted. Follow-up calls were made to a random sample of 2,662. Of those called, 1,569 (59%) completed the questionnaire between May 1982 and November 1983, and 1,007 subsequently attended a diagnostic interview. Complete data on all variables of interest were available for 829 (82%). Those included in the death certificate search were older ($M_{age}$ 64 vs. 63, $F_{(1, 1568)} = 5.57$, $p < .05$) and more likely to be employed (51% vs. 37%, $\chi^2_{(1, 1568)} = 30.55$, $p < .001$). Detailed information on the samples may be found in Lewinsohn, Rhode, Seeley, and Fischer (1991).

Between-groups comparisons of the samples revealed differences in age, mortality rate, employment status, and depression status. Although most between-groups differences did not remain significant after controlling for age, Sample 1 continued to display a higher percentage of depressed cases than Samples 2 and 3. Independent examination of each sample suggested similar patterns of convergent validity for CES-D scores and similar predictive associations with mortality. Based on these findings and a desire to increase statistical power, the three samples were combined for the following analyses.

In the 1990s, an extensive search of death certificates was conducted using the National Death Index (NDI). The NDI was searched for deaths between 1981 and 1994.

*Measures*

- Center for Epidemiologic Studies Depression Scale (Radloff, 1977). The CES-D is a self-report measure of the frequency of 20 depressive symptoms during the past week. Symptoms are rated on a 0 to 3 scale, yielding total scores with a possible range from 0 to 60. The CES-D has demonstrated good psychometric properties (Husaini, Neff, Harrington, Hughes, and Stone, 1980; Radloff, 1977), and its use as a screener for depression among older adults has been supported (Beekman *et al.*, 1997; Lewinsohn Seeley, Roberts, and Allen, 1997). The CES-D is a self-report index of the frequency of depressive symptoms. It was designed for use with community samples, and its reliability and validity have accrued substantial support (Joiner, Pfaff, and Acres, 2002; Joiner, Walker, Pettit, Perez, and Cukrowicz, 2005; Lewinsohn *et al.*, 1997; Roberts, Lewinsohn, and Seeley, 1991; Roberts and Vernon, 1983). In addition to a total depressive symptom score, the CES-D provides four factor scores labeled *Depressed affect* (*e.g.*, "*I felt sad*"), *Positive affect (e.g., "I felt hopeful about the future"), Interpersonal problems (e.g., "People were unfriendly"),* and *Somatic complaints (e.g., "I could not get going", "My sleep was restless").* The factor structure of the CES-D has received ample support (*e.g.*, Golding and Aneshensel, 1989; Hertzog, Van Alstine, Usala, Hultsch, and Dixon, 1990; Nguyen, Kitner-Triolo, Evans, and Zonderman, 2004; Wong, 2000).
- Death Certificates. A system for determining cause of death based upon diseases listed on death certificates was developed and implemented (Hurtado and Greenlick,

1971; available upon written request to Jeremy W. Pettit). The system included 24 distinct categories to represent cause of death and the presence of significant diseases. Leading causes of death were consistent with United States. national norms and were as follows: heart disease ($n$ = 314, 38.30%), neoplasm ($n$ = 158, 19.30%), neurologic-cerebrovascular ($n$ = 83, 10.10%), and respiratory ($n$ = 82, 10%). Five (.10%) participants died by suicide. Average time interval from assessment to NDI search date or death was 13.98 years ($SD$ = 1.19 years) for those who did not die, and 8.22 years ($SD$ = 3.95 years) for those who died.

– Demographics. Marital status, educational attainment, and employment status were assessed in the questionnaire (see Table 1). Data on educational attainment were missing for 214 participants. Follow-up analysis revealed that individuals with missing educational attainment data were older ($F_{(1, 3866)} = 13.60$, $p < .001$) and more often male ($\chi^2_{(1, 3866)} = 178.97$, $p < .001$), but did not significantly differ on other variables, including mortality status. Multivariate analyses of predictors of mortality were conducted both including and excluding educational attainment as a covariate, and highly similar results were obtained.

Self-report and laboratory indicators of physical health were collected among subsamples of participants. A majority (3,276; 85%) were asked to rate their current global health on a 4-point scale ranging from *"excellent"* to *"poor"*, with higher scores reflecting poorer health. Four hundred sixty-seven (12%) participants completed laboratory measures of blood pressure, heart rate, and pulmonary capacity -forced vital capacity (FVC) and forced expiratory volume (FEV)-. The low number of available participants and the potential for selection bias on the laboratory measures precluded inclusion of these variables in the larger analyses of CES-D scores and mortality. However, they may be used in an exploratory fashion to examine the adequacy of the larger data set to address the hypotheses of this study. We address this issue prior to conducting main analyses.

*Statistical analysis*

Chi-square and correlational analyses were conducted to examine associations between demographic variables and depression status. Cox proportional hazards models were used to identify prospective predictors of death. Gender violated the proportional hazards assumption. The gender *x* time interaction term was therefore included in all analyses involving gender (Tabachnick and Fidell, 2001, p. 805). An interval variable representing time was created by computing a) number of days between assessment and death among those who died, and b) number of days between assessment and end of the follow-up period among those who did not die. Probability of death expressed as a hazard ratio (*HR*) with 95% confidence intervals (*CI*) was calculated for dichotomously coded CES-D scores (scores $\geq$ 16 represented *depressed*) and for each of the CES-D factors (interval scores). Age, gender, marital status, educational attainment, and employment status were controlled in multivariate analyses. Tests were two-tailed and alpha was set at .05.

## Results

*Self-report and laboratory health findings*

Before testing primary hypotheses, we present self-report and laboratory health findings among subsets of participants to bolster confidence in the larger dataset. Poorer self-reported health significantly correlated with higher blood pressure (for diastolic, $r$ [467] = .10, $p < .05$; for systolic, $r$ [467] = .14, $p < .01$), heart rate ($r$ [467] = .14, $p < .01$), and lower pulmonary capacity (FVC and FEV; $r$ [467] = -.13, $p < .01$). Poorer self-reported health also significantly correlated with SC ($r$ [3276] = .33, $p < .001$), supporting the notion that SC overlaps with general physical health. As expected, poorer self-reported health significantly predicted mortality status at follow-up even when controlling for demographic variables (*HR* = 1.56, 95% *CI* = 1.42-1.72, $p < .001$).

Laboratory measures displayed a mixed pattern of associations with SC: significant correlations were seen for pulmonary capacity (for FVC, $r$ [467] = -.17, $p < .001$; for FEV, $r$ [467] = -.19, $p < .001$), but not for blood pressure or heart rate (largest $r$ [467] = .06, $p$'s > .15). Laboratory measures significantly predicted mortality when controlling for demographic variables, with higher systolic blood pressure (*HR* = 1.01, 95% *CI* = 1.01-1.03, $p < .05$) and lower pulmonary capacity (*HR* = .84, 95% *CI* = .73-.96, $p < .05$) emerging as significant individual predictors. Hence, laboratory and self-report health indicators collected among subsets of the total sample tended to display expected patterns of association with each other, with SC, and with mortality, lending support to the adequacy of the larger dataset to address the hypotheses of this investigation. We now turn to these hypotheses.

*Demographics and depression status*

Median age of the 3,867 respondents was 61 years, and 60.80% were female. Six hundred eighty-four (17.70%) scored at or above the CES-D cut off of 16. As compared to nondepressed, depressed participants were significantly younger, more often female, and less often married (see Table 1). *Post hoc* analyses revealed several significant between-groups differences. With regard to age, participants under 50 displayed higher rates of depression than all other age groups ($\chi^2_{(1, 3868)} = 164.37$, $p < .001$), and participants between 60-80 displayed lower rates of depression than participants ages 50-59 or over 80 ($\chi^2_{(1, 3479)} = 8.87$, $p < .01$). A continuum emerged for marital status, such that married participants displayed lower rates of depression than widowed participants ($\chi^2_{(1, 3283)} = 15.61$, $p < .01$), who displayed lower rates than divorced participants ($\chi^2_{(1, 965)} = 9.01$, $p < .01$), who displayed lower rates than never married participants ($\chi^2_{(1, 666)} = 11.19$, $p < .001$). For educational attainment, participants who did not graduate from high school reported significantly less depression than all other education level groupings ($\chi^2_{(1, 3969)} = 19.71$, $p < .01$). Depression status did not significantly differ across employment status ($\chi^2_{(2, 3867)} = 3.89$, $p$ = ns).

Intercorrelations between depression status, CES-D factor scores, and demographic variables are presented in Table 2. As expected, CES-D factor scores were moderately intercorrelated.

**TABLE 1.** Demographic characteristics and baseline characteristics by depression status.

| | | | CES-D (%) | | | |
|---|---|---|---|---|---|---|
| | *n* | *%* | *<16* | *>15* | $\chi^2$ | *p* |
| Age | | | | | 161.22 | <.001 |
| <50 | 387 | 10. | 61.6 | 38.4 | | |
| 50-59 | 1378 | 35.6 | 82.9 | 17.1 | | |
| 60-69 | 1447 | 37.4 | 86.8 | 13.2 | | |
| 70-79 | 559 | 14.5 | 86.5 | 14.3 | | |
| >80 | 96 | 2.5 | 82.3 | 17.7 | | |
| Sex | | | | | 27.61 | <.001 |
| Male | 1513 | 39.1 | 85.8 | 14.2 | | |
| Female | 2354 | 60.8 | 79.8 | 20.2 | | |
| Marital Status | | | | | 102.79 | <.001 |
| Married | 2735 | 70.7 | 85.8 | 14.2 | | |
| Divorced/Separated | 467 | 12.1 | 70.4 | 29.6 | | |
| Widowed | 495 | 12.8 | 78.9 | 21.1 | | |
| Never Married | 170 | 4.4 | 65.9 | 34.1 | | |
| Education | | | | | 26.80 | <.001 |
| <High school | 992 | 27.2 | 86.9 | 13.1 | | |
| High school | 996 | 27.3 | 80.4 | 19.6 | | |
| Some college | 743 | 20.3 | 78.1 | 21.9 | | |
| College or professional | 922 | 25.2 | 80.9 | 19.1 | | |
| Employment | | | | | 3.39 | ns |
| Employed | 1660 | 42.9 | 80.9 | 18.1 | | |
| Unemployed, seeking work | 651 | 16.8 | 80.3 | 19.7 | | |
| Retired | 1556 | 40.2 | 83.5 | 16.5 | | |

*Note.* $N$ = 3,867; for *Education*, $n$ = 3,653.

**TABLE 2.** Means, SDs, and intercorrelations between measured variables.

| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. CES-D | -- | | | | | | | | | |
| 2. CES-D DA | .73 | -- | | | | | | | | |
| 3. CES-D PA | .52 | .39 | -- | | | | | | | |
| 4. CES-D SC | .65 | .65 | .29 | -- | | | | | | |
| 5. CES-D IP | .45 | .41 | .26 | .35 | -- | | | | | |
| 6. Age | -.18 | -.24 | .01 | -.23 | -.18 | -- | | | | |
| 7. Gender | -.07 | -.12 | -.01 | -.08 | -.01 | .08 | -- | | | |
| 8. Marital Status | .13 | .16 | .09 | .11 | .11 | -.08 | -.18 | -- | | |
| 9. Education | .06 | .06 | .03 | .10 | .03 | -.15 | -.04 | .00 | -- | |
| 10. Employment | -.02 | -.05 | .03 | .01 | -.07 | .43 | .04 | -.04 | .44 | -- |
| Mean | 8.11 | 1.71 | 2.96 | 3.14 | .32 | 59.44 | -- | -- | -- | -- |
| SD | 7.47 | 2.67 | 3.21 | 3.09 | .82 | 12.08 | -- | -- | -- | -- |

*Note.* $N$ = 3,867; for *Education*, $n$ = 3,653. All $r$'s > .06 significant at $\alpha$ = .001. CES-D = dichotomously coded Center for Epidemiologic Studies Depression Scale; CES-D DA = *Depressed Affect*; CES-D PA = *Positive Affect*; CES-D SC = *Somatic Complaints*; CES-D IP = *Interpersonal*. For Gender, Female = 1, Male = 2; For Marital Status, Married = 1, Divorced/Separated = 2, Widowed = 3, Never Married = 4; For Education, < High school graduate = 1, High school graduate = 2, Some college = 3, College graduate = 4; For Employment, Employed = 1, Unemployed and seeking work = 2, Retired = 3.

*Prospective predictors of mortality*

In total, 820 participants (21.20%) died during the follow-up. Significant univariate demographic predictors of mortality were older age, male gender, lower educational achievement, and unemployment/retirement status (see unadjusted *HRs* in Table 3). Follow-up analyses revealed that participants who were employed were less likely to die than those who were unemployed and seeking work (*HR* = 1.33, 95% *CI* = 1.06-1.66, $p < .05$), and that retired participants displayed a higher mortality rate than the other employment groups (*HR* = 1.66, 95% *CI* =1.53-1.80, $p < .001$). Marital status did not significantly predict mortality. However, marital status interacted with gender to predict mortality (*HR* = .71, 95% *CI* = .61-.82, $p < .001$), such that women who were widowed were at greater risk for mortality than women in other marital status groups (*HR* = 2.39, 95% *CI* = 1.93-2.96, $p < .001$). This effect did not hold after age was controlled. That is, widowed women were at greater risk for death primarily because they were older than other women. Marital status did not significantly predict mortality among men. Gender did not significantly interact with any other variable in the prediction of mortality; remaining analyses will therefore be conducted jointly for men and women.

When univariate demographic predictors were entered simultaneously in a multivariate analysis, older age and male gender remained significant predictors of mortality (see adjusted *HRs* in Table 3). Among participants who died during the follow-up, age was the only demographic variable significantly associated with cause of death: Death due to respiratory disease ($M_{age}$ = 64.10 years, *SD* = .93 years) and neoplasm ($M_{age}$ = 64.30 years, *SD* = .69 years) occurred at younger ages than death due to other causes ($M_{age}$ = 68.50 years, *SD* = .63 years), $F_{(4, 816)} = 8.094$, $p < .001$.

**TABLE 3.** Demographic predictors of mortality.

| | *Unadjusted* | | *Adjusted* [a] | |
|---|---|---|---|---|
| | *HR* | *95% CI* | *HR* | *95% CI* |
| Age | 1.09** | 1.09-1.1 | 1.08** | 1.07-1.09 |
| Male Gender | 1.89** | 1.62-2.2 | 2.49** | 2.01-3.08 |
| Marital Status | 1.04 | 0.96-1.12 | 1.04 | 0.95-1.12 |
| Education | .91* | 0.85-0.97 | 0.97 | 0.91-1.03 |
| Employment Status | 1.66** | 1.53-1.79 | 1.09 | 0.98-1.19 |

*Note*. *N* = 3,867; for *Education*, *n* = 3,653. *HR* = hazard ratio; *CI* = confidence interval; [a]*HR*s adjusted for all other demographic variables; For *Marital Status*, Married = 1, Divorced/Separated = 2, Widowed = 3, Never Married = 4; For *Education*, < High school graduate = 1, High school graduate = 2, Some college = 3, College graduate = 4; For *Employment*, Employed = 1, Unemployed and seeking work = 2, Retired = 3. ** $p < .001$; * $p < .01$.

After controlling for demographics, depressed participants had a significant 1.23-fold higher risk of dying (see Table 4). Consistent with prediction, SC significantly

predicted mortality status, even when controlling for demographics and other CES-D factors (adjusted *HR* = 1.19, 95% *CI* = 1.03-1.38, $p < .05$). No other CES-D factor significantly associated with mortality status after controlling for demographics. Among participants who died, neither depressed status nor CES-D factor scores significantly predicted cause of death (largest $f = 1.08$, all $p$'s = *ns*).

**TABLE 4**. Depressive symptom predictors of mortality.

| | *HR* [a] | *95% CI* |
|---|---|---|
| CES-D ≥ 16 | 1.24* | 1.03-1.49 |
| Factor Scores | | |
| Depressed Affect | 1.13 | 0.98-1.31 |
| Positive Affect | 1.02 | 0.94-1.11 |
| Somatic | 1.19* | 1.03-1.38 |
| Interpersonal | 1.12 | 0.93-1.34 |

*Note*. $N = 3{,}867$. *HR* = hazard ratio; *CI* = confidence interval; [a]*HR*s adjusted for age, gender, marital status, and employment status. * $p < .05$.

We also examined whether CES-D symptoms predicted mortality in the absence of SC. SC items were subtracted from CES-D totals, and scores ≥ 11 were classified as depressed (*cf.* Penninx *et al.,* 1999). Consistent with the notion that the prospective association between CES-D scores and mortality is largely an artifact of SC, the modified CES-D variable did not significantly predict mortality (adjusted *HR* = .98, 95% *CI* = .79-1.21, $p$ = ns).

Finally, we examined whether SC predicted mortality after controlling for self-reported health among participants for whom such data were available ($n = 3276$). Poorer self-reported health significantly predicted mortality, but the SC factor did not remain a significant predictor of mortality after controlling for self-reported health (*HR* = .91, 95% *CI* = .77-1.07, $p = ns$).

## Discussion

The present findings expand the literature on the association between depressive symptoms and mortality in community samples. Consistent with prediction, CES-D scores ≥ 16 significantly predicted mortality status over follow-ups of approximately 12-15 years, and this remained the case after controlling for sociodemographics. Thus, our findings accord with the majority of previous investigations in suggesting that self-reported depressive symptoms represent a risk factor for mortality in community samples.

Examination of specific relations between CES-D factor scores and mortality offers an additional contribution of this investigation. As hypothesized, only SC emerged as a significant predictor of mortality, and this remained the case after controlling for demographics and other CES-D factors. Furthermore, the predictive effect of CES-D

scores on mortality was reduced to nonsignificance when SC items were excluded, indicating that the link between depressive symptoms and mortality was largely a function of the physiological symptoms associated with depression. This finding contradicts those of Blazer and Hybels (2004), who reported that PA was the only CES-D factor to predict mortality, and Penninx *et al.* (1999), who reported that CES-D depressive symptoms without SC items significantly predicted mortality among men. Although reasons for these contradictions are unclear, it should be noted that we found no evidence for a predictive effect of PA or for differential gender effects in the relation between CES-D symptoms and mortality. Other differences that may contribute to the discrepant findings include our younger sample age (10-13 years younger on average), ethnicity (predominately Anglo American; the majority of Blazer and Hybel's sample was African American; Penninx *et al*. used a Dutch sample), and our longer follow-up length (4-10 years longer on average). Because these are the only studies to date that have examined CES-D factor scores, the discrepant findings highlight the need for continued investigation.

The finding that self-reported depressive symptoms did not predict mortality after excluding SC mirrors several previous reports that depressive symptoms do not predict death after controlling for physical health status (Everson-Rose *et al.,* 2004; Fredman *et al.,* 1999; Hybels *et al.,* 2002; Thomas *et al.,* 1992). Of additional interest is our finding that the cognitive, affective, and interpersonal features of depressive symptoms did not meaningfully contribute to long-term risk for mortality. A pathway has been proposed in which depression may promote risky health behaviors and inactivity (*cf.* motivational depletion; Schulz, Martire, Beach, and Scheier, 2000), which in turn result in poor physical health and increased risk for mortality (Schulz, *et al.,* 2000). The results of the present study may be relevant for that pathway. First, it may be that the dysphoria (*e.g.*, Rottenberg, 2007), social deficits (*e.g.*, Pettit and Joiner, 2006), and cognitions (*e.g.*, Maldonado, Pérez-Ocón, and Herrera, 2007) that accompany depression are irrelevant for health behaviors and mortality (*i.e*., only somatic features of depression eventuate in poor health and increased risk for mortality). Alternatively, it may be that participants in this sample had extensive previous experiences with depression and, consequently, may have progressed to the point that health-risk behaviors and poor physical health were already present and were more salient predictors of mortality. A third possibility is that pre-existing physical illness precipitated the development of somatic features of depression, and that depressotypic somatic complaints only predicted mortality via their association with pre-existing physical illness (which we did not assess).

Before discussing implications of these findings, we note limitations of the present study. An obvious limitation is the lack of objective measures of physical health. Without controlling for the potential confound of physical health, the validity of the association between depressive symptoms and mortality is uncertain. However, our finding that CES-D depressive symptoms did not increase risk for mortality above and beyond the effect of SC dampens the impact of not assessing physical health. That is, the absence of physical health indicators would be more problematic if CES-D scores had remained a significant predictor of mortality after excluding SC because it would be impossible to rule out the notion that non-somatic depressive symptoms only predicted mortality

via their association with poor health. In contrast, the finding that non-somatic depressive symptoms did not incrementally contribute to risk for mortality suggests that any connection between depressive symptoms and mortality was due to the somatic features of depression. Moreover, ancillary findings among a subset of participants suggested that even SC did not predict mortality above and beyond the effect of self-reported physical health.

Additional limitations include sample characteristics and the method of identifying deceased participants. Compared to most previous investigations, our sample was young (mean age of 61). The use of a community sample without psychiatric diagnosis also restricts the applicability of these findings to relatively high functioning individuals. Different patterns of associations may emerge among more severely depressed or functionally limited populations. Finally, it is possible that our NDI search failed to identify some deceased participants due to discrepancies in name (*e.g*., name changes through marriage, use of nicknames or aliases), misreported birth date at assessment, and emigration from the country.

In spite of these limitations, the present findings are buttressed by the replication of several previously demonstrated associations. For example, higher levels of depressive symptoms were seen in younger adults, women, and unmarried participants (Hybels *et al.,* 2002; Thomas *et al.,* 1992). Also consistent with previous research, older age, male gender, lower educational attainment, and retirement status served as risk factors for mortality (*e.g*., Black and Markides, 1998; Blazer and Hybels, 2004; Fu *et al.,* 2003; Geerlings, Beekman, Deeg, Twisk, and van Tilburg, 2002; Hybels *et al.,* 2002; Penninx *et al.,* 1999; Schrijvers, Stronks, van de Mheen, and Mackenbach, 1999; Thomas *et al.,* 1992). The lack of a significant association between marital status and mortality accords with several previous investigations (*e.g*., Fredman *et al.,* 1999; Pulska, Pahkala, Laipalla, and Kivela, 1997), although others have found unmarried men to be at heightened risk for mortality (*e.g*., Ben-Shlomo, Smith, Shipley, and Marmot, 1993; Ebrahim, Wannamethee, MacCullum, Walker, and Sharper, 1995; Parkes, Benjamin, and Fitzgerald, 1969). Finally, the emergence of expected associations between self-report and laboratory measures of physical health status, CES-D SC, and mortality in subsets of the sample further boosts confidence in the validity of our findings for the total sample.

In view of its strengths and limitations, the present study augments existing work in suggesting that the relationship between depressive symptoms and mortality in community samples is at least partially accounted for by somatic problems. If depressive symptoms contribute to mortality over and above the effects of concurrent physical health status, the neurovegetative features of depression likely account for that contribution. As such, future research on the depression-mortality link should not only assess physical health status and demographic variables, but should also seek to tease apart the somatic features of depression from the cognitive, affective, and interpersonal features. Moreover, previous findings of an association between CES-D scores and mortality that failed to account for the impact of the SC factor should be interpreted with caution. The association between non-somatic depressive symptoms and mortality among community samples may not be as robust as previous findings suggest.

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