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SF-36 normative values according to level of functioning in older women

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Abstract

Purpose The 36-item Medical Outcome Study Short Form (SF-36) survey measures health-related quality of life. Age and disease-specific normative values have been published, but a focus on level of functioning may be more meaningful in case of multimorbidity. We estimated normative values for Australian women aged 79–90 years according to levels of functioning.

Methods Data were from 6127 (aged 79–84 in 2005) and 3424 (aged 85–90 in 2011) participants in the Australian Longitudinal Study on Women's Health. Surveys included the SF-36 and information on housing. Record linkage to assessment data for access to the national program for aged care support was used to obtain information on participants' need for assistance with 10 activities. Normative values were calculated for physical component (PCS), mental component (MCS), and subscale scores for subsamples defined by types of assistance needed.

Results At the ages of 79–84, the mean (95% confidence interval) PCS and MCS values for women not any needing assistance were 37.5 (37.2–37.9) and 53.0 (52.8–53.3) compared to 29.0 (27.8–30.2) and 45.9 (44.4–47.4) for women needing any assistance. At ages 85–90, the corresponding PCS values were 34.9 (34.5–35.4) vs. 28.2 (27.4–29.0) and the corresponding MCS values were 53.2 (52.8–53.6) vs. 48.7 (47.8–49.6). Values were higher for participants living in the community or retirement village vs. nursing homes/hostels. The PCS, MCS and 8 subscale values decreased as the need for assistance with more basic activities increased.

Conclusions These normative values facilitate meaningful interpretation of SF-36 scores from the perspective of level of functioning.

Keywords SF-36 · Quality of life · Functional limitations · Ageing · Multimorbidity

Introduction

The 36-item Medical Outcome Study Short Form (SF-36) survey is one of the most commonly used instruments to measure health-related quality of life in clinical trials and observational studies. The 36 items cover 8 domains [1] and scores can be calculated for each domain separately (range 0–100) or summed into weighted physical and mental component summary scores (range 0–100) [1, 2]. The domains include (1) limitations in physical activities because of health problems (physical functioning), (2) limitations in social activities because of physical or emotional problem (social functioning), (3) limitations in usual role activities because of physical health problems (role physical), (4) bodily pain, (5) psychological distress and well-being (mental health), (6) limitations in usual role activities because of emotional problems (role emotional), (7) energy and fatigue (vitality), and (8) general health perceptions (general health) [1].

A number of studies have published normative values to enhance the interpretation of the instrument's scores. Normative values indicate average values of the population or subgroups within that population. These values can be used to compare scores between populations or between specific samples and the wider population. Normative values have

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been published for various countries [3–11] and for subgroups according to socio-demographic characteristics [3–9] or diagnosis [2, 3]. For example, lower scores were found on all domains for adults with serious medical conditions than for adults with minor medical conditions [2]. Similarly, the scores for the domains 'mental health', 'role emotional', 'social functioning' and 'vitality' were lower for adults with clinical depression than for adults with symptomatic depression (i.e. depressive symptoms without meeting criteria for clinical depression) [2]. However, interpretation of scores for individuals or groups remains complex. For example, which normative values should be used as a reference for a 80-year-old person with depression and severe osteoarthritis: reference values for the correct age-group, for people with depression or for people with osteoarthritis?

While normative values for subgroups according to diagnosis are helpful to compare the health impact of specific conditions in people with single condition, interpretation of these values is complicated in the context of multimorbidity. The prevalence of multimorbidity in adults over the age of 70 is high [12–14]. In 2002, 87% of Australian women aged 75–80 years reported having 2 or more conditions (from a list of 31 chronic conditions and symptoms), with the average number of conditions being 4 (interquartile range 2–7) [13]. Particularly in this context, a focus on 'ability to undertake activities of daily living' or 'level of functioning' may be more useful than on morbidity. Therefore, the aim of this paper was to estimate normative values for women aged 79–84 and women aged 85–90 years according to level of functioning (defined as need for assistance with various activities).

Methods

Participants

The Australian Longitudinal Study on Women's Health (ALSWH) is an ongoing study of the health and wellbeing of three generations of women since 1996 [15, 16]. Participants were randomly drawn from the national Medicare health insurance database, which includes all Australian citizens and permanent residents. Sampling from the population was done at random within each age group, except that women living in rural and remote areas were sampled at twice the rate of women in urban areas. Ethics approval was obtained from the Ethics Committees of the Universities of Newcastle and Queensland, and participants signed informed consent. For more details refer to: http://www.alswh.org.au.

Data were used from the women born in 1921–1926. In 1996, the baseline survey was returned by 12,432 participants (estimated response rate = 35.5%). The sample was largely representative of Australian women in this age group, but with a somewhat higher representation of partnered women and women with post-high school education [17]. For the current analyses, we included data from participants who completed the 2005 and/or 2011 surveys and provided data on the SF-36 (Fig. 1). In 2005, the women were 79–84 years old and 6172 participants (49.6% of the baseline sample) completed the SF-36. In 2011, the women were 85–90 years old and 3424 participants (27.5% of the baseline sample) completed the SF-36. 89.3% of those who responded in 2011 had also responded in 2005. The main reason for drop-out was death, which reached 29.5% by 2011; the remainder had formally withdrawn from the study (17.0%) or did not return surveys sent to their last known address (20.9%).

SF-36

The Medical Outcomes Survey 36-item Short-Form health survey [1, 2] was completed as part of each survey. Subscale scores were calculated in accordance with the SF-36 manual for the domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, and role emotional. The scales ranged from 0 to 100, with 100 indicating optimal well-being. Physical (PCS) and mental (MCS) component scores were calculated as the weighted sums of the subscale scores (using population weights standardised against the Australian population) [3] and standardised with a population mean of 50 (range 0–100).
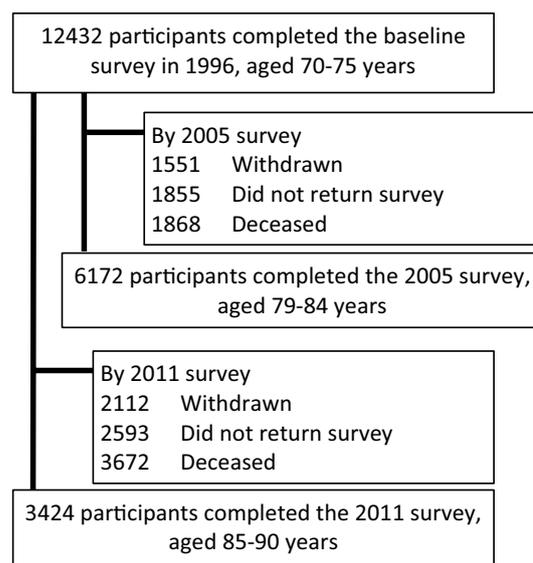

Fig. 1 Flow chart

Level of functioning

The level of functioning is based on assessed need for assistance with a range of activities suggestive of increasing levels of disability. These activities include health, home maintenance, domestic activities, transport, meals, social activities, self-care, communication, moving around, and all movement. Data on need for assistance were obtained from the Aged Care Assessment Program by the Australian Institute of Health and Welfare and linked to the survey data using probabilistic linkage methods (estimated sensitivity ≥ 94% and specificity ≥ 96%) [18]. Assessments are completed as part of usual care for all older citizens and permanent residents who apply for commonwealth subsidised home care, residential care, residential respite care, transition care or short-term restorative care through the Aged Care Assessment Program. The program aims to comprehensively assess the care needs of frail older people and to assist them to gain access to the most appropriate types of care. Assessments were done by a multidisciplinary team and repeated when changes in health or needs occurred. The date of assessment was used to determine whether the need for assistance was present at the time of survey completion in 2005 and 2011.

Housing situation was based on self-report and assessed at each survey. Response options were categorised as 'community dwelling' (i.e. house, flat, unit, apartment, villa, townhouse, mobile home, caravan, cabin, houseboat), 'retirement village' (including self-care unit) and 'nursing home or hostel'. Two additional subgroups were identified that combined information on the housing situation and the assistance required. Participants living in the community or retirement village who did not require assistance with any of the listed activities were classified as 'no assistance'. Participants living in the community who required assistance for one or more of the listed activities and participants living in nursing homes or hostels were classified as 'any assistance'.

Sample characteristics

Age, area of residence, marital status and level of education (highest qualification completed) were based on self-report and categorised as presented in Table 1. Presence of diabetes, arthritis, heart disease, stroke, cancer (including any type except skin cancer), depression and dementia were based on self-report of doctor diagnosis or treatment in the past three years. Body mass index was calculated from self-reported height (m) and weight (kg). Inability to walk 100 meters was based on the response to the SF-36 item 'Does your health now limit you to walk 100 meters?'. Participants who responded 'yes, limited a lot' were classified as being unable to walk 100 m.

Statistical analysis

Descriptive statistics were used to describe the samples in 2005 (aged 79–84) and 2011 (aged 85–90). The normative values were calculated as the mean [and 95% confidence interval (CI)] PCS, MCS and subscale scores at each survey. *Sample weights were used to account for the oversampling of women living in rural and remote areas*. The normative values were calculated for the total sample as well as for subsamples based level of functioning. Analyses were done for each age-group separately. To examine the representativeness of the analysis sample, non-response analyses were done comparing the baseline (1996) characteristics of participants with non-responders to the 2005 and 2011 surveys, respectively. From here on, 'participants' refers to study participants who returned the survey and had complete data on the SF-36, and whose data were therefore included in the analyses. 'Non-responders' refer to study participants who had missing data on the SF-36 or who did not return the survey, and who were therefore excluded from the analyses, but who were alive at the time of survey completion. Differences between participants and non-responders were examined using the t-test for approximately normally distributed continuous variables and using the chi-squared test for categorical variables. All analyses were done using Stata version 14.2 (Stata®, College Station, TX).

Results

In 2005, the 6172 participants were on average 81.2 (SD 1.4) years old (Table 1). The majority were living in the community in urban areas. In 2005, 10.8% of the participants were unable to walk 100 meters. In 2011, the sample had reduced to 3424 participants who were then on average 87.1 (SD 1.4) years old. Still the majority were living in the community in urban areas. In 2011, 18.9% of the participants were unable to walk 100 meters. Linkage with the Aged Care Assessment data identified 371 (6.0%) participants in 2005 and 822 (24.1%) participants in 2011 who required assistance.

Figure 2 provides an overview of the average PCS, MCS and subscale scores in the total samples at each time point. Figure 3 presents the normative values for the PCS and MCS scores in 2005 and 2011 (see Online Resource Table A for exact values). As expected, the values were higher for those not needing assistance than for those needing any level of assistance. The scores were also higher for those living in the community or retirement village than for those living in nursing homes or hostels. Overall, the values decreased as the need for assistance with more basic activities increased. These trends were observed for both age-groups.

Figures 4, 5 and 6 present the normative values for the 8 subscales (see Online Resource Table B for exact values).

Table 1 Sample characteristics of women in 2005 and 2011

|	2005 characteristics of women included in analyses ($n=6172$)	2011 characteristics of women included in analyses ($n=3424$)
Age range (years)	77–85	83–91
Age [mean (SD)]	81.2 (1.4)	87.1 (1.4)
Area of residence (%)		
Urban	2738 (44.4%)	1585 (47.3%)
Rural	3308 (53.6%)	1695 (50.6%)
Remote	126 (2.0%)	69 (2.1%)
Marital status (%married/de facto)	2273 (37.0%)	748 (21.9%)
Housing situation (%)		
Community	5326 (88.1%)	2629 (78.4%)
Retirement village/self-care unit	588 (9.7%)	511 (15.2%)
Nursing home/hostel	99 (1.6%)	185 (5.5%)
Other	29 (0.5%)	28 (0.8%)
Education (%)		
No formal qualification	1708 (28.8%)	912 (27.7%)
School certificate	2361 (39.8%)	1288 (39.1%)
Higher school certificate	799 (13.5%)	449 (13.6%)
Trade/apprentice	763 (12.9%)	462 (14.0%)
University degree or higher	295 (5.0%)	185 (5.6%)
Diabetes (%)	728 (11.9%)	415 (12.2%)
Arthritis (%)	2782 (45.5%)	1599 (47.1%)
Heart disease (%)	1501 (24.6%)	997 (29.3%)
Stroke (%)	225 (3.7%)	147 (4.3%)
Cancer (%)	281 (4.6%)	157 (4.6%)
Depression (%)	450 (7.4%)	260 (7.7%)
Dementia (%)	84 (1.4%)	128 (3.8%)
Body mass index (mean (SD))	25.3 (4.6)	24.7 (4.6)
Unable to walk 100m (%)	632 (10.8%)	605 (18.9%)

SD Standard deviation
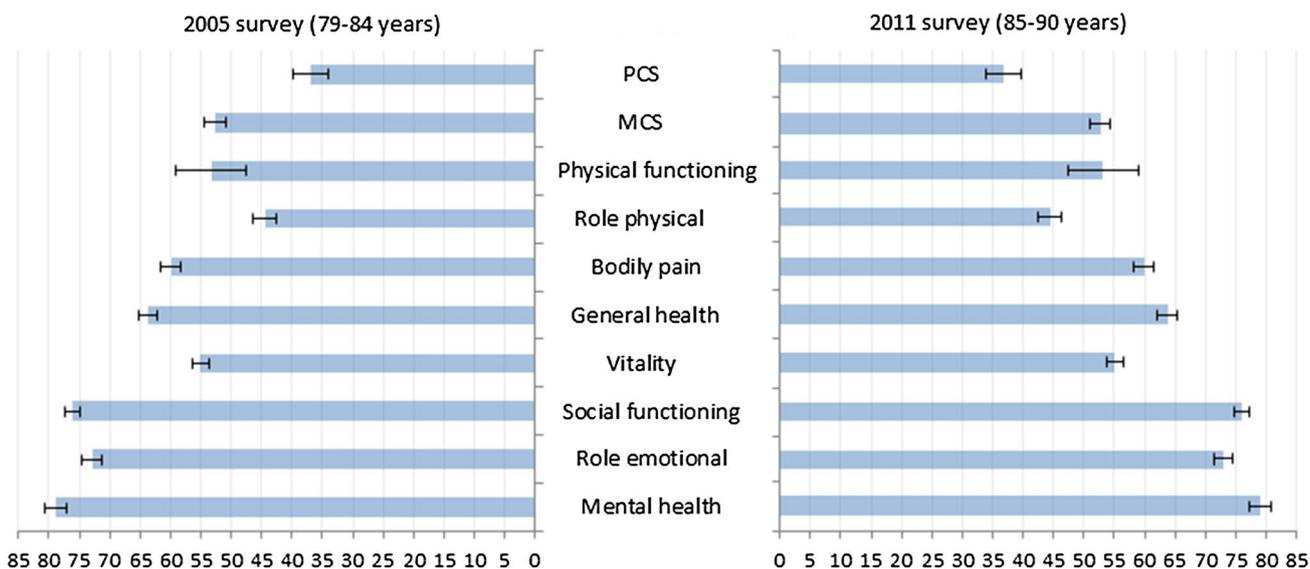
Fig. 2 Average values for the SF-36 physical and mental component scores and each of the subscales in the total sample presented are the means and 95% confidence intervals for women aged 79–84 years (left) and aged 85–90 years (right)
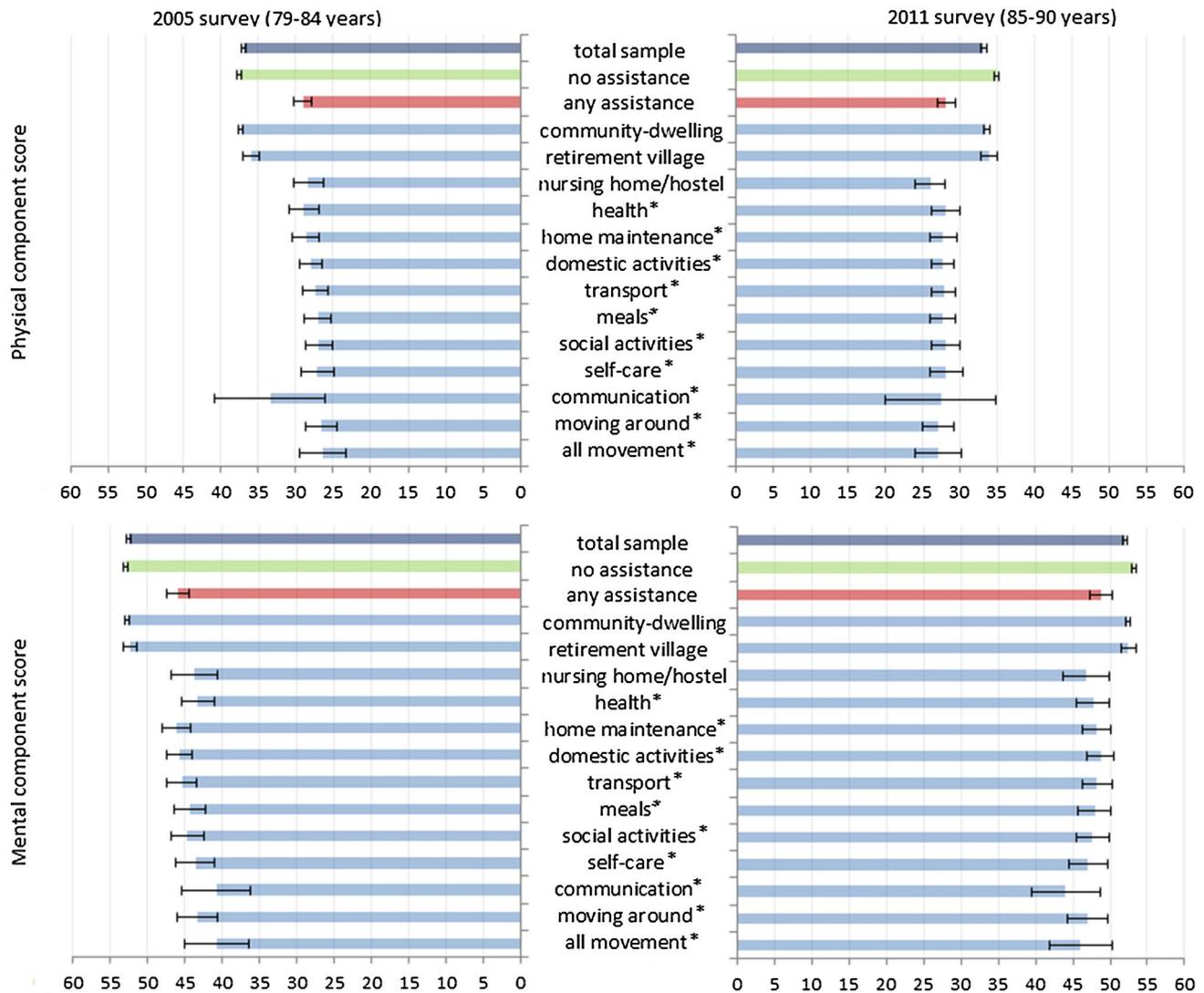
Fig. 3 Normative values for the SF-36 physical and mental component scores by level of functioning presented are the means and 95% confidence intervals for the subscales role emotional (top) and mental health (bottom) for women aged 79–84 years (left) and aged 85–90 years (right). *Includes participants requiring assistance for this activity

As anticipated, those needing assistance with any of the activities scored much lower on each of the subscales than those not needing any assistance. For physical function, role physical and vitality there was a trend toward lower scores for needing assistance with activities that are more physically demanding, such as 'moving around' (Figs. 4, 5). The scores for bodily pain (Fig. 4) and mental health (Fig. 6) were remarkably consistent across the levels of functioning. The scores for general health (Fig. 5) and social functioning (Fig. 5) were most strongly associated with needing assistance with communication.

In 2005, there were 4392 non-responders (who were known to still be alive) and in 2011 this number increased to 5336. Comparison of participants with non-responders showed that the participants were slightly younger, slightly more likely to be married or partnered, more likely to live in a house (rather than a flat, apartment or other) and more likely to have post-high school diplomas or degrees ($p < 0.01$; Online Resource Table C). The participants were also less likely to have chronic conditions and less likely to be unable to walk 100 meters ($p < 0.001$).

Discussion

This paper presents normative values for SF-36 component and subscale scores relative to level of functioning in women in their early eighties (79–84 years in 2005) and in their late eighties (85–90 years in 2011). These normative values will facilitate a more meaningful interpretation of SF-36 scores
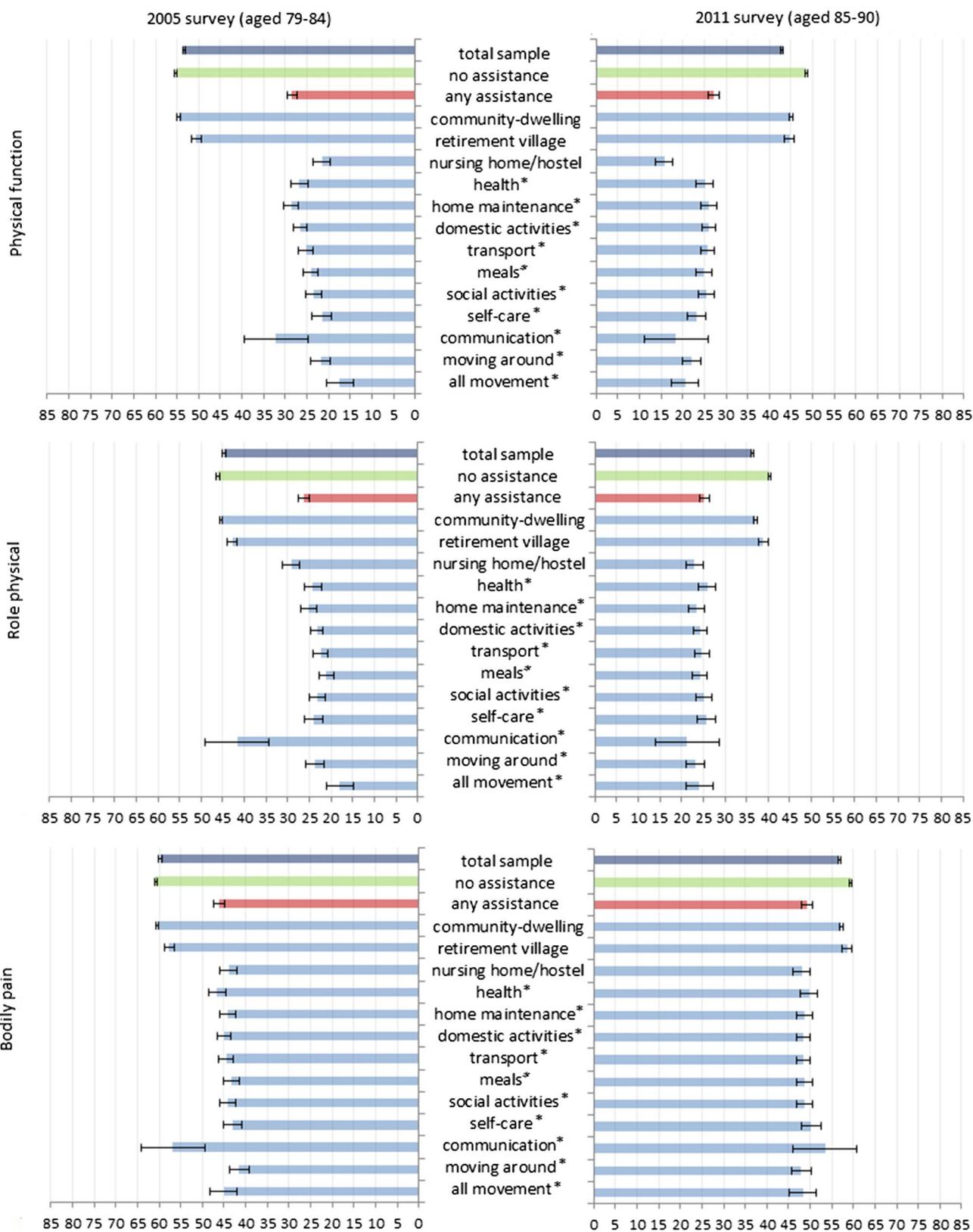
Fig. 4 Normative values for the subscales physical function, role physical and bodily pain by level of functioning presented are the means and 95% confidence intervals for the subscales role emotional (top) and mental health (bottom) for women aged 79–84 years (left) and aged 85–90 years (right). *Includes participants requiring assistance for this activity
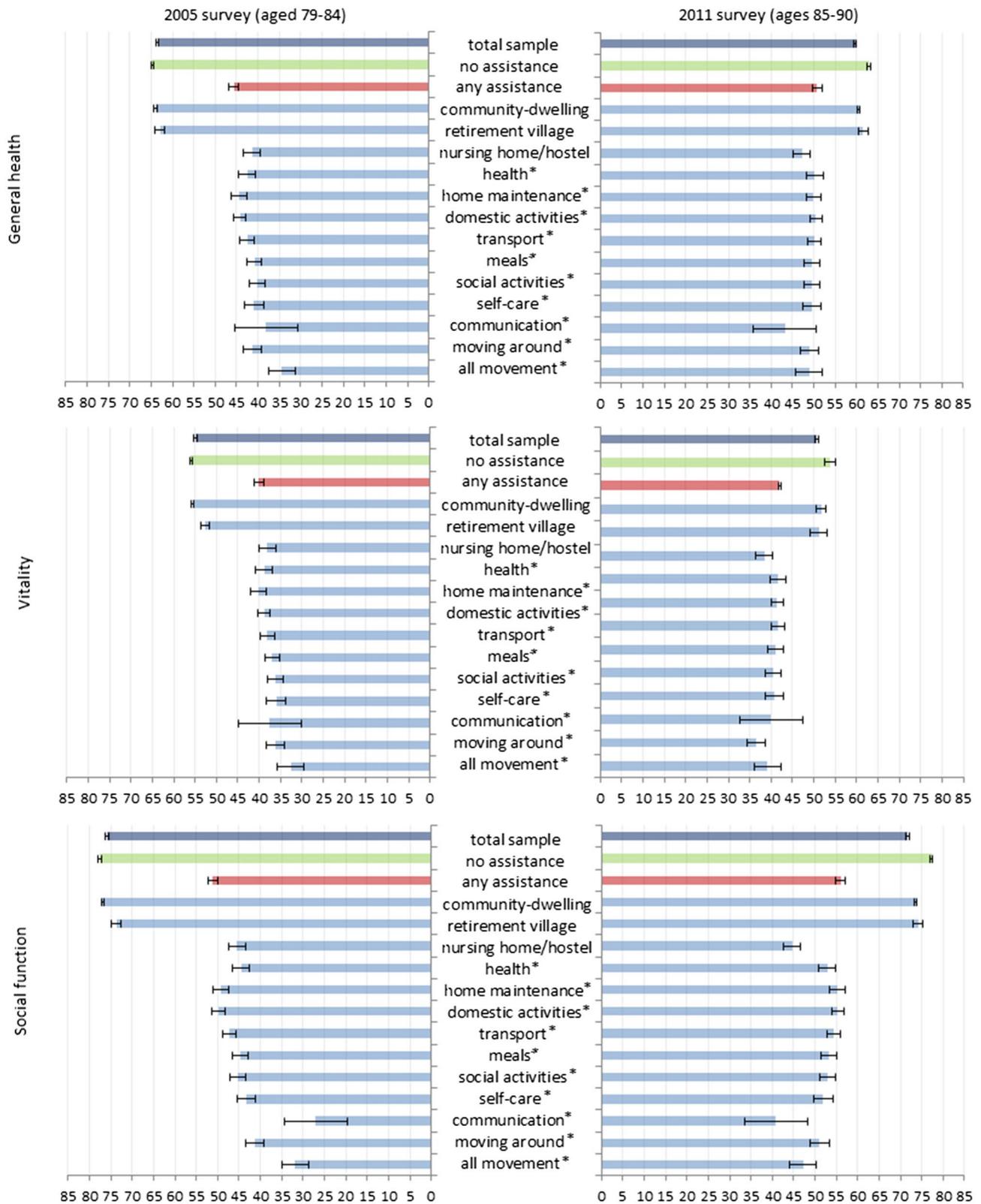
Fig. 5 Normative values for the subscales general health, vitality and social functioning by level of functioning presented are the means and 95% confidence intervals for the subscales role emotional (top) and mental health (bottom) for women aged 79–84 years (left) and aged 85–90 years (right). *Includes participants requiring assistance for this activity
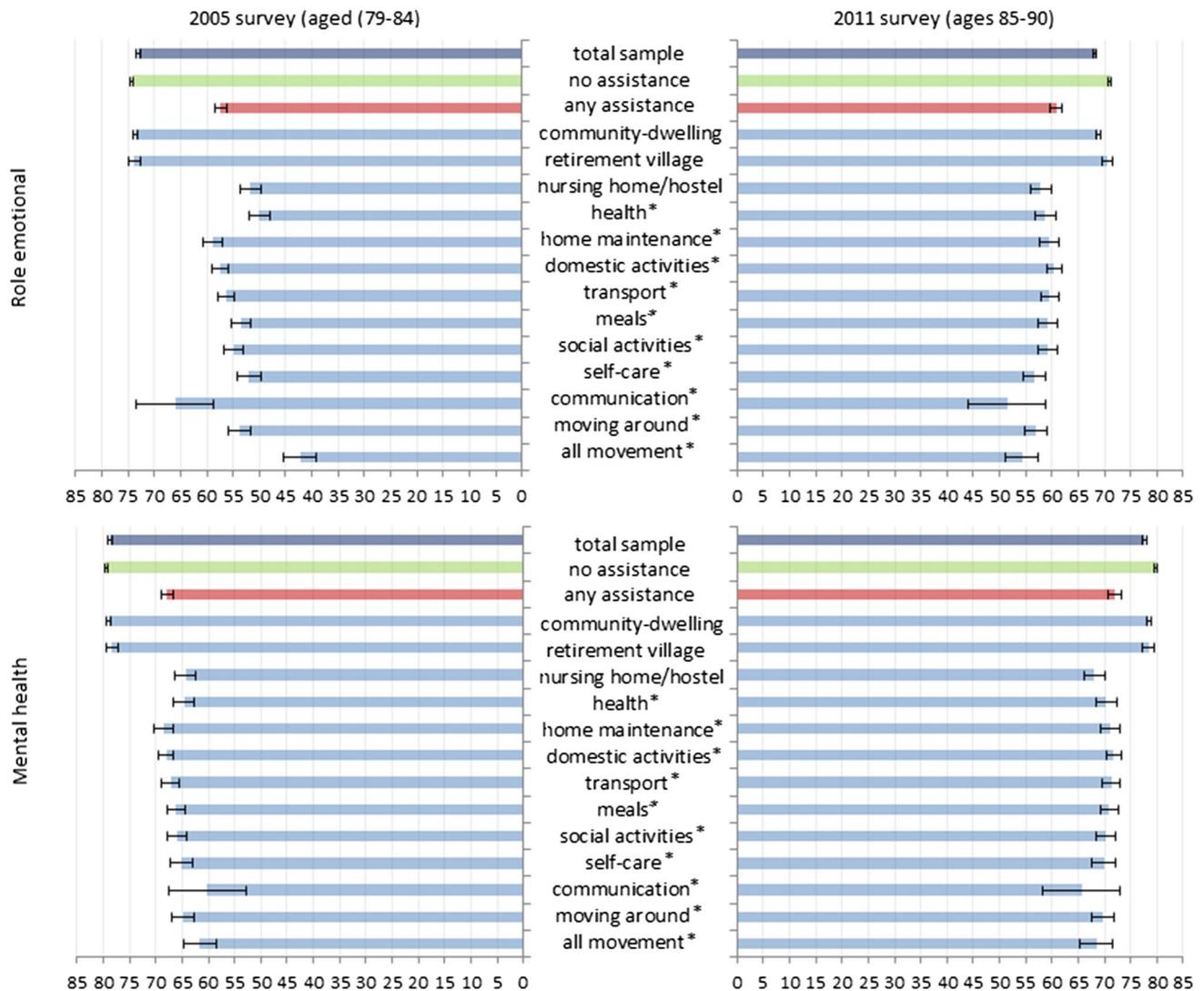
Fig. 6 Normative values for the subscales role emotional and mental health by level of functioning presented are the means and 95% confidence intervals for the subscales role emotional (top) and men- tal health (bottom) for women aged 79–84 years (left) and aged 85–90 years (right). *Includes participants requiring assistance for this activity

in research and clinical settings from the perspective of level of functioning.

As anticipated, the normative values decreased as the need for assistance with more basic activities increased. This finding is in line with studies that present lower component and subscale scores for subgroups with chronic conditions (e.g. stroke, Parkinson's disease and diabetes) that have a great impact on people's independence in daily functioning than for subgroups without that condition [19–22]. The findings also align with those of a clinical sample (n = 402, aged 18+, 2–14 multimorbidities), in which scores on all SF-36 domains decreased with increasing number of chronic morbidities [23]. The latter study also showed that the impact of chronic conditions on daily activities was the most important predictor of health-related quality of life [24]. Furthermore,

presence of psychological symptoms predominantly affect the psycho-emotionally oriented subscales (i.e. vitality, role emotional and mental health), while physical symptoms predominantly affect physically oriented subscales (i.e. physical functioning, role physical and bodily pain) [8]. Collectively, these findings confirm the construct validity of the SF-36. More importantly, these findings also provide various frames of reference for interpreting the SF-36 scores: from a disease perspective, from a symptoms perspective, and with the current paper, from a perspective of daily functioning.

In the current sample of Australian women aged 79–90 years, as expected, those living in a nursing home had lower scores on all 8 subscales than those living in the community or retirement village (Figs. 4, 5, 6, Online Resource Table B). These findings are largely in line with those

from Norwegian ($n = 1364$) and Canadian ($n = 45$) studies, which found that nursing home residents had lower scores on the subscales physical functioning, general health, vitality, social functioning and mental health than community dwelling older adults (25, 26). In contrast, in the Norwegian study, the nursing home residents scored higher on role physical. Drageset et al. [25] suggested that the nursing home residents may have adapted their role expectations to their capacities and living situation. Due to limited demands and support of the nursing home environment, they may be able to fulfil their roles despite severe limitations in physical and or mental functioning [25]. In the Norwegian study, the nursing home residents also scored higher on bodily pain. The authors suggested that pain perception may be less in male nursing home residents [25], but this does not seem to fully explain their findings given that nearly three quarters of the nursing home sample ($n = 164$, 72.2%) were women. An alternative explanation may be that, at least in Norway, pain is better managed in the nursing home setting than in the community. In the Canadian study no statistically significant group-differences were found in bodily pain, but that study included only 45 participants who all had a non-malignant pain problem, which likely explains the limited contrast between the groups on this subscale [26]. A study in rural India found that residents of homes for the elderly ($n = 40$) scored *higher* on 6 of the 8 subscales than community-dwelling older adults ($n = 71$) [27]. However, no information was provided on the age, level of care or health of the participants, which hampers meaningful comparison of their findings with those of other studies. Thus, while generally nursing home residents score lower on SF-36 subscales than community-dwelling older adults, this may not be the case for all subscales in all settings.

When the participants were 85–90 years old, they scored on average 3.7 points lower on PCS than when they were 79–84 years old (Fig. 3, Online Resource Table A). Interestingly, the differences in PCS scores for the two age-groups were small within the subgroups defined by level of functioning (2 points for 'communication' and < 1 points for all other activities). This suggests that the differences in PCS scores for the total sample at younger and older ages are explained by the differences in level of functioning rather than by age itself. The opposite pattern was observed for MCS. In the total samples, the participants scored only 0.4 points lower when aged 85–90 years than when aged 79–84 years. In contrast, the differences in MCS scores between the two age-groups were 2.1 to 6.4 points lower in the older age-group for each of the activities. These differences in scores increased with lower levels of functioning. This suggests that the impact of level of functioning on MCS scores increases with age, even above the age of 79. These findings confirm the need for normative values by level of functioning rather than by age alone.

Strengths of the current study include the large sample size and objective data on level of functioning. This allowed detailed analyses of normative values even for subgroups with less common disabilities. A limitation is that not all women in the study received an assessment. Of the original cohort ($n = 12,432$), 10,763 (86.6%) participants had at least one aged-care service or assessment record during the follow-up period. The assessments are completed for all older citizens who apply for commonwealth subsidised home care, residential care, residential respite care, transition care or short-term restorative care through the Aged Care Assessment Program. Participants without an assessment were assumed to have no need for assistance with any of the activities. This assumption may have led to underestimation of participants' need for assistance and therefore underestimation of the values for the 'no assistance' group. While the sample at baseline was largely representative of the general female population aged 70–75 in 1996, the non-response analysis shows that the analysis sample for this paper was somewhat healthier and better educated than the non-responders. Hence, the values for the total sample may be representative for a somewhat better educated and healthier population. Indeed, comparison of the current values for the total sample with values from the Household Income and Labour Dynamics in Australia ($n = 530$ men and women, aged 75 + years) shows that the values are somewhat higher on all component and subscale scores in the current sample [28]. Measurement of the sample characteristics was based on self-report, which may have led to misclassification, particularly for the chronic conditions and body mass index. Furthermore, data were available for women aged 79–90 years only. As age and sex differences in component and subscale scores have been found [8, 29, 30], the results cannot be generalised to men or to women of different ages. Comparison of normative values between countries shows that values differ between countries due to demographic and cultural differences. For example, the current values for the total group aged 79–84 years were more than 2 points *lower* than the norms from the 1996–1997 New Zealand Health Survey (365 women aged 75+) for 5 of the 8 subscales [31], and more than 2 points *higher* than the norms in the Swedish population studies (125 women aged 75+) for 4 of the 8 subscales [8]. We therefore recommend that the current analyses are replicated in datasets including men, datasets including women of different age-groups, and in other countries.

In conclusion, this paper presents normative values for SF-36 component and subscale scores relative to level of functioning in women in their eighties. These normative values will facilitate a more meaningful interpretation of SF-36 scores in research and clinical settings from the perspective of daily functioning. Validation of the values in a different sample and replication of this study in other countries and in samples including men and different age-groups is

recommended so that researchers and clinicians can choose the set of normative values that is most relevant to their population of interest.

Compliance with ethical standards

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

Data sharing statement ALSWH data may be made available to collaborating researchers where there is a formal request to make use of the material. Permission to use the data must be obtained from the Publications, Analyses and Substudies (PSA) Committee of ALSWH. Further details can be found at http://alswh.org.au/for-researchers.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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