



The link between relationship status, health factors, care needs and utilization of formal care facilities

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ABSTRACT

Background: As regards Dutch healthcare, the last decades have been characterized by reforms meant to reduce formal care use. Single older adults are found to be much more dependent on formal care facilities compared to their partnered counterparts, which raises concerns for the expanding number of singles in our society. **Objective:** The aim was to investigate the link between relationship status and the use of formal care facilities. **Methods:** Secondary data from TOPICS-MDS (N = 42093) was used to study whether this link can be understood through a mediation effect from health (physical health, mental health, and quality of life) and/or through a moderation effect from being partnered on the link between care needs and the use of formal care facilities. **Results:** Mediation analyses showed that partnered older adults experienced better health and well-being than their single counterparts, which partly explained that they were less dependent on formal care. Moderation analyses revealed that being partnered decreased the positive link between care needs and the use of certain care facilities. **Conclusions:** Being partnered reduces formal care dependency through numerous health, social, practical and care benefits. However, in light of the decreasing stability of relationships and overburdening of partner caregivers, policy developments should focus on mobilizing the care potential in the totality of older persons' social relationships.

KEYWORDS: Healthcare utilization, Formal care facilities, Informal / Partner care, The Older Persons and Informal Caregivers Survey Minimum Data Set (TOPICS-MDS)



Introduction

During the last decades, yearly healthcare costs in the Netherlands increased up to over 100 billion euros in 2018 (CBS, 2019). Due to population aging and medical technological developments, those costs will be nearly doubled by 2040 (RIVM, 2018). For this reason, the Dutch welfare state has been forced to reduce publicly provided care facilities including professional home and residential care (Da Roit, 2013). More than 90% of the budget for daycare has been cut and many other austerity measures have been taken (Rijksoverheid, 2013). Introduction of the Long-term Care Act in 2015 decreased the access to formal institutional, home- and daycare facilities even more (Da Roit & De Klerk, 2014). Those reforms contribute to a do-it-yourself paradigm of care and require not only an increase of self-reliance of older persons themselves, but an increased share of helping others, so-called informal caregiving, as well (Pavolini & Ranci, 2008). Whereas formal care includes all forms of paid professional and institutional care, informal care is generally defined as the unpaid care provided by a person with whom the care-receiver has a social relationship, such as a spouse, parent, child, friend or other non-kin (Triantafillou et al., 2010). Informal care activities can be similar to formal care activities and consist of domestic help, personal care and support in the home situation (Broese van Groenou, 2012). Whereas most recent research focused on the developments around informal caregiving, less is known about the formal care utilization of older persons.

Although most older adults prefer to “age in place” and avoid the use of formal care facilities, not everyone has the (cap)ability to decrease their formal care dependency (Van Houtum et al., 2014). In light of recent cutbacks in care facilities, it is important to investigate what factors are related to formal care usage. For decades, the study of healthcare utilization by the aged has been dominated by *Andersen’s behavioral model of healthcare use* which acknowledged health factors (e.g. number of health problems), predisposing factors (e.g. age, gender, socio-economic status), and resources (e.g. income) as major individual determinants for the use of formal care (Andersen & Newman, 1973). Nonetheless, recent research found that relationship status is also strongly associated with the use of formal care as partnered adults are half as likely to enter and use formal care facilities compared to single adults (e.g. Plaisier et al., 2011). Despite the fact that such findings are highly relevant with the increasing number of singles in our society and related societal developments (e.g. shrinking family ties and increased female employment), today only little is known about the link between relationship status and



formal care use (Thomeer et al., 2015). Because partners are likely to become increasingly important considering the recent policy initiatives towards informal care (Carlson et al., 2007), the current study contributed to existing literature by studying this link between having a partner and the use of different formal care facilities. The first aim was to investigate whether different health factors (physical health, mental health and quality of life) mediate the link between relationship status and formal care use. The second aim was to study whether the associations between care needs and the use of specific care facilities were moderated by relationship status due to social and practical advantages such as partner care provision. Since they are the fastest growing segment of the population and have high levels of care needs, this research focused on older adults. Findings from this research can be used to develop care policies that encourage “aging in place” while acknowledging the importance of a partner without losing sight of societal developments reflecting individualization and its consequences.

Formal care and relationship status

Formal care is care provided by a public institution or a professional, and includes care facilities either inside (help with household activities, personal care and nursing care) or outside the home. As mentioned above, partnered older adults are found to be less dependent on formal care facilities compared to their single counterparts. For example, research showed that partnered adults are half as likely to enter long-term care facilities as single adults (Freedman, 1996; Noël-Miller, 2010). Such findings are consistent for married, re- and unmarried partnered adults, and for men as well as women (Thomeer et al., 2015). Furthermore, Ermer and Proulx (2017) found that partnered adults have a decreased likelihood of using health homecare as well. Moreover, older persons with a partner were found to receive formal domestic care four times less compared to single elderly, respectively 9% versus 36% (Plaisier et al., 2011). Thus, it seems that having a partner reduces the chance of both entering and using formal care facilities.

Regarding this link between relationship status and care use, multiple explanations were found in the literature. On the one hand, this link could be explained by the fact that being partnered has been associated with a variety of positive physical and mental health outcomes, indicating that older adults with a partner have fewer care needs. On the other hand, practical benefits from a partner (e.g. financial advantages, provision of support and informal care) might decrease dependency on formal care as well. Both explanations are clarified below.



First, the link between relationship status and formal care use might be explained by health and well-being benefits that the partnered enjoy. Multiple studies have found health benefits for measures as number of illnesses, disabilities and chronic conditions, self-rated health, functional limitations and rates of morbidity and mortality (e.g. Hughes & Waite, 2009; Lorenz et al., 2006; Williams & Umberson, 2004). A partner is also found to be responsible for greater mental health and well-being, happiness, enhanced life satisfaction and a higher self-reported quality of life (e.g. Næss et al., 2015). Opposite thereto, single adults are found to experience more physical and mental health concerns, more loneliness, less life satisfaction, smaller social networks and less social contacts (Cornwell & Waite, 2009; Dykstra et al., 2005). This highlights the importance of a partner for an older persons' health and well-being (Wong & Waite, 2015). Since older persons spend the most time with their spouse or partner, those relationships are found to be central to their social well-being and to affect their health behaviors, mental- and physical health on the short- and long-term (Lindau et al., 2003; Umberson & Montez, 2010). Therefore, health benefits of being partnered are found to benefit older adults in particular (Umberson et al., 2006). Since a better health decreases the likelihood of formal care use (Mudrazija et al., 2015), health benefits explain that partnered older adults are less dependent on formal care in the first place.

On top of this, even when partnered older adults are in need of (health)care, their partners are likely to prevent them from using formal care facilities because they provide multiple practical and social resources, and partner care. It is evident that such resources include economic resources and financial advantages (Hughes & Waite, 2009), and social support – including a greater likelihood of children as important source of support as well (Antonucci & Akiyama, 1995). Besides, partners bring embeddedness in social systems such as families and friends (Coleman, 1988; McPherson et al., 2006). Those resources indicate that partnered older adults have a decreased likelihood to use formal care because those financially able to stay at home and receive alternative care choose to do so (Friedman et al., 2005). Moreover, social support and embeddedness in social systems are found to reduce the use of formal care facilities as well, since social ties may serve as substitutes for formal care (Charles & Sevak, 2005).

Moreover, a partner increases the use of preventive care services (Lau & Kirby, 2009) and is likely to provide care when needed. Today, partners are found to be the first ones and the most suitable persons to provide care when physical and psychological problems appear (Agree



& Glaser, 2009; Jacobs et al., 2016). Since partners are very likely to cohabitate, partnered older adults enjoy the benefits of cohabitation with regard to informal care provision as well (Van Duin et al., 2018). The comprehensiveness of partner care is revealed by the negative relation found between partner care and the use of formal long-term care (Noël-Miller, 2010), and the finding that partners are the ones providing informal care without the need of complementary formal care (Suanet et al., 2012). Such findings support the idea that formal and informal care are each other's substitutes and thus, replace each other (Swinkels et al., 2016). This *substitution theory* illustrates that even when partnered older adults are in need of care, benefits with regard to receiving care and support explain that they are less likely to use formal care facilities than their single counterparts.

Conceptual model

From literature mentioned above, crucial factors regarding the link between being partnered and using formal care facilities were identified. By means of *Andersen's behavioral model of health-care use*, the *substitution theory* and the *marital resource model*, those findings were combined into an integrated conceptual model for current research.

As shortly mentioned earlier, the study of healthcare utilization by the aged has been dominated by *Andersen's behavioral model of healthcare use* (Bass & Boelker, 1987). According to this model, an individual's use of health services is determined by three key indicators: need, predisposing, and enabling factors (Andersen & Newman, 1973). Need factors represent the most immediate cause of health service use as it covers the perception of health or illness and therewith, the perceived and actual need for healthcare. Predisposing factors describe individual characteristics that determine care use, such as demographics (e.g. age and gender), social status, norms and attitudes. Lastly, enabling factors include personal and community resources that enable care use, such as economic resources and social ties. Validated by previous research mentioned above, both need and enabling factors are strongly associated with being partnered. Whereas health and well-being benefits for partnered older adults decrease their need for healthcare, partner care and economic and social resources serve as enabling factors and *substitute* formal care utilization (Suanet et al., 2012; Umberson, & Montez, 2010). Despite the fact that research and theory widely demonstrated the link between relationship status and factors



relating to care use, *Andersen's behavioral model of healthcare use* does not acknowledge the value of having a partner.

Meanwhile, the evident relevance of being partnered with respect to health, well-being and care use has been highlighted in the *marital resource model*. According to this model, relationship status differences in physical and mental health and well-being are the result from economic, psychological and social resources that partners provide (Ross et al., 1990). This model appoints the importance of financial advantages from partners for healthier living conditions and higher-quality healthcare. Besides, it values partners as sources of social support and affection that lead to better mental health and well-being. Further, it confirms that partners are likely to adopt standards of a healthy lifestyle through a stability of life and mutual monitoring of health behaviors (Carr & Springer, 2010; Kalmijn, 2017; Zella, 2017).

The conceptual framework of the current study recognizes the importance of, and endeavors to explain how, being partnered affects ones' formal care use in its entirety – defined as *formal care dependency* – as well as for specific care facilities separately (Figure 1). To obtain more insight into those associations, the research questions central in this study are: '*Does being partnered predict less formal care dependency among older adults, and is this link mediated by differences in physical health, mental health, and quality of life? How does relationship status influence the link between care needs and the use of formal care facilities?*'

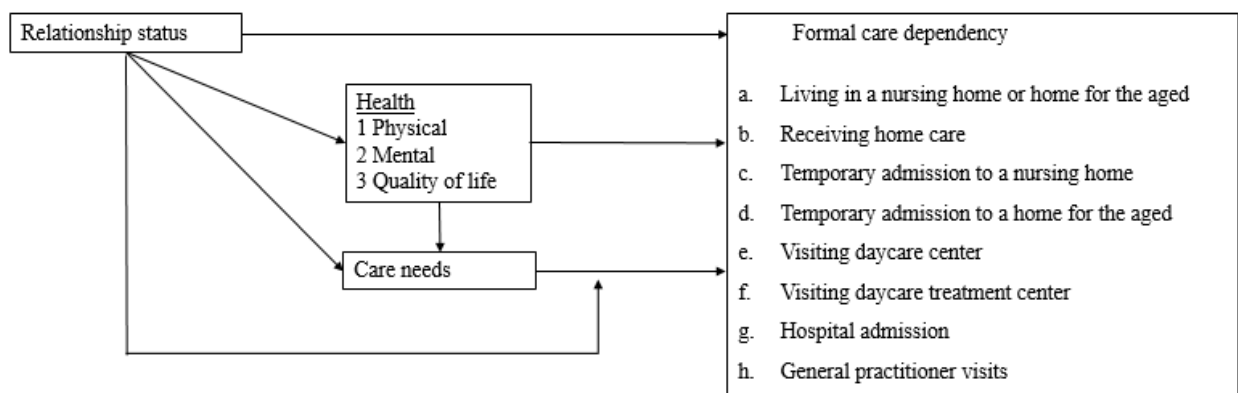


Figure 1. Conceptual framework

In accordance with earlier research findings (e.g. Ermer & Proulx, 2017), it was first expected that being partnered leads to less usage of formal care facilities.



Hypothesis 1: Being partnered predicts lower formal care dependency compared to single counterparts, beyond that already controlled for by age, gender and educational level

After determining differences between partnered and single older adults regards formal care use, current study attempted to understand those differences. As previous research has evidently shown that partnered older adults enjoy health and well-being benefits relative to their single counterparts, it is studied whether those factors elucidate less formal care dependency of the partnered. Based on earlier research findings and the theoretical explanation from *the marital resource model* connecting thereto, it is hypothesized that better physical health, mental health and quality of life of partnered older adults explain the negative link between being partnered and formal care dependency. Those health factors were studied separately to get more insight into their autonomous significance.

Hypothesis 2: Physical health (a), mental health (b) and quality of life (c) mediate the link between relationship status and formal care dependency

Besides providing health benefits, partners are found to play a crucial role as being the most resourceful caregivers as well (e.g. Suanet et al., 2012). In accordance with the concept that informal and formal care are each other's' substitutes (Swinkels et al., 2016), partnered older adults are expected to use less formal care facilities than single counterparts with similar care needs. It is hypothesized that the positive link between care needs and the use of formal care facilities is less strong for partnered elderly than among those without a partner (3a to 3f).

Because earlier research found that care substitution does not apply to doctor- and hospital visits (Bolin et al., 2008), being partnered is not expected to change the positive link between care needs and hospital admission and general practitioner visits (3g and 3h).

Hypothesis 3: Being partnered weakens the positive association between care needs and... living in a nursing home or a home for the aged (a), receiving homecare (b), being temporarily admitted to a nursing home (c), being temporarily admitted a home for the aged (d), visiting a daycare center (e), visiting a day treatment center (f)

Being partnered does not change the positive association between care needs and... hospital admission (g) and GP visits (h)



Methods

Quantitative research methods with self-report surveys were used to study the association between being partnered and the use of multiple formal care facilities. This quantitative design is highly suitable to study hypotheses based on a theoretical framework. Advantages of this design is replicability and the conviction that results are found to be valid, reliable and generalizable (Field, 2018).

Data

Secondary data from The Older Persons and Informal Caregivers Survey - Minimum Data Set (TOPICS-MDS) were used to answer the research questions. The TOPICS-MDS database was developed on behalf of the Organization of Health Research and Development (ZonMw) in part to ensure uniform collection of outcome measures, promote comparability between studies, stimulate reuse of the database and contribute to knowledge on older persons and the care they need (Van den Brink et al., 2015). Between 2008 and 2016, 53 different research projects in the Netherlands have contributed data to this initiative, resulting in a pooled dataset with data from >43000 older persons and >9,000 informal caregivers in total. For this study, fully anonymized data on the care receivers was used from a survey named '*Zorgvrager, baseline*' (Appendix 1).

Participants

The final sample for this research consisted of the respondents who completed the survey, were aged 60 years and older, and filled in their age and relationship status (N = 42093). In total, 16999 men (40.4%) and 25072 women (59.6%) with an age varying from 60 to 102 with the average of 78.90 (SD= 7.030) were included. At time of completion, the majority of the participants was married (48.4%) or widowed (38.8%), against smaller percentages of divorced (6.0%), single (5.2%) and partnered (1.6%) individuals.

Dependent variables

Formal care dependency Within this study, formal care dependency is defined as the extent to which someone uses various formal care facilities. Seven formal care facilities were studied including hospital admission, general practitioner (GP) visits, receiving homecare, temporary admission to a nursing home (NH) and a home for the aged (HA), and going to a daycare (DCC) and daycare treatment (DCTC) center. The use of the seven formal care facilities



was measured through questions with dichotomous answer categories (*1 - yes or 0 - no*), for example: ‘*Did you receive homecare, such as district nursing or home help?*’ and ‘*Have you been temporarily included in a nursing home during the last twelve months?*’ (See Appendix 2, Table 5 for complete overview). For hypothesis 1 and 2, the answers on those seven care facilities were summed up into the variable ‘Formal care dependency’ (score ranging from 0 to 7), with a higher score representing more dependency.

Formal care use If respondents filled in that they used a care facility (*1 – yes*), they were asked an additional question about the size of their care utilization for those specific facilities (e.g. number of hours homecare per week or number of weeks in a nursing home). For hypothesis 3, the variables corresponding to the size of the usage of seven formal care facilities were studied separately (Appendix 2, Table 6). Additionally, living in a nursing home or home for the aged was included as dependent variable as well. This variable was measured through the question: ‘*What is your living situation?*’ with the answer categories: in a home for the aged, in a nursing home, independent (alone) and independent (with others). This variable was dichotomized to be included in the regression analysis; the first two answer categories were scored as *1 - nursing home or home for the aged* and the last two as *0 - other, independent*.

Independent variables

Relationship status The independent variable for hypothesis 1 and 2 was measured through the question ‘*What is your marital status?*’ with five possible answer categories: married, divorced, widow / widower / partner deceased, single and sustainable living together (unmarried). Based on earlier research (Thomeer et al., 2015), it is expected that the effects of being partnered is similar for married, re- and unmarried partnered adults. Therefore, participants who filled in to be sustainably living together or married were scored as *1 - partnered*, and those who said to be single, divorced or widowed were scored as *0 - single*. In hypothesis 3, relationship status was used as moderator.

Care needs In hypothesis 3, the fifteen items of the Functioning (i)ADL KATZ-15 were used for the independent variable. After reliability and consistency were tested ($\alpha=.865$), those items were summated into one variable. Example items are: ‘*Do you need help walking about?*’ and ‘*Do you need help taking care of your house?*’ which can be answered with a simple yes (= *1*) or no (= *0*), with higher scores representing greater need for care.



Mediating variables

Physical health Respondents were asked to indicate morbidities experienced for 17 pre-defined diseases and conditions from the Local and National Health Monitor (e.g. diabetes, heart failures, asthma). By clicking the checkbox corresponding to that disease, they could mark the diseases and conditions they (have) had in the past twelve months. Ticked checkboxes were scored as 1, whereas empty checkboxes were scored as 0. Reliability for those items is considered critically low ($\alpha=.497$), which can be explained by the fact that the 17 items concern divergent diseases. Given the fact that the intention is to provide an overview of morbidities to assess one's health, this is not seen as problematic within the scope of this study. All items were summed up into one variable 'Morbidity' and thereafter reverse scored into 'Physical health' in order that a higher score represented better physical health (*0 - morbidity on 17 items to 17 - morbidity on 0 items*).

Mental health Items from the RAND-36 mental health subscale (Moorer et al., 2001) were used as a unidimensional measurement of mental state. The five questions concerned how often respondents have felt 1 *Very nervous*, 2 *Calm and peaceful*, 3 *Down-hearted and blue*, 4 *Happy* and 5 *Down* in the past four weeks (*1 = All of the time* and *6 = None of the time*). First, reverse scored items (1, 3 and 5) were recoded. The items related to one reliable component ($\alpha=.698$) and were computed into the scale variable 'Mental illness' (ranging from 5 to 30). This variable was reverse scored into a variable where a higher score indicated better mental health; this variable was named 'Mental health'.

Quality of life Three items based on Cantril's Self Anchoring Ladder (Cantril, 1965) and the RAND-36 were used to measure self-perceived quality of life. Those are internationally recognized quality of life surveys which are validated for use in the Netherlands (Hays & Morales, 2001). An example item is: *'In general, how would you rate the quality of your life?'* which can be answered on a Likert scale ranging from *1 - Excellent* to *5 - Poor*. After reverse scored items were recoded to ensure that higher scores represented a better quality of life, a factor analysis identified one component. Upon removal of one item that concerned a comparison in quality of life over time, reliability would increase from $\alpha=.680$ to $\alpha=.740$. Since this study is not investigating changes over time, this item was excluded and the other variables were computed into the variable 'Quality of life'.



Moderator

Relationship status * Care Needs A new variable, consisting of the interaction between the predictor and moderator variable, was created. After the values of both variables were standardized, the product of both standardized items were computed into a variable named 'Moderator' in order to conduct the moderation analyses.

Covariates

Predisposing factors relating to older people's attitudes and willingness to use care are often indicated by gender, age and socio-economic status (Li, 2005). Therefore, gender (1 - female, 0 - male), age (in years) and educational level (i.e. low, middle, high) were included as covariates in every analysis. Besides, based on earlier research findings (e.g. Van Duin et al., 2018), living arrangement was used as a confounder in hypothesis 1 and 2. Finally, to control for health differences between partnered and single older adults in hypothesis 3, health status was used as an additional covariate. For this covariate, the variables for physical and mental health (see '*mediating variables*') were summated into the variable 'Health status'.

Data analysis

The hypotheses were tested by means of hierarchical multiple regression, mediation and moderation analyses in IBM SPSS Statistics 25. Hierarchical multiple regression was used for predicting differences in formal care dependency between partnered and single older adults, beyond accounted for demographic variables and living arrangement (*H1*). Mediation analyses were conducted to investigate whether differences in mental health, physical health and quality of life explain the association between relationship status and formal care dependency. After determining significant associations between the predictor, dependent and mediator variables, the Hayes' (2013) PROCESS macro was used to measure indirect effects of relationship status by means of bootstrap analyses with 5000 samples and 95% confidence intervals (*H2*). Following that, moderation analyses were used to test whether relationship status changes the association between care needs and the use of different care facilities, while controlling for health status (*H3*). Finally, stratified analyses were performed to investigate how those associations differed for single and partnered older adults.



Results

Demographic characteristics of the respondents and their scores on key variables in this study are presented in Table 1. Corresponding numbers and percentages are given about the total sample as well as for partnered and single older adults independently. Separate columns show between-groups differences regards utilization of specific formal care facilities, for example that single older adults were three times as likely to be temporarily admitted to a home for the aged (5.4% compared to 1.4%), whereas a little greater percentage of partnered older adults was admitted to a hospital (25.7% compared to 24.8%).

Table 1

Numbers and percentages of partnered and single older adults using formal care facilities

	N	Total	Partnered older adults	Single older adults
		% or M (SD)	% or M (SD)	% or M (SD)
Age mean (SD)	42093	78.9 (7.03)	76.8 (6.30)	81.0 (7.09)
Gender	42071			
<i>male</i>		40.4	71.1	28.9
<i>female</i>		59.6	35.7	64.3
Educational level	33459			
<i>low</i>		25.2	20.6	29.5
<i>middle</i>		33.1	34.4	31.9
<i>High</i>		41.7	45.0	38.5
Relationship status	42093			
<i>married</i>		48.4	96.8	.
<i>divorced</i>		6.0	.	12
<i>widow / widower / partner deceased</i>		38.8	.	77.6
<i>single</i>		5.2	.	10.4
<i>sustainable living together</i>		1.6	3.2	.
Physical health	33481	14.8 (1.89)	15.1 (1.77)	14.5 (1.96)
Mental health	37390	21.2 (5.09)	21.7 (5.08)	20.7 (5.05)
Quality of life	35040	6.65 (1.45)	6.86 (1.48)	6.44 (1.39)
Care needs	32705	2.99 (3.30)	2.29 (3.11)	3.68 (3.32)
Living arrangement	42093			
<i>independent, alone</i>		41.3	5.3	77.2
<i>independent, with others (partner, children, etc.)</i>		48.4	90.5	6.2
<i>home for the aged / residential care</i>		9.4	3.6	15.2
<i>nursing home</i>		0.9	0.5	1.3



Receiving homecare	42093	31.2	20.3	42.1
Being temporarily admitted to a nursing home	34783	2.1	1.3	2.8
Being temporarily admitted to a home for the aged	33313	3.3	1.4	5.4
Visiting a daycare center	37385	3.2	2.5	4.0
Visiting a day treatment center	30702	1.4	1.6	1.1
Hospital admission	38027	25.2	25.7	24.8
General practitioner visits	36750	23.9	24.2	23.6

Besides the dissimilarities in the specific formal care facilities partnered and single older adults used, notable differences were found in their total formal care dependency as well (Figure 2). Altogether, respondents used one ($M=1.01$, $SD=1.00$) out of the seven formal care facilities on average. However, partnered older adults ($M=.873$, $SD=.960$) scored significantly lower than their single counterparts ($M=1.14$, $SD=1.02$). The distribution of the scores on formal care dependency was right-skewed as most people used none (37.0%), one (35.7%) or two (18.8%) care facilities. Whereas most partnered older adults used no formal care facilities (43.4%), the greatest percentage of their single counterparts used one care facility (37.6%).

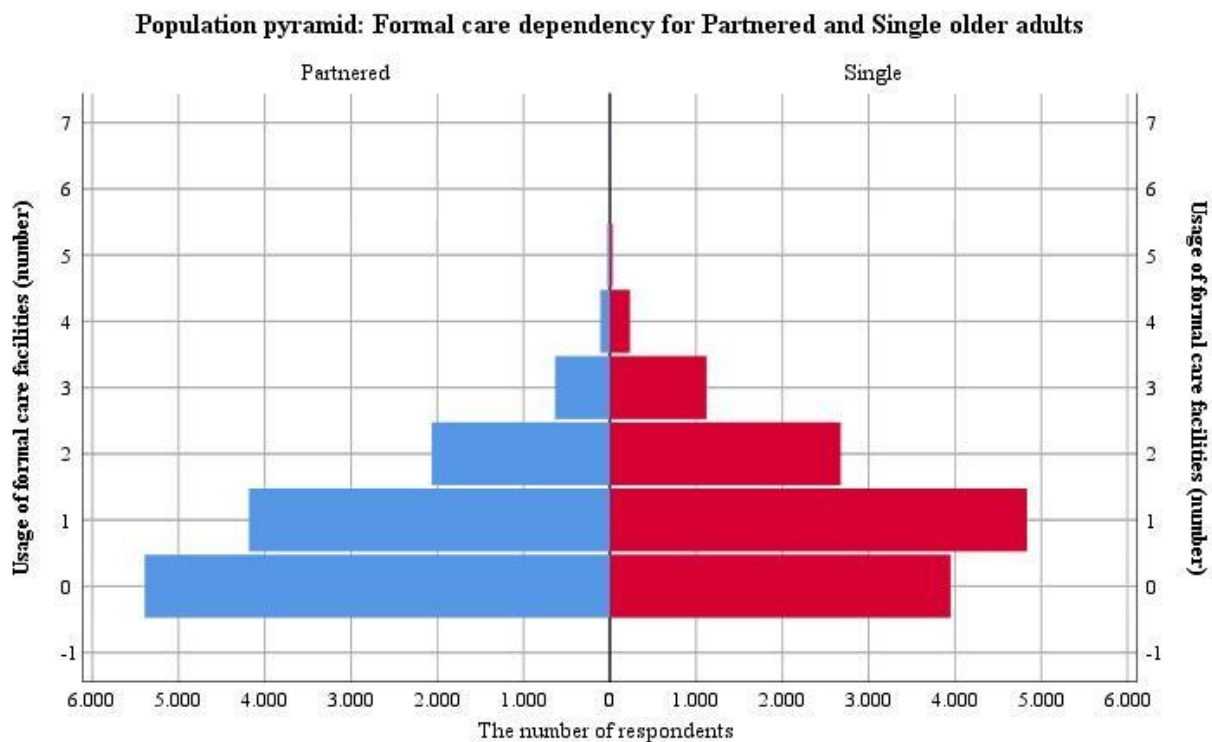


Figure 2. Number of formal care facilities used by partnered and single older adults



Hypothesis 1

An hierarchical multiple regression analysis (MRA) was performed to test the hypothesis that being partnered predicts lower formal care dependency, after accounting for demographics and living arrangement (*HI*). Before interpreting the results, assumptions were checked and have been met (Appendix 3). Step 1 of the analysis showed that age, gender, educational level and living arrangement predicted formal care dependency ($R^2 = .020$, $F(4, 20907) = 105.74$, $p < .001$). Relationship status was added to the regression equation on step 2, and accounted for an additional explanation of the variance, $\Delta R^2 = .009$, $\Delta F(1, 20906) = 196.74$, $p < .001$. The regression coefficient ($\beta = -.106$, Table 2) showed that the score on formal care dependency is lower for partnered older adults compared to their single counterparts. Herewith, confirming hypothesis 1. Taken together, the predictor variables accounted for 3% of the variability in formal care dependency, $R^2 = .029$, $F(5, 20906) = 124.72$, $p < .001$. According to Cohen's effect size, the magnitude of this effect is considered small ($f^2 = .030$).

Table 2

Unstandardized (B) and standardized (β) regression coefficients, squared semi-partial correlations and p values

	B [95% CI]	β	sr^2	Sig.
Step 1				
Age	.017 [.015, .019]**	.125	.014	.000
Gender (1 = female)	.071 [.043, .099]**	.034	.001	.000
Educational level	-.047 [-.064, -.030]**	-.038	.001	.000
Living arrangement (1 = in a care facility)	-.029 [-.080, .022]	-.008	.000	.272
Step 2				
Age	.014 [.012, .016]**	.099	.008	.000
Gender (1 = female)	.003 [-.027, .033]	.001	.000	.851
Educational level	-.044 [-.061, -.028]**	-.036	.001	.000
Living arrangement (1 = in a care facility)	-.059 [-.110, -.007]*	-.016	.000	.025
Being partnered	-.215 [-.245, -.185]**	-.106	.009	.000

* $p < .05$ ** $p < .001$



Hypothesis 2

Linear regression analyses were conducted in order to examine the link between relationship status, formal care dependency and the mediators (physical health, mental health and quality of life). As already tested in the first analysis, a significant total effect (path c) from relationship status on formal care dependency was found when controlled for demographics and living arrangement, $R^2 = .029$, $F(5, 20906) = 124.72$, $p < .001$. As presented in Figure 3, significant effects were confirmed between being partnered, the mediator variables and formal care dependency (path a and b; more details presented in Appendix 4), allowing further mediation analysis using the PROCESS macro for SPSS (Hayes, 2003). Covariates were included and the strongest effects were found between being partnered and physical health ($\beta = .097^{**}$) and physical health and formal care dependency ($\beta = .202^{**}$)

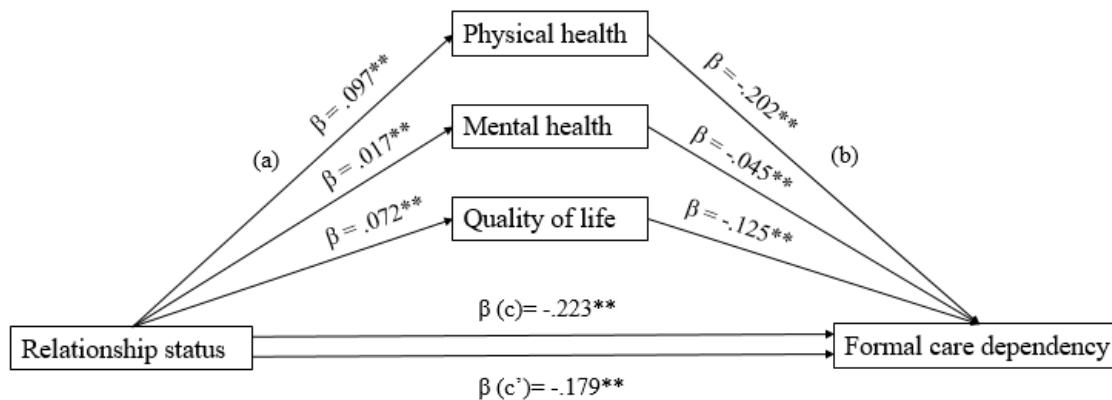


Figure 3. Mediation model linking relationship status to formal care dependency via physical health, mental health and quality of life. $**p < .001$

As regards the mediation analysis, physical health, mental health and quality of life were simultaneously added to the model as mediators. Again, demographics and living arrangement were included as covariates. Unsurprisingly, total ($b = -.223$, $t(8000) = -13.48$, $p < .001$) and direct effects ($b = -.179$, $t(8000) = -11.19$, $p < .001$) from being partnered on formal care dependency were found. The bootstrap analyses also revealed indirect effects via physical health ($b = -.0182$, BCa 95% CI [-.0245, -.0119]), mental health ($b = -.0066$, BCa 95% CI [-.0095, -.0041]) and quality of life ($b = -.0193$, BCa 95% CI [-.0241, -.0148]). Since the 95% confidence intervals of the mediators did not comprise 0, those three negative effects were found to be significant. As hypothesized, being partnered was thus associated with better physical health



(*H2a*), mental health (*H2b*) and quality of life (*H2c*), which were associated with lower formal care dependency. However, the effects in this model were considered small ($f^2 = .027$).

Hypothesis 3

After assumptions were checked and data was inspected (Appendix 3), eight linear regressions with moderation were performed to examine the moderation effect of relationship status on the association between care needs and the use of different formal care facilities (*H3*). Covariates were included in step 1 and 2, where after the moderator was added in step 3. As hypothesized, being partnered *weakened* the positive association between care needs and living in a NH/HA ($\Delta R^2 = .026$, $\Delta F(1, 26241) = 888.17$, $p < .001$), homecare ($\Delta R^2 = .002$, $\Delta F(1, 9027) = 17.05$, $p < .001$), weeks in NH ($\Delta R^2 = .000$, $\Delta F(1, 26235) = 12.98$, $p < .001$) and weeks in HA ($\Delta R^2 = .004$, $\Delta F(1, 26241) = 110.20$, $p < .001$). Against expectations, being partnered *strengthened* the positive associations between care needs and DCC visits ($\Delta R^2 = .002$, $\Delta F(1, 26241) = 57.60$, $p < .001$) and DCTC visits ($\Delta R^2 = .014$, $\Delta F(1, 26241) = 46.59$, $p < .001$). Likewise, the small positive effect from being partnered on the association between care needs and days in hospital ($\Delta R^2 = .000$, $\Delta F(1, 26241) = 8.29$, $p = .004$) disproved the hypothesis. In line with expectation, no effect was found from the moderator on GP visits ($\Delta R^2 = .000$, $\Delta F(1, 26241) = 3.06$, $p = .080$). An overview of the standardized (β) regression coefficients is presented in Table 3.

Finally, stratified analyses were performed to study differences between partnered and single older persons regarding the link between care needs and the use of eight care facilities (Table 4). Remarkable differences were found for living in a nursing home or home for the aged, receiving homecare and visiting a daycare or day treatment center. Whereas care needs strongly predicted living arrangement and homecare for single older adults, the relation between care needs and visits to a daycare or day treatment center were stronger for their partnered counterparts.



Table 3

Standardized (β) regression coefficients of each predictor on each step of the moderation analyses

	Living in NH/HA	Homecare (hours p/w)	Weeks in NH	Weeks in HA	DCC (visits)	DCTC (visits)	Days in hospital	GP visits
Step 1								
Age	.330**	.047**	.052**	.126**	.051**	-.004	-.012*	-.066**
Gender (1 = female)	.044**	-.001	.011	.028**	.019*	-.007	-.038**	-.019*
Educational level	-.064**	-.021*	.001	.003	-.022**	-.004	-.007	-.036**
Health status	-.054**	-.036*	-.011	-.009	-.022**	-.012	-.024**	-.019**
Step 2								
Age	.195**	-.003	.002	.074**	-.028**	-.044**	-.078**	-.094**
Gender (1 = female)	-.025**	-.032*	-.011	.001	-.012	-.020*	-.067**	-.033**
Educational level	-.032**	-.001	.013*	.015*	-.002	.007	.010	-.029**
Health status	.027*	.006	.000	.002	-.002	-.001	-.009	-.013*
Being partnered	-.084**	-.025*	-.013	-.035**	-.001	.009	-.020*	-.015*
Care needs	.321**	.258**	.133**	.122**	.224**	.122**	.173**	.070**
Step 3								
Age	.179**	-.008	.000	.068**	-.023*	-.040**	-.077**	-.093**
Gender (1 = female)	-.023**	-.034*	-.010	.001	-.012	-.021*	-.067**	-.033**
Educational level	-.031**	.000	.014*	.016*	-.002	.007	.009	-.029**
Health status	-.023**	-.005	.001	.004	-.003	-.002	-.010	-.013*
Being partnered	-.082**	-.007	-.013	-.034**	-.001	.009	-.021*	-.015*
Care needs	.309**	.251**	.132**	.118**	.228**	.125**	.175**	.071**
Moderator	-.162**	-.047**	-.022**	-.064**	.046**	.042**	.018*	.011

* $p < .05$ ** $p < .001$

Table 4

Standardized (β) regression coefficients from stratified analyses (partnered vs single older adults)

	Living in NH/HA	Homecare (hours p/w)	Weeks in NH	Weeks in HA	DCC (visits)	DCTC (visits)	Days in hospital	GP visits
Partnered older adults	.220**	.217**	.145**	.099**	.284**	.165**	.162**	.048**
Single older adults	.388**	.320**	.136**	.120**	.155**	.071**	.139**	.031*

Covariates: Age, gender, educational level, health status

* $p < .05$ ** $p < .001$



Discussion

The goal of this study was to examine the link between being partnered and using formal care facilities. The first analysis showed that older adults with a partner were found to use less formal care facilities than their single counterparts, also when taking into account differences in age, gender, educational level and living arrangement. This is congruent with findings that single older adults enter long-term care facilities twice as often and receive formal domestic care four times as much (e.g. Noël-Miller, 2010; Thomeer et al., 2015; Plaisier et al., 2011).

The second analysis showed that physical health, mental health and quality of life mediated the link between relationship status and formal care dependency. Hence, the better health and well-being that older adults with a partner experienced, explained that they were less dependent on formal care than their single counterparts. According to the *marital resource model*, those benefits are the result from psychological, economic and social resources (Ross et al., 1990). However, it is important to take into account that multiple longitudinal studies showed that the link between being partnered and health is reciprocal and reflects both social causation (i.e. being partnered provides health-enhancing resources) and health selection (i.e. persons in the best health are most likely to be and remain in a relationship) processes (Carr & Springer, 2010; Goldman, 2001). Furthermore, it must be noted that the satisfaction and support associated with the relationship - the 'relationship quality' - is also of great importance. Earlier research found that unsatisfying relationships undermine both psychological well-being and life satisfaction (e.g. Williams, 2003) and physical health outcomes (Holt-Lunstad et al., 2008). Future research could use the *convoy model of social relations* to take relationship quality into consideration. It acknowledges the importance of social relations for the lives, health and well-being of older people while also recognizing the variation in their closeness, quality, function and structure (Antonucci et al., 2014).

The third analysis showed that being partnered weakens the positive association between care needs and living in or being temporarily admitted to a nursing home or home for the aged and receiving homecare. Those results are in accordance with the findings that when problems appear, partners are the first ones to provide care as well as the ones providing care without the need of complementary formal care (Jacobs et al., 2016; Suanet et al., 2012). Partner care also explains that single and partnered older adults use different care facilities when they are in need of care. Contrary to expectations, this study found that partnered older persons visited daycare or



day treatment centers more often than single counterparts. A possible explanation for this is that partners motivate or support each other to go there when they believe that it yields something (e.g. physical activation or social contacts), which can be understood as a form of mutual monitoring of health behaviors (Zella, 2017). Another explanation is that partner care provision and support ensure that care receivers with a partner are able to continue living in their home for a longer period. For them, additional care such as those daycare visits is needed, whereas single older adults rely more on long-term care facilities. Finally, this link between being partnered and visiting daycare or treatment centers is consistent with the evidence that such visits are used as a means to relieve informal carers such as partners (Movisie, 2014).

Altogether, those analyses support the conceptual framework of this study (Figure 1) in which the importance of having a partner is acknowledged with regard to older persons' formal care dependency.

Strengths and limitations

The large sample size and the combination of theories and literature from multiple disciplines (gerontology, family sociology, health and behavioral sciences) in its conceptual framework were strengths of this study.

A limitation was that the distribution of the variable formal care dependency is right skewed, violating the assumption of normality and possibly underestimating the results. Because dichotomizing would result in losing quantity and quality of data, and transforming the variable did not seem to improve the normality, no further measures have been taken regarding this issue. On the other hand, for the sake of this study the variable relationship status was dichotomized, which led to the limitation that existing differences between single, widowed and divorced older adults were not acknowledged. Furthermore, the dataset possessed missing values for some of the variables. This resulted in different sample sizes for the analyses conducted and decreased the similarity of those. Finally, it was unfortunate that measures of informal care were lacking in the dataset. Therefore, results from the third analyses are cumbersome, and it can only be presumed that partner care explains the link between care needs and the use of specific care facilities.



Practical implications

In this study, the importance of having an intimate partner committed to provide care and support has been highlighted for persons born between circa 1930 and 1940. Regarding policy development, the importance of an intimate partner for the health and formal care needs of older adults should be taken into account. However, the increasing number of single people and the decreasing stability of partnerships in our society presumably undermine the optimistic ideas of partner care (Umberson & Montez, 2010). Related societal developments such as shrinking family ties, increased female employment, greater geographical mobility and weakened solidarity seem to be at odds with informal involvement in care as well (Pickard et al., 2000; Ryan et al., 2012). Such societal changes - reflecting individualization of personal life - may have decreased people's feelings of obligation and their willingness to care for their relatives (Fingerman et al., 2012). Thus, for the younger generations, less older adults will be partnered and the relationships that exist, will doubtless be based on different norms and values. Therefore, it is inconceivable to generalize findings from this study to younger generations.

On the other hand, if partners prove crucial caregivers in the younger generations as well, concerns related to care burden arise. Partner caregivers were found to have a higher risk of overburdening than others because they are likely to co-reside with the care recipient, provide intensive hours of different types of care, and have a strong emotional relationship with the care receiver (e.g. Pinquart & Sörensen, 2011) They reported mental and physical health problems more often compared to adult-child caregivers (Oldenkamp et al., 2016). An explanation is that intimate partners share almost none of the care with other informal caregivers, whereas children are likely to collaborate with relatives and other non-kin (Jacobs et al., 2016; Fast et al., 2004). Finally, partner caregivers tend to be particularly vulnerable due to the fact that they – mostly - are themselves elderly, often in poor health and in need of support from (in)formal care services (Tinker et al., 1999).

Concluding, a secure and lasting policy development should not focus particularly on partner care but on elaborating and/or mobilizing the care potential in the totality of older persons' social relationships. Gaining more insight into current informal caregivers and expanding their support services to identify new sources of care may help policy makers to achieve strong care networks among older adults.



Conclusion

In conclusion, this study confirmed that partnered older adults were generally less dependent on formal care facilities than their single counterparts. Better physical and mental health and a higher quality of life were found as explanatory factors for this association. Furthermore, the comprehensiveness of partner care and support was illustrated by the moderating effect from being partnered on the link between care needs and formal care facility utilization. Interestingly, stratified analyses showed that the groups differed in the specific facilities they most often use. Whereas single older persons were more likely to live in a home for the aged or nursing home, their partnered counterparts visited daycare or day treatment centers more often.

Based on all the above, it has become clear that future research is needed to better understand the complex, reciprocal associations between relationship status, health and well-being, care needs and informal and formal care use. Development of an integrative theory of care might be one of the first steps to improve our understanding regarding the interdependence between all those factors; and the link between formal and informal care in particular. With respect to this connection, Timonen (2009) already stated: “*the link between informal and formal care is complex (...): they increasingly overlap and are reshaping each other*”. By investigating if, when, and how those forms of care substitute and/or complement to each other – and how this differs for single and partnered older persons – future policies can better respond to the different care demands of those groups. Adding insights from the convoy model of social relations to the *marital resource model* and the *behavioral model of healthcare use* might complete this integrative theory that recognizes complex care contexts, the role of relationship status and other related factors.



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Appendix 1: Questionnaire Zorgvrager, baseline (in Dutch)

TOPICS-MDS

VRAGENLIJST

Zorgvrager
Baseline

Uw ervaringen als zorgvrager zijn waardevol

U ontvangt zorg. In deze lijst staan vragen over wat die zorg betekent voor u als zorgvrager. Uw antwoorden worden gebruikt in onderzoek naar verbetering van de zorg voor ouderen. Want hoe meer er bekend is over zorg voor ouderen, hoe beter er rekening mee gehouden kan worden. Bijvoorbeeld bij het veranderen van voorzieningen, regelingen of wetten voor zorg en welzijn. Uw ervaringen zijn dus waardevol, ook voor andere ouderen. Uw antwoorden worden anoniem verwerkt en uw gegevens worden niet verder verspreid.

Als u deze vragenlijst invult, heeft dit geen invloed op de zorg die u ontvangt.

Als u nog vragen hebt, kunt u ons bellen op ...

Aanwijzingen bij deze vragenlijst

- Het invullen van de vragenlijst kost u ongeveer een half uur.
- Lees elke vraag eerst helemaal door voordat u een antwoord kiest.
- Kruis dan het antwoord aan dat het beste bij u past.
- Kruis bij elke vraag maar één antwoord aan.
- Als u meer dan één antwoord aan mag kruisen, dan wordt dat bij de vraag genoemd.
- Als u het moeilijk vindt om de vragen te begrijpen of in te vullen, vraag dan hulp aan uw partner, een familielid of vriend.
- Sommige vragen lijken ‘dubbel’, maar we verzoeken u ze toch in te vullen. Ze zijn bedoeld om uw situatie nog eens van een andere kant te bekijken.
- Bent u klaar, kijk dan of u geen vragen vergeten bent.

Geboortedatum, geslacht en postcode

Vul hieronder uw gegevens in:

1 Geboortedatum:-.....-.....

2 Geslacht:

- Man
- Vrouw

3 Postcode:

--	--	--	--

Persoonlijke gegevens

4 In welk land bent u geboren?

- Nederland
- Ander land:

5 In welk land is uw vader geboren?

- Nederland
- Ander land:

6 In welk land is uw moeder geboren?

- Nederland
- Ander land:

7 Wat is de hoogste opleiding die u hebt afgemaakt?

- Minder dan 6 klassen lagere school
- 6 klassen lagere school, lom-school, mlk-school
- Meer dan lagere school / basisschool zonder verder afgesloten opleiding
- Ambachtsschool
- Mulo / mms / mavo / middelbaar beroepsonderwijs
- Hbs / gymnasium / atheneum
- Universiteit / hoger onderwijs

8 Wat is uw burgerlijke staat?

- Gehuwd
- Gescheiden
- Weduwe / weduwnaar / partner overleden
- Ongehuwd

- Duurzaam samenlevend, ongehuwd

Woonsituatie

9 Wat is uw woonsituatie?

- Zelfstandig, alleen
- Zelfstandig, met anderen (partner, kinderen enzovoorts)
- Verzorgingshuis / woonzorgcentrum sinds - -
- Verpleeghuis sinds

Gezondheid en ziekten

De volgende vragen gaan over uw gezondheid. Kruis het hokje aan van het antwoord dat het beste bij u past.

10 Hoe is in het algemeen uw gezondheid?

- Uitstekend
- Erg goed
- Goed
- Redelijk
- Slecht

11 Hoe is in het algemeen uw gezondheid, in vergelijking met een jaar geleden?

- Veel beter
- Iets beter
- Ongeveer hetzelfde
- Iets slechter
- Veel slechter

De volgende vragen gaan over hoe het vandaag met u gaat. Kruis aan welke zin het beste past bij uw gezondheid zoals die nu is.

12 Lopen:

- Ik heb geen problemen met lopen. Ik heb enige problemen met lopen.
- Ik ben bedlegerig.

13 Zelfzorg:

- Ik heb geen problemen om mezelf te wassen of aan te kleden.
- Ik heb enige problemen om mezelf te wassen of aan te kleden.
- Ik ben niet in staat om mezelf te wassen of aan te kleden.

14 Dagelijkse activiteiten (bijvoorbeeld werk, studie, huishouden, gezins- en vrijetijdsactiviteiten):

- Ik heb geen problemen met mijn dagelijkse activiteiten.
- Ik heb enige problemen met mijn dagelijkse activiteiten.
- Ik ben niet in staat mijn dagelijkse activiteiten uit te voeren.

15 Pijn/klachten:

- Ik heb geen pijn of andere klachten.
- Ik heb matige pijn of andere klachten.
- Ik heb zeer ernstige pijn of andere klachten.

16 Stemming:

- Ik ben niet angstig of somber.
- Ik ben matig angstig of somber.
- Ik ben erg angstig of somber.

17 Hersenfuncties zoals geheugen, aandacht en denken:

- Ik heb geen problemen met mijn geheugen, aandacht en denken.
- Ik heb enige problemen met mijn geheugen, aandacht en denken.
- Ik heb ernstige problemen met mijn geheugen, aandacht en denken.

De volgende vragen gaan over de ziekten en aandoeningen die u hebt of hebt gehad.

18 Zet een kruisje bij de ziekten en aandoeningen die u hebt of hebt gehad in de afgelopen 12 maanden. U kunt meer dan één antwoord aankruisen.

- Suikerziekte
- Beroerte, hersenbloeding, herseninfarct of TIA
- Hartfalen
- Een vorm van kanker (kwaadaardige aandoening)

- Astma, chronische bronchitis, longemfyseem of CARA / COPD
- Onvrijwillig urineverlies (incontinentie)
- Gewrichtsslijtage (artrose, slijtagereuma) van heupen of knieën
- Botontkalking (osteoporose)
- Gebroken heup
- Andere botbreuken dan gebroken heup
- Duizeligheid met vallen
- Prostaatklasten door goedaardige prostaatvergroting
- Depressie
- Angst- / paniekstoornis
- Dementie
- Gehoorproblemen
- Problemen met zien

Taken en bezigheden in het dagelijks leven

De volgende vragen gaan over hoe u functioneert in het dagelijks leven. Kies uw antwoord voor de situatie zoals deze nu is. Kruis het hokje aan van het antwoord dat het beste bij u past.

19 Hebt u hulp nodig bij het baden of douchen?

- nee
- ja

20 Hebt u hulp nodig bij het aankleden?

- nee
- ja

21 Hebt u hulp nodig bij het kammen van uw haar of het scheren?

- nee
- ja

22 Hebt u hulp nodig met naar het toilet gaan?

- nee
- ja

23 Maakt u gebruik van incontinentiemateriaal?

nee

ja

24 Hebt u hulp nodig bij het opstaan uit een stoel?

nee

ja

25 Hebt u hulp nodig bij het lopen?

nee

ja

26 Hebt u hulp nodig bij het eten?

nee

ja

27 Hebt u hulp nodig bij het gebruiken van de telefoon?

nee

ja

28 Hebt u hulp nodig bij het reizen?

nee

ja

29 Hebt u hulp nodig bij het boodschappen doen?

nee

ja

30 Hebt u hulp nodig bij het bereiden van een maaltijd?

nee

ja

31 Hebt u hulp nodig bij huishoudelijk werk?

nee

ja

32 Hebt u hulp nodig bij het innemen van medicijnen?

- nee
- ja

33 Hebt u hulp nodig bij het omgaan met geld?

- nee
- ja

Hoe u zich voelt

De volgende vragen gaan over hoe u zich de afgelopen maand hebt gevoeld. Kruis het hokje aan van het antwoord dat het beste bij u past.

34 Hoe vaak bent u in de afgelopen maand erg nerveus geweest?

- Altijd
- Heel vaak
- Redelijk vaak
- Soms
- Bijna nooit
- Nooit

35 Hoe vaak hebt u zich de afgelopen maand kalm en rustig gevoeld?

- Altijd
- Heel vaak
- Redelijk vaak
- Soms
- Bijna nooit
- Nooit

36 Hoe vaak hebt u zich de afgelopen maand neerslachtig en somber gevoeld?

- Altijd
- Heel vaak
- Redelijk vaak

- Soms
- Bijna nooit
- Nooit

37 Hoe vaak hebt u zich de afgelopen maand gelukkig gevoeld?

- Altijd
- Heel vaak
- Redelijk vaak
- Soms
- Bijna nooit
- Nooit

38 Hoe vaak hebt u zich de afgelopen maand zo somber gevoeld dat niets u kon opvrolijken?

- Altijd
- Heel vaak
- Redelijk vaak
- Soms
- Bijna nooit
- Nooit

Sociale activiteiten

39 Hoe vaak hebben uw lichamelijke gezondheid of emotionele problemen uw sociale activiteiten (zoals bezoek aan vrienden of naaste familieleden) belemmerd?

- Voortdurend
- Meestal
- Soms
- Zelden
- Nooit

Kwaliteit van leven

De volgende vragen gaan over uw 'kwaliteit van leven'. Daarmee wordt bedoeld wat u van uw leven vindt. Bijvoorbeeld of u tevreden met uw leven bent, of u plezier in uw leven hebt en of uw leven u voldoening geeft. Kruis het hokje aan van het antwoord dat het beste bij u past.

40 Hoe is in het algemeen uw kwaliteit van leven?

- Uitstekend
- Erg goed
- Goed
- Redelijk
- Slecht

41 Welk rapportcijfer geeft u uw leven op dit moment?

Rapportcijfer:

42 Hoe is in het algemeen uw kwaliteit van leven, in vergelijking met een jaar geleden?

- Veel beter
- Iets beter
- Ongeveer hetzelfde
- Iets slechter
- Veel slechter

Uw zorggebruik

43 Bent u de afgelopen 12 maanden opgenomen geweest in een ziekenhuis?

- Nee
- Ja, namelijk dagen in totaal.

Zo ja, in welke ziekenhuizen?

Opname 1

Ziekenhuis: _____

Plaats: _____

Opname 2

Ziekenhuis: _____

Plaats: _____

Opname 3

Ziekenhuis: _____

Plaats: _____

Opname 4

Ziekenhuis: _____

Plaats: _____

Opname 5

Ziekenhuis: _____

Plaats: _____

44 Hebt u de afgelopen 12 maanden voor uzelf de huisartsenpost bezocht of een visite van een huisarts gehad in avond, nacht of weekend?

Nee

Ja, namelijk keer in totaal.

45 Hebt u thuiszorg? Bijvoorbeeld wijkverpleging, gezinsverzorging of alfahulp.

Nee

Ja, namelijk uur per week.

46 Bent u de afgelopen 12 maanden tijdelijk opgenomen geweest in een verzorgingshuis? Bijvoorbeeld omdat u na een ziekenhuisopname nog niet direct naar huis kon.

Nee

Ja, namelijk weken in totaal.

47 Bent u de afgelopen 12 maanden tijdelijk opgenomen geweest in een verpleeghuis?
Bijvoorbeeld omdat u na een ziekenhuisopname nog niet direct naar huis kon.

Nee

Ja, namelijk weken in totaal.

48 Gaat u naar dagopvang?

Nee

Ja, namelijk dagen per week.

49 Gaat u naar dagbehandeling?

Nee

Ja, namelijk dagen per week.

Afsluiting

50 Heeft iemand u geholpen bij het invullen van deze vragenlijst?

Nee, ik heb de lijst alleen ingevuld.

Ja, iemand heeft mij geholpen met het invullen van de lijst.

51 Zo ja, waaruit bestond de hulp?

Iemand anders heeft de antwoorden genoteerd; ik heb de antwoorden zelf gekozen.

Ik heb de antwoorden samen met iemand gekozen en genoteerd.

Iemand heeft de antwoorden voor mij gekozen en genoteerd.

Hebt u nog opmerkingen, schrijf ze dan hieronder op:

Dit is het einde van de vragenlijst. Wij danken u hartelijk voor het invullen!!!

Appendix 2: Descriptives formal care dependency and formal care use

Table 5

Measures and descriptives for independent variable formal care dependency

	Yes (1)	No (0)
Do you have homecare?	31.2	68.8
Have you been admitted temporarily to a nursing home in the last 12 months?	2.1	97.9
Have you been admitted temporarily to a home for the aged in the last 12 months?	3.3	96.7
Do you visit a daycare center (dagopvang)?	3.2	96.8
Do you visit a daycare center (dagbehandeling)?	1.4	98.6
Have you been admitted to a hospital in the past 12 months?	25.2	74.8
Did you visit the GP or did the GP visit you over the last 12 months?	23.9	76.1
What is your living arrangement? (1 - Nursing home or home for the aged, 0 - Other, independent)	10.3	89.7

Table 6

Measures and descriptives from variables for independent variable formal care use

	N	M	SD	Min	Max
Number of hours of homecare per week: ...	12610	4.58	7.35	0	168
Number of weeks in nursing home: ...	42093	.169	1.95	0	52
Number of weeks in the home for the aged: ...	42093	.49	4.51	0	52
Number of days per week at daycare center: ...	42093	.07	.479	0	7
Number of days per week in daycare center: ...	42093	.02	.253	0	7
Number of days in total in hospital in the past 12 months: ...	42093	2.02	8.07	0	365
Number of GP visits or GP home visits: ...	42093	.48	1.847	0	82
What is your living arrangement? (1 - Nursing home or home for the aged, 0 - Other, independent)	42093	.10	.304	0	1

Appendix 3a: Assumption-check and data inspection

Hypothesis 1 and 2 (same variables)

Prior to performing the regression analyses, the assumptions were checked. A small number of (multivariate) outliers was found, but ignored given their small impact (Cook's Distance > .001). Inspection of the standardized residual plots indicated that the assumptions of linearity and homoscedasticity were met, whereas a right skewed distribution violated the assumption of normality. However, no further measures have been taken regarding this issue as dichotomizing would result in losing quantity and quality of data, and transforming the variable did not seem to improve the normality. Finally, relatively high tolerances for the predictors indicated that multicollinearity would not interfere with our ability to interpret the outcomes (Field, 2018).

Hypothesis 3

Before conducting the analyses, assumptions were checked. Outliers were found and deleted for homecare (7), weeks in NH (8), and daycare center visits (5). Inspection of the standardized residual plots indicated that assumptions of normality, linearity and homoscedasticity of residuals were met. Again, a small number of (multivariate) outliers was found, and ignored given their small impact (Cook's Distance > .001). Furthermore, relatively high tolerances indicated that there were no concerns for multicollinearity between the variables. Altogether, those findings indicate that assumptions have been met to conduct regression analysis.

Furthermore, pearson inter-correlations (r) were analyzed to become familiar with the data. As can be derived from Table 7, positive correlations were found between care needs and formal care facilities. Such correlations confirmed the expectations that higher care needs are correlated to more usage of those facilities. The strongest correlations were found between care needs and living arrangement ($r = .404^{**}$), homecare ($r = .247^{**}$) and daycare center visits ($r = .209^{**}$). Opposite thereto, the weakest correlation was found between care needs and GP visits ($r = .040^{**}$). Furthermore, negative correlations were found between being partnered and using multiple specific care facilities such living in a nursing home or home for the aged ($r = -.202^{**}$). As expected, correlation is lacking between being partnered and Hospital admission ($r = -.001$) and GP visits ($r = .002$). Against expectations, interestingly, a small positive correlation was found between relationship status and daycare treatment visits ($r = .011^*$)

Appendix 3b: Inter-correlations for moderation

Table 7

Pearson correlations for independent, dependent and moderator variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Relationship status	1	-.210**	.152**	-.202**	-.006	-.036**	-.073**	-.035**	.011*	-.001	.002
2. Care needs	-.210**	1	-.372**	.404**	.247**	.127**	.147**	.209**	.101**	.135**	.050**
3. Health	.152**	-.372**	1	-.155**	-.066**	-.044**	-.065**	-.090**	-.032**	-.085**	-.096**
4. Living in NH/HA	-.202**	.404**	-.155**	1	.032**	.114**	.248**	.051**	.005	.041**	-.022**
5. Homecare	-.006	.247**	-.066**	.032**	1	.047**	.033**	.082**	.029**	.060**	.036**
6. Weeks in NH	-.036**	.127**	-.044**	.114**	.047**	1	.043**	.021**	.030**	.146**	.009
7. Weeks in HA	-.073**	.147**	-.065**	.248**	.033**	.043**	1	.032**	-.004	.036**	-.002
8. DCC visits	-.035**	.209**	-.090**	.051**	.082**	.021**	.032**	1	.064**	.020**	.030**
9. DCTC visits	.011*	.101**	-.032**	.005	.029**	.030**	-.004	.064**	1	.049**	.042**
10. Days in hospital	-.001	.135**	-.085**	.041**	.060**	.146**	.036**	.020**	.049**	1	.087**
11. GP visits	.002	.040**	-.096**	-.022	.036**	.009	-.002	.030**	.042**	.087**	1

* p< .05 ** p< .001

Appendix 4: Steps for mediation analyses

Path c: Single linear regression showed that relationship status predicts formal care dependency, $R^2 = .018$, $F(1, 25266) = 455.44$, $p < .001$.

Table 8

Path c with Formal care dependency as dependent variable

Variable	B	95% CI	β	t	p
Relationship status	-.267	[-.291, .242]	-.133	-21.34	.000

Path a: A single linear regression showed that, when controlled for mental health and quality of life, being partnered accounted for an additional compliance of the variance for physical health ($\Delta R^2 = .009$, $\Delta F(1, 30014) = 312.98$, $p < .001$) Being partnered also predicted mental health ($\Delta R^2 = .000$, $\Delta F(1, 30014) = 10.915$, $p = .001$) and quality of life ($\Delta R^2 = .005$, $\Delta F(1, 30014) = 208.38$, $p < .001$) when controlled for the two other mediator variables.

Table 9

Path a with Relationship status as Predictor, when controlled for the other mediator variables

Variable	B	95% CI	β	t	p
Physical health	.365	[.325, .405]	.097	17.691	.000
Mental health	.171	[.070, .273]	.017	3.304	.001
Quality of life	.207	[.179, .235]	.072	14.435	.000

Path b: A multiple linear regression showed that higher scores on physical health, mental health and quality of life predicted lower formal care dependency ($R^2 = .083$, $F(3, 20104) = 604.52$, $p < .001$). Values for those three predictors are presented in Table 10.

Table 10

Path b with Formal care dependency as dependent variable

Predictor	B	95% CI	β	t	p
Physical health	-.109	[-.116, -.101]	-.202	-28.327	.000
Mental health	-.009	[-.012, -.006]	-.045	-5.765	.005
Quality of life	-.088	[-.099, -.066]	-.125	-15.948	.000

Appendix 5: Syntax main analyses

Syntax for hypothesis 1

DATASET ACTIVATE DataSet1.

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) BCOV R ANOVA COLLIN TOL CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Formal_care_dependency_7_1
/METHOD=ENTER Age_adj Gender Education_3 Household_composition_biv
/METHOD=ENTER Partnered
/SCATTERPLOT=(*ZRESID ,*ZPRED)
/RESIDUALS DURBIN HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

Matrix procedure for hypothesis 2

Run MATRIX procedure:

***** PROCESS Procedure for SPSS Version 3.00 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2018). www.guilford.com/p/hayes3

Model : 4

```
Y : Formal_c
X : Partnere
M1 : Physical
M2 : Mental_h
M3 : Quality_
```

Covariates:

```
Age_adj Gender Educatio Househol
```

Sample

Size: 18083

OUTCOME VARIABLE:

Physical

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1942	,0377	3,3854	141,7093	5,0000	18077,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	17,1026	,1719	99,4802	,0000	16,7656	17,4396
Partnere	,1808	,0306	5,9117	,0000	,1208	,2407
Age_adj	-,0332	,0020	-16,3595	,0000	-,0372	-,0292
Gender	-,1793	,0303	-5,9168	,0000	-,2386	-,1199
Educatio	,1098	,0170	6,4544	,0000	,0765	,1431
Househol	-,3036	,0521	-5,8247	,0000	-,4058	-,2014

Covariance matrix of regression parameter estimates:

	constant	Partnere	Age_adj	Gender	Educatio	Househol
constant	,0296	-,0019	-,0003	-,0008	-,0008	,0014
Partnere	-,0019	,0009	,0000	,0003	,0000	,0001
Age_adj	-,0003	,0000	,0000	,0000	,0000	,0000
Gender	-,0008	,0003	,0000	,0009	,0000	,0000
Educatio	-,0008	,0000	,0000	,0000	,0003	,0001
Househol	,0014	,0001	,0000	,0000	,0001	,0027

OUTCOME VARIABLE:

Mental_h

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1472	,0217	25,1100	80,0421	5,0000	18077,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	17,4542	,4682	37,2780	,0000	16,5364	18,3719
Partnere	,6810	,0833	8,1779	,0000	,5178	,8442
Age_adj	,0414	,0055	7,4947	,0000	,0306	,0523
Gender	-,9758	,0825	-11,8265	,0000	-1,1376	-,8141
Educatio	,2076	,0463	4,4817	,0000	,1168	,2985
Househol	-,8466	,1420	-5,9639	,0000	-1,1248	-,5683

Covariance matrix of regression parameter estimates:

	constant	Partnere	Age_adj	Gender	Educatio	Househol
constant	,2192	-,0140	-,0025	-,0062	-,0059	,0103
Partnere	-,0140	,0069	,0001	,0023	-,0001	,0010

Age_adj	-,0025	,0001	,0000	,0000	,0000	-,0002
Gender	-,0062	,0023	,0000	,0068	,0003	-,0001
Educatio	-,0059	-,0001	,0000	,0003	,0021	,0004
Househol	,0103	,0010	-,0002	-,0001	,0004	,0201

OUTCOME VARIABLE:

Quality_

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1566	,0245	1,9635	90,9449	5,0000	18077,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	6,6234	,1309	50,5868	,0000	6,3667	6,8800
Partnere	,2320	,0233	9,9625	,0000	,1863	,2776
Age_adj	-,0050	,0015	-3,2313	,0012	-,0080	-,0020
Gender	-,0478	,0231	-2,0716	,0383	-,0930	-,0026
Educatio	,0950	,0130	7,3318	,0000	,0696	,1204
Househol	-,4184	,0397	-10,5408	,0000	-,4962	-,3406

Covariance matrix of regression parameter estimates:

	constant	Partnere	Age_adj	Gender	Educatio	Househol
constant	,0171	-,0011	-,0002	-,0005	-,0005	,0008
Partnere	-,0011	,0005	,0000	,0002	,0000	,0001
Age_adj	-,0002	,0000	,0000	,0000	,0000	,0000
Gender	-,0005	,0002	,0000	,0005	,0000	,0000
Educatio	-,0005	,0000	,0000	,0000	,0002	,0000
Househol	,0008	,0001	,0000	,0000	,0000	,0016

OUTCOME VARIABLE:

Formal_c

Model Summary

R	R-sq	MSE	F	df1	df2	p
,3105	,0964	,9203	240,9818	8,0000	18074,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,8329	,1127	25,1268	,0000	2,6119	3,0539
Partnere	-,1790	,0160	-11,1874	,0000	-,2103	-,1476
Physical	-,1006	,0041	-24,7765	,0000	-,1086	-,0927
Mental_h	-,0097	,0016	-5,9918	,0000	-,0129	-,0066
Quality_	-,0832	,0059	-14,1767	,0000	-,0947	-,0717

Age_adj	,0080	,0011	7,5136	,0000	,0059	,0101
Gender	-,0399	,0159	-2,5142	,0119	-,0710	-,0088
Educatio	-,0313	,0089	-3,5197	,0004	-,0487	-,0139
Househol	-,1177	,0273	-4,3149	,0000	-,1711	-,0642

Covariance matrix of regression parameter estimates:

	constant	Partnere	Physical	Mental_h	Quality_	Age_adj	Gender	Educatio	
Househol									
constant	,0127	-,0004	-,0002	,0000	-,0001	-,0001	-,0003	-,0002	,0003
Partnere	-,0004	,0003	,0000	,0000	,0000	,0000	,0001	,0000	,0000
Physical	-,0002	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
Mental_h	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
Quality_	-,0001	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
Age_adj	-,0001	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
Gender	-,0003	,0001	,0000	,0000	,0000	,0000	,0003	,0000	,0000
Educatio	-,0002	,0000	,0000	,0000	,0000	,0000	,0000	,0001	,0000
Househol	,0003	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0007

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

Formal_c

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1616	,0261	,9917	96,9848	5,0000	18077,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,3905	,0931	4,1972	,0000	,2082	,5729
Partnere	-,2231	,0165	-13,4802	,0000	-,2555	-,1906
Age_adj	,0114	,0011	10,3752	,0000	,0092	,0136
Gender	-,0084	,0164	-,5106	,6097	-,0405	,0238
Educatio	-,0523	,0092	-5,6758	,0000	-,0703	-,0342
Househol	-,0440	,0282	-1,5614	,1185	-,0993	,0112

Covariance matrix of regression parameter estimates:

	constant	Partnere	Age_adj	Gender	Educatio	Househol
constant	,0087	-,0006	-,0001	-,0002	-,0002	,0004
Partnere	-,0006	,0003	,0000	,0001	,0000	,0000
Age_adj	-,0001	,0000	,0000	,0000	,0000	,0000
Gender	-,0002	,0001	,0000	,0003	,0000	,0000
Educatio	-,0002	,0000	,0000	,0000	,0001	,0000
Househol	,0004	,0000	,0000	,0000	,0000	,0008

***** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y *****

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps
-.2231	,0165	-13,4802	,0000	-,2555	-,1906	-,2211

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c'_ps
-,1790	,0160	-11,1874	,0000	-,2103	-,1476	-,1774

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
TOTAL	-,0441	,0046	-,0534	-,0351
Physical	-,0182	,0032	-,0245	-,0119
Mental_h	-,0066	,0014	-,0095	-,0041
Quality_	-,0193	,0024	-,0241	-,0148
(C1)	-,0116	,0033	-,0181	-,0049
(C2)	,0011	,0036	-,0062	,0082
(C3)	,0127	,0027	,0075	,0180

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
TOTAL	-,0437	,0046	-,0528	-,0349
Physical	-,0180	,0031	-,0243	-,0118
Mental_h	-,0066	,0014	-,0094	-,0041
Quality_	-,0191	,0024	-,0239	-,0147
(C1)	-,0115	,0033	-,0180	-,0049
(C2)	,0011	,0036	-,0061	,0081
(C3)	,0125	,0027	,0074	,0178

Specific indirect effect contrast definition(s):

- (C1) Physical minus Mental_h
- (C2) Physical minus Quality_
- (C3) Mental_h minus Quality_

***** ANALYSIS NOTES AND ERRORS *****

Level of confidence for all confidence intervals in output:

95,0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

NOTE: Variables names longer than eight characters can produce incorrect output.

Shorter variable names are recommended.

----- END MATRIX -----

Syntax for hypotheses 3a to 3h

DATASET ACTIVATE DataSet1.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) BCOV R ANOVA CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT Household_composition_biv

/METHOD=ENTER Age_adj Gender Education_3 Health_new

/METHOD=ENTER Partnered KATZ_Needs15

/METHOD=ENTER Moderator

/RESIDUALS DURBIN.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) BCOV R ANOVA CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT Hours_Homecare_rec

/METHOD=ENTER Age_adj Gender Education_3 Health_new

/METHOD=ENTER Partnered KATZ_Needs15

/METHOD=ENTER Moderator

/RESIDUALS DURBIN.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) BCOV R ANOVA CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT Nursing_home_weeks_rec

/METHOD=ENTER Age_adj Gender Education_3 Health_new

/METHOD=ENTER Partnered KATZ_Needs15

/METHOD=ENTER Moderator

/RESIDUALS DURBIN.

REGRESSION

/DESCRIPTIVES MEAN STDDEV CORR SIG N

/MISSING LISTWISE

/STATISTICS COEFF OUTS R ANOVA CHANGE

```
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Nursing_home_weeks_rec
/METHOD=ENTER Age_adj Gender Education_3 Health_new
/METHOD=ENTER Partnered KATZ_Needs15
/METHOD=ENTER Moderator
/RESIDUALS DURBIN.
```

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT T0_C_HA_WEEKS
/METHOD=ENTER Age_adj Gender Education_3 Health_new
/METHOD=ENTER Partnered KATZ_Needs15
/METHOD=ENTER Moderator
/RESIDUALS DURBIN.
```

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Daycare_centre_rec
/METHOD=ENTER Age_adj Gender Education_3 Health_new
/METHOD=ENTER Partnered KATZ_Needs15
/METHOD=ENTER Moderator
/RESIDUALS DURBIN.
```

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT T0_C_OT_DAYS
/METHOD=ENTER Age_adj Gender Education_3 Health_new
```

```
/METHOD=ENTER Partnered KATZ_Needs15  
/METHOD=ENTER Moderator  
/RESIDUALS DURBIN.
```

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N  
/MISSING LISTWISE  
/STATISTICS COEFF OUTS R ANOVA CHANGE  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT T0_C_HOSPDAYS  
/METHOD=ENTER Age_adj Gender Education_3 Health_new  
/METHOD=ENTER Partnered KATZ_Needs15  
/METHOD=ENTER Moderator  
/RESIDUALS DURBIN.
```

REGRESSION

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N  
/MISSING LISTWISE  
/STATISTICS COEFF OUTS R ANOVA CHANGE  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT T0_C_GP_DAYS  
/METHOD=ENTER Age_adj Gender Education_3 Health_new  
/METHOD=ENTER Partnered KATZ_Needs15  
/METHOD=ENTER Moderator  
/RESIDUALS DURBIN.
```

Stratified analyses

```
DATASET ACTIVATE DataSet1.  
USE ALL.  
COMPUTE filter_$=(Partnered = 1).  
VARIABLE LABELS filter_$ 'Partnered = 1 (FILTER)'.  
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.  
FORMATS filter_$ (f1.0).  
FILTER BY filter_$.  
EXECUTE.
```

```
USE ALL.
```

```
COMPUTE filter_$=(Partnered = 0).  
VARIABLE LABELS filter_$ 'Partnered = 0 (FILTER)'.  
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.  
FORMATS filter_$ (f1.0).  
FILTER BY filter_$.  
EXECUTE.
```

After case selection, regression analyses were conducted as presented above (See '*Syntax for hypotheses 3a to 3h*').