

1 **Caring for women with ovarian cancer in the last year of life: a longitudinal study of**
2 **caregiver quality of life, distress and unmet needs**

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30 **Running head:** Ovarian cancer caregivers in the last year of life
31

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59

60 **Abstract**

61 **Purpose**

62 Caregiver burden, quality of life (QOL) and unmet needs are poorly understood,
63 particularly at the end of life. We explored these issues in caregivers of women with
64 ovarian cancer.

65 **Patients and Methods**

66 The Australian Ovarian Cancer Study (AOCS) is a prospective population-based study of
67 women newly diagnosed with primary epithelial ovarian cancer. Ninety-nine caregivers
68 of women participating in the AOCS QOL sub-study (88% response rate) rated their
69 QOL (SF-12), psychological distress (HADS), optimism (LOT), social support (Duke)
70 and unmet needs (SCNS-carers), and patients rated their QOL (FACT-O), every three
71 months for two years. This analysis included measurements in the patient's last year of
72 life.

73 **Results**

74 Caregivers had significantly lower mental and physical QOL than population norms
75 ($p < 0.01$). Mean distress ($p = 0.01$) and unmet needs increased over time, however social
76 support remained constant. In linear mixed models, (using scores for each psychosocial
77 variable over time), optimism ($p < 0.0001$), social support ($p < 0.0001$), higher unmet needs
78 ($p = 0.008$), physical wellbeing ($p < 0.0001$), and time to death ($p < 0.0001$) but not patient
79 QOL, predicted caregiver mental well-being and distress. Highest unmet needs in the last
80 6 months related to managing emotions about prognosis, fear of cancer spread, balancing
81 one's own and the patient's needs, impact of caring on work and making decisions in the
82 context of uncertainty.

83

84 **Conclusions**

85 Aspects of caregiver functioning, rather than patient quality of life, predict caregiver

86 quality of life and distress. Caregivers need help with managing emotions about

87 prognosis, balancing their own and the patient's needs, work, and decision-making when

88 there is uncertainty.

89

90 **Introduction**

91 Ovarian cancer places a particularly significant burden on patients and their family
92 members, due to its high mortality rate and complex, prolonged, multimodal treatments
93 [1]. It is a disease characterised by multiple recurrences and many lines of chemotherapy,
94 with decreasing duration of benefit over time.

95

96 Family members are often called upon to provide emotional and practical support, and
97 physical care [1]. Caregivers often feel unprepared for this role [1], and can also
98 experience financial stress if unable to maintain income-generating activity, existential
99 distress and anxiety related to future uncertainty [1]. Studies have documented higher
100 levels of distress and poorer quality of life in caregivers compared to controls, and
101 significant needs for informational, practical and emotional support [2]. Further, poorer
102 physical health due to the strain of caregiving can increase caregivers' own risk of
103 mortality [3,4].

104

105 Predictors of high caregiver distress include other life stresses [5], poorer social support
106 [6], lower social economic status and younger age [7,8], lower carer optimism [9] and a
107 closer caregiver-patient relationship [8]. Caregiver distress also increases with greater
108 patient physical impairment and need for palliative care [10]. Thus supporting carers
109 during the final months of illness is particularly important. Despite this, little research has
110 focused on caregiver experiences at this time, with very few studies specifically focused
111 on caregivers of women with ovarian cancer. Caregivers of women with ovarian cancer
112 may have unique concerns, give that they are primarily male (husbands), and given the

113 complex, repeated treatment regimens and high symptom burden in the last year of life in
114 ovarian cancer.

115

116 Only two quantitative studies have explored caregiver QOL in ovarian cancer. One cross-
117 sectional study found significantly higher anxiety and depression in 373 caregivers
118 compared to controls [11]. Another study [12] of 30 caregivers found their QOL
119 improved on completion of chemotherapy, regardless of the patient's tumour response.
120 Caregiver QOL was correlated with patient worry, distress and functioning. Neither of
121 these studies focused specifically on issues for caregivers at the end of life.

122

123 Therefore the aims of this longitudinal study were, in the patient's last year of life, to:

124

- 125 1) Describe the QOL of caregivers of women with ovarian cancer
- 126 2) Describe the most frequent and severe unmet needs in caregivers
- 127 3) Identify caregiver and patient predictors of caregiver quality of life

128

129 **Methods**

130

131 **Participants and procedures**

132

133 Participants included in this analysis were women taking part in the Australian Ovarian
134 Cancer Study QOL study (AOCS-QOL) and their nominated primary support person
135 (caregiver). AOCS is a prospective population-based study that recruited women aged

136 18–79 years newly diagnosed with primary epithelial ovarian cancer (including fallopian
137 tube and primary peritoneal cancers) between 2002 and 2006 [13]. Women were
138 recruited through major treatment centres and state-based cancer-registries. The AOCS
139 has collected detailed epidemiological, pathology and initial treatment data, as well as
140 ongoing treatment and clinical outcome data [13].

141

142 The AOCS-QOL study investigated the role of psychosocial factors in predicting patient
143 and caregiver outcomes, recruiting AOCS participants who were alive in May 2005 or
144 recruited to AOCS after this date [14]. Initial contact was made by AOCS to preserve
145 confidentiality. Consenting women were mailed an information statement, consent form,
146 questionnaire booklet and a reply paid envelope, and a request to invite their primary
147 caregiver (over the age of 18) to also participate in the study. Women were 3–55 months
148 post-diagnosis (mean 25.8 months) at study entry [13,14].

149

150 Measures of quality of life, psychological distress, optimism, social support, and unmet
151 needs were collected by validated measures from both patients and caregivers at three-
152 monthly intervals for up to two years. If more than one item on any questionnaire was
153 missing, the participant was contacted; missing psychosocial data are therefore minimal.

154

155 The current analyses include 99 caregivers who completed at least one assessment within
156 the last year of life of the woman for whom they were caring. The study was approved
157 and conducted in accordance with the ethical standards of the University of Sydney,
158 Queensland Institute of Medical Research Human Research Ethics Committees and all

159 participating sites across Australia.

160

161 **Measures**

162

163 *Primary outcome variable*

164 The primary outcome variable is caregiver QOL, measured using the 12-item Short Form

165 – version 2 (SF-12v2) of the Health Survey [15]. The SF-12v2 is the most widely used

166 health related QOL measure in the general population and consists of two components,

167 physical health (PCS) and mental health (MCS). Higher scores indicate better QOL.

168 Australian population norms for the SF-12v2 were obtained from the Australian Bureau

169 of Statistics, collected in 1997.

170

171 *Demographic and treatment variables*

172 Carer age, gender, education, marital status, occupational status and relationship to the

173 patient were self-reported via questionnaire. Place of residence (major city or

174 regional/remote) was determined from residential postcodes. Date of patient's cancer

175 diagnosis was obtained through the AOCS. Current treatment data (on chemotherapy/

176 radiotherapy or not) was self-reported with each patient questionnaire.

177

178 *Carer Psychosocial variables*

179 Hospital Anxiety and Depression Scale (HADS) [16]. The 14-item HADS measures

180 anxiety (7 items) and depression (7 items). Total scores (combining sub-scales) measure

181 distress. Higher scores indicate greater morbidity.

182

183 Duke-UNC Functional Social Support Questionnaire [17]. This 8-item scale, developed
184 for use in general practice settings, measures satisfaction with the functional and affective
185 aspects of social support. Higher scores indicate better social support.

186

187 Life Orientation Test-Revised (LOT-R) [18]. This 10-item scale measures dispositional
188 optimism; higher scores indicate greater optimism.

189

190 Supportive Care Needs Survey (SCNS)-carers version [19]. This 44 item questionnaire
191 was adapted from a measure developed for caregivers of cancer survivors. Respondents
192 indicate on a 5-point scale whether they have a need, and if so, how strong that need is.
193 Higher scores indicate greater need.

194

195 *Patient quality of life*

196 Functional Assessment of Cancer Therapy-Ovarian scale (FACT-O-version 4) [20]. This
197 ovarian cancer-specific QOL instrument assesses the four core QoL domains of physical
198 (7 items), social (7 items), emotional (6 items) and functional wellbeing (7 items),
199 together with 11 additional items assessing disease and treatment issues specific to
200 ovarian cancer (symptom burden). Higher scores indicate better QOL.

201

202 **Statistical Methods**

203 Patient and caregiver data were merged by patient ID and by matching caregiver
204 assessment date to the closest patient assessment date within 1 month. Months to patient

205 death was calculated as the date of death minus the patient's assessment date, rounded to
206 the nearest month.

207

208 The primary outcomes (SF-12v2 mental and physical wellbeing) were scored according
209 to author guidelines using population norms (mean 50, standard deviation 10). We tested
210 the proportion of participants who scored below 1 SD against the expected value of 16%
211 (assuming the aforementioned normal distribution) using one sample tests of proportions.
212 Distress, as measured by the total HADS, was also investigated.

213

214 Individual unmet need items were recoded as no need (0) or any need (1) and scored as
215 recommended in the SCNS manual. Total scores for each sub-domain (physical,
216 psychological, sexual, supportive care and information) were standardised to 100. The
217 total unmet needs score was the average of the five domains, with a possible range of 0-
218 100. The top five (or more if there were ties) prevalent unmet needs were computed for
219 the four 3-month periods, where prevalence was defined as the proportion of women
220 reporting 3 or greater. Mean severity amongst those with any unmet needs was computed
221 also.

222

223 The associations between baseline psychosocial variables with QOL and distress were
224 investigated using linear mixed models. Mixed models account for the correlation within
225 participant due to repeated measures on participants and give unbiased estimation for data
226 which are missing completely at random and at random [21]. All statistical analyses were
227 performed in SAS version 9.3 (Cary, NC).

228

229 Each participant's first observation in the year preceding death (referred to as "baseline")
230 for psychosocial variables was used to predict all subsequent observations of the
231 outcomes. In addition to the psychosocial variables, fixed effects of caregiver age,
232 months to patient death and patient current treatment (yes/no: radiotherapy or
233 chemotherapy); and a random effect of patient were included in the model. Caregiver sex,
234 relationship to patient and rurality were also considered, but were excluded due to lack of
235 association with outcomes.

236

237 Each outcome measure was also modeled with time-varying psychosocial covariates, to
238 investigate on-going effects of possible changes in the psychosocial variables over time.
239 Models were pre-specified, and based on theoretical and background knowledge.

240

241 The following variables were graphed over time (months to death), with 95% confidence
242 intervals (CI): mental wellbeing (SF-12v2), physical wellbeing (SF-12v2), distress
243 (HADS), unmet needs (SCNS-Carers) and social support (Duke).

244

245 **Results**

246

247 Of 798 women with ovarian cancer who participated in the AOCS-QOL study, 423
248 nominated caregivers, and of these, 373 (a response rate of 88%), agreed to participate.
249 Of these, 99 caregivers had at least 1 assessment point during the patient's last year of
250 life, with a total of 203 assessments. Thirty-eight participants (38%) had one assessment
251 only, 28 (28%) had two assessments, 23 (23%) had three assessments, and 10 (10%) had

252 four assessments. Thirty-three assessments were in the last 3 months of life, 57
253 assessments were from 4-6 months before death, 61 were from 7-9 months before death
254 and 51 assessments were between 10 and 12 months from death.

255

256 We compared the 99 participants from this study with the 118 women for whom we had
257 data from the last year of life who did not have a participating carer. Women with carers
258 were more likely to be married or partnered (56% versus 18%), but there were no
259 statistically or clinically significant differences in age, quality of life, distress, social
260 support or needs at the first assessment in their last year of life.

261

262 Patient and caregiver characteristics are shown in Table 1. Caregivers were on average 59
263 years old, mostly male (80%) and married to the patient (78%). Sixteen percent were
264 children of the patient while 6% were in another relationship. One third (37%) were
265 employed and most (63%) lived in a major city. Patients were on average 31 months
266 since diagnosis with just over half (51%) on treatment at baseline.

267

268 Table 1 about here

269

270 **QOL**

271 High proportions of caregivers had low *mental wellbeing*, as compared to the population
272 norm of 16%, at 7-9 months before patient's death (30%, $p=0.008$), at 4-6 months (32%,
273 $p=0.003$) and at 0-3 months before patient's death (39%, $p=0.001$). The proportion of
274 participants with lower *physical wellbeing* than the population norm was statistically

275 significantly higher at 4-6 months only (30%, $p=0.01$), although there was a trend
276 towards worse physical quality of life at 0-3 months also (27%, $p=0.09$) (see Table 2).
277 Figure 1 shows that mean levels for both mental and physical well-being declined slightly
278 over the 12 month study period.

279

280 Table 2 about here

281

282 **Psychosocial trajectories**

283 Mean distress levels in caregivers increased significantly over time ($p=0.01$, Figure 1).

284 The number of unmet needs also increased over time, although this was not statistically
285 significant. However social support remained constant, suggesting that social support did
286 not increase in proportion with growing distress and need for this group of caregivers.

287

288 **Unmet needs**

289 Fifty-six percent of caregivers reported at least one unmet need in the period 10-12
290 months before the patient's death, 70% 7-9 months, 83% 4-6 months and 88% 0-3
291 months (chisquare test of trend, $p = 0.0007$). The top five (or more if tied) prevalent
292 unmet needs of caregivers at each 3 month interval before the patient's death, are shown
293 in Table 3. The severity of unmet needs increased over time, peaking 3-6 months before
294 death, but reducing in the last 0-2 months of the patient's life. At the beginning of the
295 year, the most prevalent and severe unmet needs were for more support from other family
296 members, reducing the patient's stress and addressing sex life problems. Reducing the
297 patient's stress became the top priority for the remainder of the year, with accessing

298 prognostic information, handling the topic of cancer in social situations and dealing with
299 lack of acknowledgement of the impact on being a caregiver, taking 2nd and 3rd places
300 during this time.

301

302 Disappointment about lack of recovery and fear of the cancer spreading became
303 prominent in the last few months of the patient's life. Interestingly, working through
304 feelings about death and dying were amongst the top five unmet needs only at the
305 beginning of the year, suggesting a relatively early acknowledgement of approaching
306 death. Other issues which reached the top five only in the last three months, included
307 balancing one's own needs with those of the patient's, the impact of caring on work
308 activities and making decisions in the context of uncertainty.

309

310 **Factors associated with QOL**

311 Results of the mixed model analyses using baseline variables as predictors are shown in
312 Table 4. We excluded patient's current treatment from the models because it was not
313 statistically significant in any of them, and its estimated effects were small. *Mental*
314 *wellbeing* was positively associated with baseline optimism (p=0.01) and social support
315 (p=0.002) and negatively associated with patients' baseline QoL (p=0.02). Similarly,
316 worse distress (total HADS) was associated with lower baseline optimism (p=0.01) and
317 social support (p=0.02) and with higher unmet needs (p=0.02). *Physical wellbeing* was
318 not associated with any of the measured variables.

319

320 Table 4 about here

321

322 Associations were similar but stronger in the time-varying model (Table 4), which
323 showed that *mental wellbeing* was significantly positively associated with current
324 optimism ($p<0.0001$) and social support ($p<0.0001$) and negatively associated with
325 higher unmet needs ($p=0.008$) and *physical wellbeing* ($p<0.0001$), but not patient QOL
326 ($p=0.9$). Similarly, distress was significantly lower in women with high current optimism
327 and social support, and higher in those with high unmet needs ($p=0.0005$) and fewer
328 months to death ($p<0.0001$). *Physical wellbeing* was negatively associated with mental
329 wellbeing ($p<0.0001$) and positively associated with social support ($p=0.02$) in the time-
330 varying model. Notably, caregiver age was not related to outcomes in either model.

331

332 **Discussion**

333

334 This large prospective study provides the first available data on the experience of
335 caregivers of women with recurrent ovarian cancer throughout the women's last year of
336 life. Documenting the trajectories of caregivers' physical and mental QoL, distress,
337 unmet needs and social support over the last year of life, the findings clearly demonstrate
338 deterioration in mental wellbeing and an increase in distress in the 12 months before
339 death. Both mental and physical wellbeing was compromised for caregivers, particularly
340 in the last 6 months of the patient's life. A third of caregivers reported scores which fell
341 below one standard deviation of population norms, representing a clinically significantly
342 reduction in quality of life. Furthermore, scores remained consistently poor over the year.
343 This is a significant concern not only for the caregivers themselves, but also because

344 these caregivers are so vital to supporting the patients, and reinforces previous studies
345 that have shown that caregiving has a real toll on caregivers [1].

346

347 Distress and needs increased over time, but social support remained constant. This
348 suggests that social support did not increase to match the caregivers' growing needs. As
349 social support was consistently associated with better wellbeing, this deficiency clearly
350 has an important impact on caregivers. Of note, caregiver distress was also impacted by
351 needs not being met by cancer services, suggesting that caregivers need support not only
352 from family and friends but also from their cancer team. Unmet needs increased steadily
353 over time, decreasing only in the last three months of the patient's life, when perhaps
354 palliative care staff were more involved. Traditionally cancer services have focused on
355 patient care, but these findings suggest that caregivers should also be a focus for active
356 monitoring and intervention.

357

358 Caregiver unmet needs shifted over time, from an initial focus on obtaining support for
359 the wider family, discussing the cancer in social situations and on issues around
360 sexuality, to needing help with disappointment and fear, and making decisions under
361 conditions of uncertainty at the end of the year. This maps well to the change over time
362 from living with cancer, to preparing for death. Early unmet needs were similar to those
363 identified by Soothill et al [22], in caregivers of heterogeneous cancer patients, for help
364 with managing daily life, emotions and social identify. However, later unmet needs
365 appear to be unique to the period close to death. These data provide some useful guidance
366 to cancer services on the issues likely to be paramount for caregivers at different points of

367 the cancer trajectory. In particular, these findings suggest that caregivers could benefit
368 from early contact with psychosocial staff for help with managing current and future
369 losses, rather than waiting for post-death referral to bereavement services. Further, during
370 the entire treatment phase, these caregivers reported strong needs for information,
371 suggesting that they may need individual consultations with nursing and medical staff,
372 and access to information resources and support groups targeted to their needs.

373

374 Apart from social support, caregiver optimism, both at baseline and over the entire year,
375 was associated with better mental wellbeing and lower distress. Optimistic caregivers
376 were perhaps better able to cope with the disappointment and fear that increased as death
377 approached. Optimism has previously been shown to be associated with improved quality
378 of life [23] and even survival, but has primarily been explored in relation to patient,
379 rather than caregiver, outcomes. Caregivers often use a wide array of coping behaviours
380 in response to the stress encountered [1], and the place of optimism amongst this array
381 requires further research.

382

383 Interestingly, the patient being on treatment was not associated with decreased caregiver
384 QOL, reinforcing the findings summarized by Le et al [1]. Perhaps the hope provided by
385 treatment counter-acts the challenges of side effects and tumor progression. Furthermore,
386 while patient self-reported quality of life at baseline was associated with caregiver mental
387 wellbeing, when considered over time it was not a significant predictor. Perhaps the
388 situation of caring for someone with advanced cancer is so overwhelming that variations
389 in the patient's reported quality of life are not enough to mitigate caregiver concerns.

390 Similar findings have been reported in recent research exploring caregiver distress at the
391 end of life. Tang, Siew, Cheng et al [24], for example, reported that the caregiver's sense
392 of coherence moderated the impact of caregiver burden on their stress, and noted that
393 theories of stress and coping suggest that the impact of caregiving on caregivers' lives
394 depends more on personal psychological resources than on objective caregiving demands
395 or social resources.

396

397 **Strengths and Limitations, and future directions**

398

399 As part of a large cohort study, the women cared for by the caregivers in this analysis
400 were recruited across stages of disease and at varying times since diagnosis. However, as
401 our interest was in the last year of life, this heterogeneity had little impact on results.
402 Further, with up to eight assessment points, we were able to closely track these caregivers
403 over a year, and include time-varying variables in the analyses. Another strength is the
404 population-based nature of the cohort, who were recruited from all major centres treating
405 women with ovarian cancer as well as via cancer registries across Australia.

406

407 It is often challenging to gain access to caregivers in order to invite them into research
408 studies, as by necessity identification and contact of caregivers has to occur via the
409 patients for whom they are caring. While our initial response rate of caregivers for this
410 study was high (88%), only 53% of patients nominated a caregiver for the study, and it is
411 possible that these data do not fully reflect outcomes for all caregivers of women with
412 ovarian cancer. As we did not have informed consent from the women who did not

413 nominate a caregiver to examine their characteristics, we could not explore systematic
414 differences between these women and those who did nominate a caregiver.

415

416 Future research could usefully evaluate interventions targeting caregivers of women with
417 ovarian cancer across the disease trajectory to reduce their distress and allow them to
418 maintain as optimal quality of life as possible during this challenging time.

419

420 The authors declare that there are no conflicts of interest.

421 **References**

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433

434 **Table 1. Carer and patient demographics and characteristics, disease and treatment**
 435 **at the first assessment during the last year of life.**

436 Mean and standard deviation (SD) for continuous variables, and frequency and
 437 percentage for categorical variables are shown.
 438

Carers (n = 99)	Mean (SD) or n (%)
Age (years)	59 (13.2)
Age group (years)	
≤40	8 (8)
41-50	15 (15)
51-60	23 (23)
61-70	31 (32)
>70	21 (21)
Gender (male)	80 (80)
Relationship to patient	
Husband or partner	77 (78)
Child	16 (16)
Sibling or friend	6 (6)
Married or partnered	
Current partner	88 (89)
Not partnered	11 (11)
Work status	
Full time	38 (37)
Part time	2 (2)
Not employed/missing	62 (61)
Education	
School only (≤12 years)	27 (27)
Trade/Technical	53 (54)
University	19 (19)
Residential location	
Major city	64 (63)
Regional/remote	38 (37)
Social support (possible range 8-40)	60 (13.1)
Optimism (possible range 0-24)	15 (4.8)
Unmet needs severity (possible range 0-100)	33 (19.1)
Mental health ² (possible range (0-100))	44 (10.9)
Physical health (possible range 0-100)	49 (11.3)
Distress (possible range 0-42)	14 (7.7)
Patients (n = 99)	
Age mean years (standard deviation)	63 (8.7)
Age group (years)	
≤40	4 (4)
41-50	17 (17)

51-60	33 (33)
61-70	28 (28)
>70	17 (17)
On treatment at baseline	51 (51)
Months since diagnosis	31 (14.3)
Quality of life (possible range 0-100)	74 (15.2)

439 ¹Numbers may not add up to total due to missing data

440 ² population mean = 50, SD = 10

441

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443

444 **Table 2. Number (%) of caregivers below one standard deviation (SD) of population**
 445 **norms for mental wellbeing and physical wellbeing SF-12v2.**
 446

Months before death	Mental wellbeing		Physical wellbeing	
	n (%) 1 SD below norms	p-value ¹	n (%) 1 SD below norms	p-value ¹
10-12 months n = 51	10 (20%)	0.4	11 (22%)	0.3
7-9 months n = 61	18 (30%)	0.008	13 (21%)	0.3
4-6 months n = 57	18 (32%)	0.003	17 (30%)	0.01
0-3 months n = 33	13 (39%)	0.001	9 (27%)	0.09

447 ¹ One-sample proportion test, against US population norms, where 16% are expected to
 448 be less than 1 SD.
 449
 450
 451

452 **Table 3. Top five (or more if tied) most prevalent unmet needs for caregivers at 10**
 453 **to 12, 7 to 9, 4 to 6, and 0-3 months preceding patient death and mean severity.** N
 454 gives number of non-missing observations.
 455

Months before death	Unmet need ¹	Number reporting any need	Prevalence ² (95% CI)	Mean severity ³ (95% CI)
10-12 months				
n = 41	Getting more support from family	13	32 (24, 39)	4.4 (4.1, 4.7)
	Reducing patient's stress	10	24 (18, 31)	4.5 (4.1, 4.9)
	Addressing sex life problems	10	24 (18, 31)	4.2 (3.9, 4.5)
	Accessing prognosis information	9	22 (16, 28)	4.4 (4.0, 4.8)
	Accessing treatment information	9	22 (16, 28)	4.4 (4.0, 4.8)
	Managing concerns about recurrence	9	22 (16, 28)	4.6 (4.2, 5.0)
	Having opportunity to discuss concern with doctor	9	22 (16, 28)	4.4 (4.0, 4.8)
	Handling topic of cancer in social situations	9	22 (16, 28)	4.4 (4.0, 4.8)
	Working through feelings about death and dying	9	22 (16, 28)	4.4 (4.0, 4.8)
7-9 months				
n = 50	Reducing patient's stress	19	38 (31, 45)	4.3 (4.0, 4.5)
	Handling topic of cancer in social situations	15	30 (24, 37)	4.1 (3.9, 4.3)
	Accessing prognosis information	11	22 (16, 28)	4.5 (4.2, 4.9)
	Accessing treatment information	11	22 (16, 28)	4.5 (4.1, 4.8)
	Accessing information about patient's physical needs	11	22 (16, 28)	4.3 (4.0, 4.6)
	Getting emotional support for loved ones	11	22 (16, 28)	4.4 (4.0, 4.7)
4-6 months				
n = 52	Reducing patient's stress	22	42 (36, 49)	4.4 (4.1, 4.6)
	Accessing prognosis information	20	39 (32, 45)	4.3 (4.0, 4.5)
	Dealing with lack of acknowledgement of impact of being carer	20	39 (32, 45)	4.2 (4.0, 4.4)
	Accessing information about patient's physical needs	19	37 (30, 43)	4.3 (4.0, 4.5)

	Parking	18	35 (28, 41)	4.4 (4.1, 4.6)
0-3 months				
n = 26	Reducing patient's stress	11	42 (33, 52)	4.4 (4.0, 4.7)
	Disappointment about recovery	11	42 (33, 52)	4.4 (4.0, 4.7)
	Fears of cancer spreading	10	39 (29, 48)	4.4 (4.0, 4.8)
	Making decisions in context of uncertainty	10	39 (29, 48)	4.5 (4.1, 4.9)
	Parking	9	35 (25, 44)	4.8 (4.4, 5.1)
	Impact of caring on work and activities	9	35 (25, 44)	4.6 (4.2, 5.0)
	Balancing own needs with patient's	9	35 (25, 44)	4.6 (4.2, 5.0)
	Accessing prognosis information	9	35 (25, 44)	4.2 (3.9, 4.6)

456 ¹ Each of the needs was measured on a scale which stated "In the last month, what was
457 your level of need for help with", where response options were 1 = "not applicable", 2 =
458 "satisfied", 3 = "Low need", 4 = "Moderate need", 5 = "High need".

459 ²Prevalence is the proportion of caregivers reporting 3 or greater

460 ³Amongst caregivers with any unmet need

461

462 **Table 4. Association of caregiver mental and physical quality of life, and distress**
 463 **with psychological variables while controlling for months to death, age, social**
 464 **support, and patient’s quality of life.**
 465

Outcome	Explanatory variable	Baseline predicts later ¹		Time varying ²	
		Estimate ³ (95% CI)	p-value	Estimate ³ (95% CI)	p-value
Mental Wellbeing	Optimism	0.6 (0.2, 1.1)	0.01	0.6 (0.4, 0.9)	<0.0001
	Unmet needs	-0.1 (-0.3, 0.02)	0.08	-0.1 (-0.2, -0.05)	0.008
	Physical wellbeing	-0.07 (-0.3, 0.1)	0.4	-0.3 (-0.4, -0.2)	<0.0001
	Social support	0.5 (0.2, 0.9)	0.002	0.5 (0.3, 0.7)	<0.0001
	Caregiver Age (per 10 years)	0.2 (-1.6, 1.9)	0.8	0.4 (-0.7, 0.15)	0.4
	Months to death	0.3 (-0.3, 0.9)	0.3	0.3 (-0.03, 0.6)	0.07
	Patient QoL	-0.2 (-0.3, -0.04)	0.02	-0.003 (-0.08, 0.08)	0.9
Physical Wellbeing	Optimism	0.5 (-0.3, 1.2)	0.3	0.2 (-0.2, 0.5)	0.4
	Unmet needs	-0.1 (-0.4, 0.07)	0.2	-0.04 (-0.2, 0.5)	0.4
	Mental wellbeing	-0.2 (-0.6, 0.2)	0.3	-0.4 (-0.12, 0.04)	<0.0001
	Social support	0.2 (-0.3, 0.7)	0.5	0.3 (0.04, 0.5)	0.02
	Caregiver Age (per 10 years)	-1.8 (-4.3, 0.7)	0.2	-1.3 (-2.9, 0.3)	0.1
	Months to death	-0.2 (-0.7, 0.3)	0.4	-0.07 (-0.4, 0.2)	0.7
	Patient QoL	0.03 (-0.2, 0.3)	0.8	0.05 (-0.04, 0.1)	0.3
Distress	Optimism	-0.5 (-0.8, -0.2)	0.009	-0.5 (-0.7, -0.4)	<0.0001
	Unmet needs	0.1 (0.02, 0.2)	0.02	0.08 (0.04, 0.1)	0.0005
	Physical wellbeing	0.03 (-0.09, 0.1)	0.7	-0.02 (-0.1, 0.05)	0.5
	Social support	-0.2 (-0.4, -0.04)	0.02	-0.3 (-0.4, -0.2)	<0.0001
	Caregiver Age (per 10 years)	0.3 (-0.8, 1.3)	0.6	-0.1 (-0.9, 0.6)	0.8
	Months to death	-0.1 (-0.4, 0.2)	0.5	-0.3 (-0.5, -0.08)	0.005
	Patient QoL	0.05 (-0.5, 0.1)	0.3	-0.02 (-0.07, 0.03)	0.5

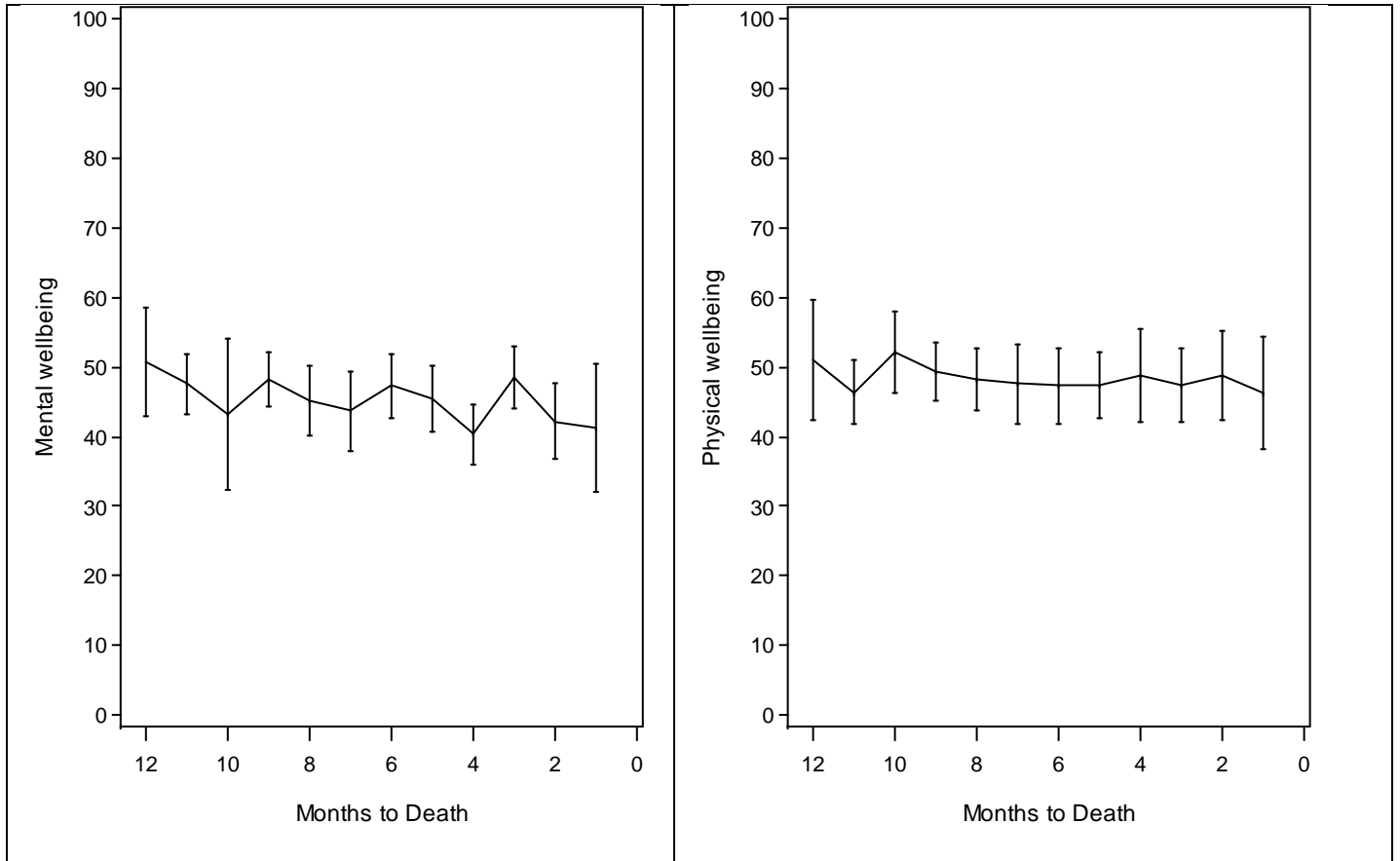
466 ¹ Each caregiver’s first observation in the year preceding death for psychosocial variables was used to
 467 predict all subsequent observations of QoL.

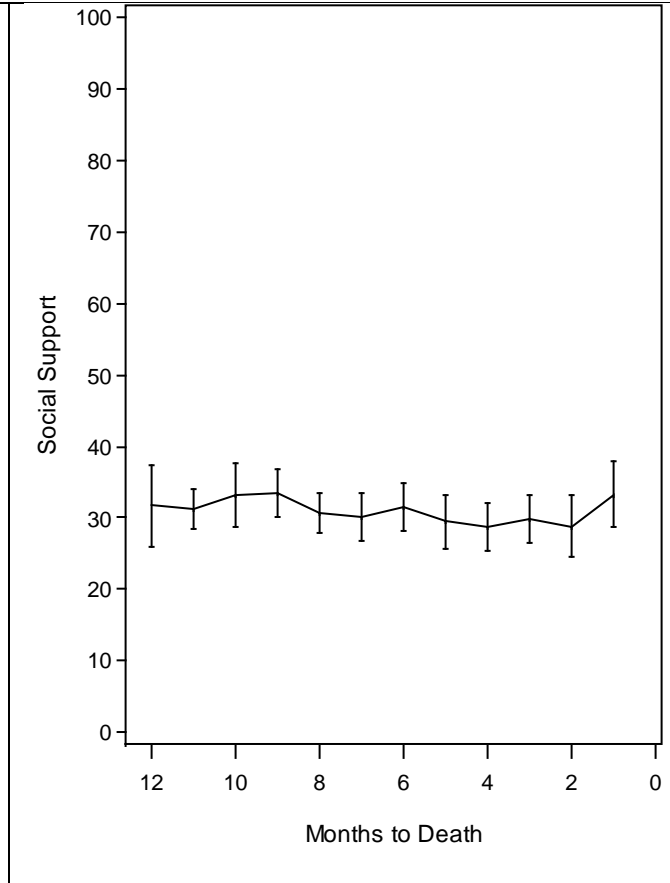
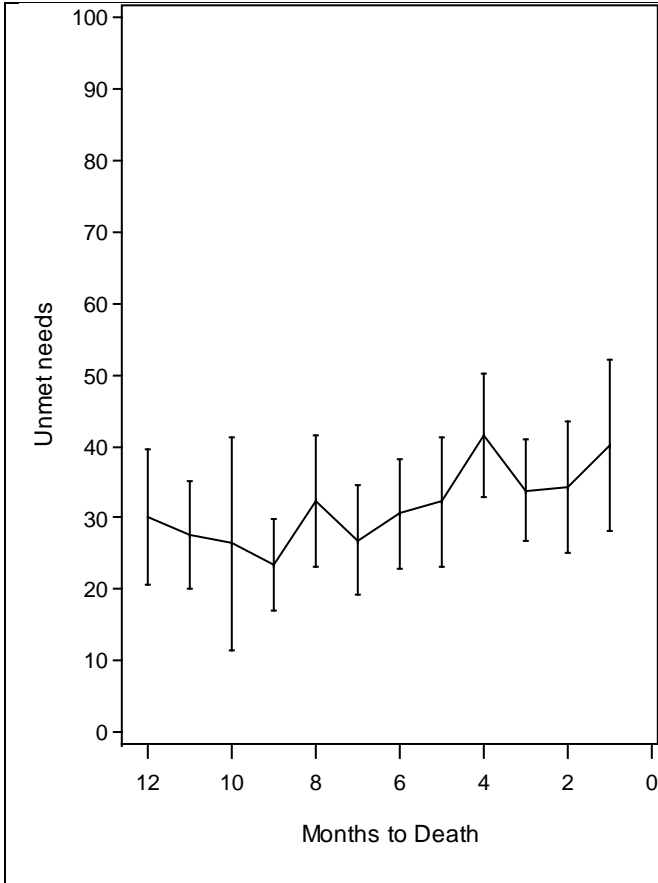
468 ² Variables are allowed to vary with time.

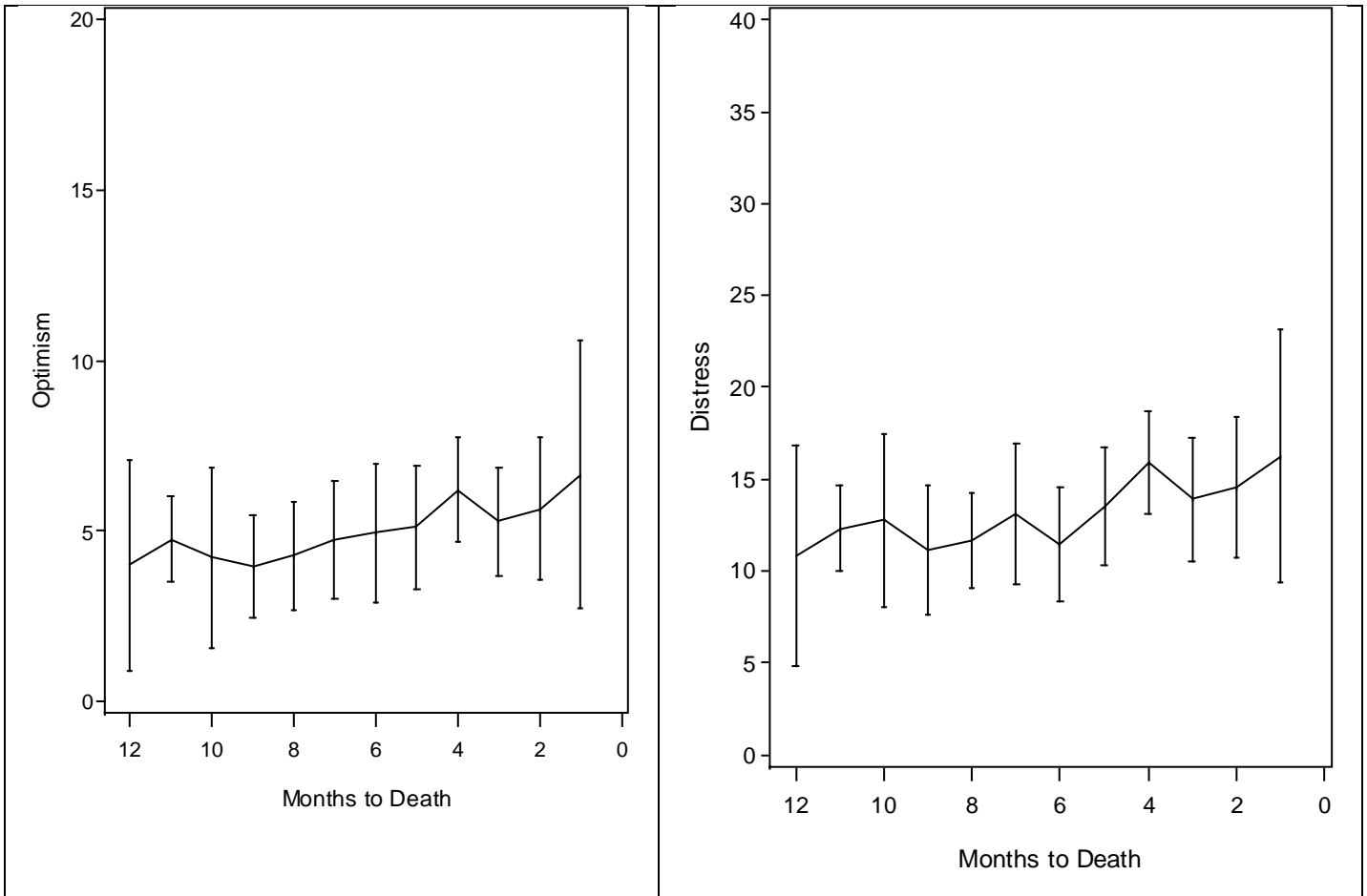
469 ³Regression coefficient estimates and 95% confidence intervals from a mixed model are shown.

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476 Figure 1. Mean mental and physical wellbeing, unmet needs, social support, optimism
 477 and depression over months to death, with 95% confidence intervals. Distress is the only
 478 outcome with a significant increase over time ($p = 0.01$).

479