Center for Epidemiologic Studies Depression Scale
- Shortened Version

Age Cohorts	Younger, Mid-age and Older
Surveys	Survey 2
Derived Variable	CESD
Definition	10-item unweighted summed score measuring depression
Source Items (Index Numbers)	CESD1 to CESD10 (CESD-001 to CESD-010)
Statistical form	Continuous variable
Index Number	CESD-012
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Background

Depression is associated with decreased life satisfaction, physical and mental decline, increased health service use and increased mortality.[1,2] Assessing depression is complicated, particularly in the presence of disability, physical disease and other mental disorders.[3,4] Various screening scales have been developed to improve recognition of depressive symptoms.[5,6] In epidemiological studies, screening scales can provide estimates of the prevalence of depression using consistent measurement criteria across samples and time.[4]

CES-D and CESD-10

One of the most commonly used self-report depression screening scales is the 20-item Center for Epidemiologic Studies Depression Scale (CES-D) which was designed as a screening instrument for symptoms of depressed mood in older adults.[7] It has been validated across a range of ages making it appropriate for use in longitudinal studies.[8] Responses are on a 4-point scale, coded 0 to 3.[7] The scale is suitable for self-administration, is easy to read and is easily scored.[6] However, there have been reports that the elderly sometimes have problems with multiple-item, forced-choice scales.[4]

Shrout and Yager[9] demonstrated that the length of the 20-item CES-D could be halved without appreciable loss to reliability and quartered without significantly affecting the validity. Various short and/or simplified forms of the 20-item CES-D have been evaluated.[10-14] The most commonly used abbreviated forms are the Boston form (10 dichotomously scored items[15]), the Iowa form (11 items with three response options[15]) and the four-category response 10-item form (CESD-10) developed by Andresen et al.[10] The Iowa form and CESD-10 have been found to perform as well as the original 20-item CES-D.[12,13]

In factor analysis of the CES-D in three groups of white Americans (n=2 514, 1 060 and 1 422), Radloff[7] identified four factors: depressed affect, positive affect, somatic and retarded activity, and interpersonal. Of the CESD-10 items, three items (c, f, j) loaded on "Depressed", two items (e, h) on "Positive" and the remaining five items loaded on "Somatic". Radloff stated 'The factors found in the general population are consistent with the components of depression built into the scale. However, the high internal consistency of the scale found in all groups argues against undue emphasis on separate factors. The items are all symptoms related to depression. For epidemiologic research, a simple total score is recommended as an estimate of the degree of depressive symptomatology.'[7]

In separate studies of 1 206 and 615 older people,[10,11] factor analysis of the CESD-10 yielded two factors: "positive affect" (items h and e) and the remaining eight items made up "negative affect" Loadings were not provided in the Andresen study[10,] but the loadings in the Boey study[11] suggested some cross-loading for items c (0.24), h (0.23) and a (0.20). Boey stated 'Principal component analysis revealed two relatively independent factors of the CESD-10, this finding is in line with the contention that positive affect and negative affect are two distinct constructs. Though positive affect and negative affect can be distinguished conceptually and empirically, it is not practicable to use two separate scores of the CESD-10 for screening purposes. Furthermore, the factor of positive affect included only two items, which is hardly sufficient to form a scale. With all its 10 items, the CESD-10 can be regarded as a measure of affect i.e. the presence of negative affect and, to a lesser extent, the absence of positive affect.' [11]

CESD-10 Scores
The positive mood items (e and h) are reversed and the score is the sum of all item scores. Andresen[10] recommends the conservative approach of mean imputation for only one missing item. The range of scores is 0 to 30, with higher scores representing a more depressed mood.

Depression screening scales generally overestimate the prevalence of depression.[4,16] Most studies using the 20-item CES-D recommend a score of 16 or more to categorise individuals as positive for depressive symptoms, however higher cut-off scores have been used in different populations to decrease the number of false positives.[7,17,18] Validation of the CESD-10 against the 20-item CES-D using a cut-offs of 8, 9, 10 has shown the cut-off of 10 or more, minimises false positives with little loss of sensitivity.[10,11]

Source Items
The CESD-10[10] was first included in full version of Survey 2 for all 3 age cohorts of the ALSWH. Items and codes are shown over the page. An extra item (k), 'I felt terrific', was added for the Mid-age and Older cohorts so that the scale finished with a positive item. Data are not shown for this item as it was not included in the calculation of scale scores.

Below is a list of ways you might have felt or behaved. Please indicate how often you have felt this way DURING THE LAST WEEK.

CESD1	a	I was bothered by things that don't usually bother me
CESD2	b	I had trouble keeping my mind on what I was doing
CESD3	c	I felt depressed
CESD4	d	I felt everything I did was an effort
CESD5	e	I felt hopeful about the future [a]
CESD6	f	I felt fearful
CESD7	g	My sleep was restless
CESD8	h	I was happy [a]
CESD9	i	I felt lonely
CESD10	j	I could not "get going"
	k	I felt terrific'

Positive Item Score	Negative Item Score	Response
3	0	Rarely or none of the time (less than 1 day)
2	1	Some or a little of the time (1-2 days)
1	2	Occasionally or a moderate amount of the time (3-4 days)
0	3	Most or all of the time (5-7 days)

Scale Evaluation

Item Responses

Full versions of Survey 2 were completed by 9 604 Younger women, 11 648 mid-age women and 9 514 older women. The distribution of their responses to the CESD-10 items is shown in Table 1. Proportions of missing data for the CESD-10 items were similar for the Younger (1.3-2.7%) and mid-age women (1.3-2.4%). Among the older women, the missing data ranged from 32.5% (I was happy) to 47.5% (I felt fearful).

Across-scale completion was high for Younger and mid-age women, with 97% and 98% respectively completing sufficient items (9 or 10) to have a CESD-10 score calculated. However, less than half the older women (44%) completed sufficient items to have a score calculated. Ten percent of women had all items missing, 16% answered only one item, and a further 9% answered only two items (Table 2).

Consequently, the ALSWH has decided to discontinue use of the CESD-10 as a measure of depression in the Older cohort. An extensive exploration of the reasons for and correlates of missing data in the Older cohort has been published.[19]

Table 1   Distribution (%) of responses and percent missing for CESD-10 items among all 3 age cohort at Survey 2

		Rarely or none of the time	Some or a little of the time	Occasionally or a moderate amount of the time	Most or all of the time	Number (percent) missing
Younger Cohort (n = 9 197)						
a	I was bothered by things that don't usually bother me	60.8	28.7	8.2	2.4	142 (1.5)
b	I had trouble keeping my mind on what I was doing	45.3	37.8	12.7	4.2	131 (1.4)
c	I felt depressed	54.7	29.1	11.4	4.7	155 (1.6)
d	I felt everything I did was an effort	55.5	30.6	9.8	4.0	201 (2.1)
e	I felt hopeful about the future [a]	13.8	27.5	32.6	26.1	168 (1.8)
f	I felt fearful	72.1	19.6	6.5	1.9	259 (2.7)
g	My sleep was restless	36.1	35.4	18.8	9.7	164 (1.7)
h	I was happy [a]	4.7	18.8	36.1	40.3	123 (1.3)
i	I felt lonely	55.4	28.5	11.4	4.7	282 (1.9)
j	I could not "get going"	41.7	40.0	13.5	4.8	182 (1.9)
Mid-age Cohort (n =11 648)						
a	I was bothered by things that don't usually bother me	69.9	22.4	5.5	2.2	182 (1.6)
b	I had trouble keeping my mind on what I was doing	57.7	31.4	7.7	3.2	148 (1.3)
c	I felt depressed	65.6	23.4	7.6	3.4	283 (2.4)
d	I felt everything I did was an effort	57.5	28.8	8.7	5.0	160 (1.4)

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e	I felt hopeful about the future [a]	17.8	21.5	19.3	41.4	266 (2.3)
f	I felt fearful	75.8	16.8	5.1	2.3	218 (1.9)
g	My sleep was restless	36.7	37.1	15.7	10.5	165 (1.4)
h	I was happy [a]	6.6	16.1	22.1	55.3	179 (1.5)
i	I felt lonely	68.8	20.0	7.4	3.8	167 (1.4)
j	I could not "get going"	48.0	36.3	10.4	5.2	143 (1.2)
Older Cohort (n = 9 501)						
a	I was bothered by things that don't usually bother me	72.9	16.9	8.6	1.6	4 071 (42.8)
b	I had trouble keeping my mind on what I was doing	69.3	15.9	12.5	2.2	4 161 (43.7)
c	I felt depressed	66.7	18.5	12.3	2.6	3 994 (42.0)
d	I felt everything I did was an effort	55.0	20.3	17.6	7.1	3 784 (39.8)
e	I felt hopeful about the future [a]	22.2	7.3	17.4	53.1	4 055 (42.6)
f	I felt fearful	76.7	13.0	8.4	1.9	4 515 (47.5)
g	My sleep was restless	40.4	22.3	25.7	11.5	3 550 (37.3)
h	I was happy [a]	9.5	3.3	12.2	75.0	3 091 (32.5)
i	I felt lonely	60.9	18.1	16.5	4.5	3 976 (41.8)
j	I could not "get going"	49.8	25.3	19.4	5.5	3 756 (39.5)

[a] Positive mood items

Table 2   Number and percent of CESD-10 items missing

Number of	Younger		Mid-age		Older	
items missing	Number	Percent	Number	Percent	Number	Percent
0	8 969	93.4	10 810	92.8	4 182	44.0
1	361	3.8	594	5.1	453	4.8
2	96	1.0	97	0.8	187	2.0
3	29	0.3	25	0.2	120	1.3
4	16	0.2	9	0.1	141	1.5
5	30	0.3	9	0.1	206	2.2
6	16	0.2	7	0.1	293	3.1
7	22	0.2	6	0.1	517	5.4
8	17	0.2	7	0.1	900	9.5
9	13	0.1	13	0.1	1 555	16.3
10	35	0.4	71	0.6	960	10.1

Scale reliability

Cronbach's alphas for all exceed 0.8 and the ALSWH criteria of 0.6 (Table 3). Item-to-total correlations are low (<0.5) for items e and g (Table 3). Kaiser's measure of sampling adequacy is good (0.9 for both age-cohorts).

Factor Analysis

For both the Younger and Mid-age cohorts, exploratory factor analysis using varimax rotation suggested the same factors described by Andresen at al[10]. and Boey[11] - a positive affect factor (items h and e) and a negative affect factor (remaining 8 items) (Tables 4 & 5). Almost all the loadings exceed the ALSWH criteria of 0.5. Cross-loading is highest for items c and i; item h from the positive affect factor cross-loads to a lesser extent. When the items were forced onto one factor, the loadings ranged from 0.82 to 0.41 for the Mid-age cohort and 0.81 to 0.45 for the Younger cohort. These loadings are the same as the un-rotated factor loadings in the two factor solution (data not shown).

Communalities for 5 and 3 items for the Younger and Mid-age cohorts respectively are less than 0.5 based on the 2-factor solution (Table 3). There are further major reductions in communalities for items e and h after forcing a 1-factor solution.

In accord with the recommendation of Boey[11], a single factor solution was preferred, using all items of the CESD-10 as a measure of affect. This also allows for direct comparison with other publications based on the CESD-10.

Table 3 Correlation with item-total and Cronbach's alpha for standardised variables with deletion of individual items and communality estimates

Deleted item/item	Correlation with total	Cronbach's Alpha	Communality Estimates 2-factor	Communality Estimates 1-factor
Younger Cohort				
None		**0.85**		
a	0.52	0.84	0.42	0.40
b	0.59	0.83	0.56	0.48
c	0.72	0.82	0.66	0.65
d	0.63	0.83	0.60	0.54
e	0.35	0.85	0.77	0.20
f	0.50	0.84	0.39	0.37
g	0.41	0.85	0.34	0.26
h	0.62	0.83	0.72	0.50
i	0.57	0.83	0.47	0.46
j	0.56	0.83	0.48	0.44
Mid-age Cohort				
None		0.86		
a	0.58	0.85	0.50	0.47
b	0.66	0.84	0.62	0.58
c	0.74	0.84	0.68	0.67
d	0.70	0.84	0.65	0.62
e	0.33	0.87	0.79	0.17
f	0.59	0.85	0.47	0.47
g	0.47	0.86	0.41	0.34
h	0.60	0.85	0.68	0.46
i	0.49	0.86	0.35	0.33
j	0.61	0.85	0.55	0.51

Table 4 Results of factor analysis

Factor	Mid-age cohort Eigenvalue	Mid-age cohort Difference	Mid-age cohort Proportion	Younger Cohort Eigenvalue	Younger Cohort Difference	Younger Cohort Proportion
1	4.31	3.20	0.43	4.61	3.52	0.46
2	1.11	0.32	0.11	1.09	0.32	0.10

Table 5   Factor loadings from varimax rotation (2 factors) and un-rotated (1 factor) analyses

Item	Younger Factor 1	Younger Factor 2	Younger Factor 1	Mid-age Factor 1	Mid-age Factor 2	Mid-age Factor 1
d	**0.75**	0.19	**0.73**	**0.78**	0.21	**0.79**
b	**0.74**	0.13	**0.70**	**0.77**	0.16	**0.76**
j	**0.68**	0.17	**0.66**	**0.73**	0.14	**0.71**
c	**0.64**	**0.51**	**0.81**	**0.71**	0.41	**0.82**
a	**0.62**	0.19	**0.63**	**0.68**	0.18	**0.69**
g	**0.58**	0.04	**0.51**	**0.64**	0.02	**0.58**
f	**0.58**	0.22	**0.61**	**0.62**	0.29	**0.68**
i	**0.50**	0.47	**0.68**	0.46	0.38	**0.57**
e	-0.02	**0.88**	0.45	-0.002	**0.89**	0.41
h	0.36	**0.77**	**0.71**	0.38	**0.73**	**0.68**

Derived Variable

Scores and missing values
Study participants are considered to have completed the CESD-10 if they completed 9 or more of the 10 items.[10] The mean of the 9 items completed is imputed as the response for the missing item. The score is set to missing if fewer than nine items are completed. Scores are calculated as the sum of item codes (with reversed codes for positive mood items) and are shown in Table 6. CESD scores are not normally distributed and cannot be successfully transformed to approximate a normal distribution.

Table 6   Distributional properties of summed score for CESD-10

Summed Score	Number	Mean	(SD)	Median	Skewness	Range
Younger	9 330	7.61	(5.49)	6.00	1.07	0-30
Mid-age	11 404	6.47	(5.61)	5.00	1.23	0-30

Categorisation
Although a cut-off score of 10 has been recommended[10,11], there are no clear guidelines for categorisation. Generally the ALSWH has classified women with a CESD-10 score of 10 or more depressed.

The SAS code defining CESD-10 scores is:

```
cesd10_1 = y2q72a ;
cesd10_2 = y2q72b ;
cesd10_3 = y2q72c ;
cesd10_4 = y2q72d ;
cesd10_6 = y2q72f ;
cesd10_7 = y2q72g ;
cesd10_9 = y2q72i ;
cesd10_10 = y2q72j ;
cesd10_5 = 3-y2q72e ;
cesd10_8 = 3-y2q72h ;

array cesditem{10}
    cesd10_1 cesd10_2 cesd10_3 cesd10_4 cesd10_5
    cesd10_6 cesd10_7 cesd10_8 cesd10_9 cesd10_10;

sumq72  = sum(of cesditem{*}) ;
meanq72 = mean of cesditem{*});
missq72 = nmiss of cesditem{*});

if missq72 = 0 then cesd10 = sumq72 ;
else if missq72 = 1 then cesd10 = sumq72 + meanq72 ;
else cesd10 = . ;
```

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