

ARTICLE

Childlessness and social and emotional loneliness in middle and later life

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Abstract

Despite theoretical accounts asserting the importance of children for the wellbeing of individuals as they age, research evidence suggests that children may be inconsequential when it comes to loneliness. Yet, there is reason to expect some subgroups may be more vulnerable to the impact of childlessness than others and this may also differ depending on the type of loneliness being assessed. This paper addresses the relationship between childlessness and social and emotional loneliness in middle and later life, including differential vulnerability associated with age, gender and marital/partner status. The study drew on data from three waves (2007, 2012 and 2018) of the Canadian General Social Survey for a nationally representative sample of adults aged 45 and older (N = 49,892). In general, childlessness assumed greater importance with regard to social than emotional loneliness. Women reported lower levels of social loneliness in conjunction with childlessness than men. Further, childlessness was associated with higher levels of overall and social loneliness among older than middle-aged adults. Fewer interactions were evident between marital/partner status and childlessness. Among women specifically, those who were cohabiting, separated/divorced or never married reported lower levels of social loneliness than their married counterparts. In contrast, childlessness was linked to greater emotional loneliness only among separated/divorced men and widowed women. Overall, our results suggest that having children available does matter for feelings of loneliness in middle and later life but that the relationship varies and is contingent on the social contexts (age, gender, marital/partner status) and the type of loneliness (social, emotional) involved.

Keywords: childlessness; emotional loneliness; loneliness; middle-aged adults; social loneliness

Introduction

In recent decades, there has been a marked increase in the number of individuals and couples experiencing childlessness, whether by choice or a consequence of factors such as delayed partnership, infertility or divorce.¹ Although the majority of

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older adults today belong to cohorts in which childlessness rates are quite low (Lin and Brown, 2012; Ravanera and Beaujot, 2014), subsequent cohorts have seen significant increases in rates in a number of countries, including Canada, the United States of America and many parts of Europe (Rowland, 2007; Ravanera and Beaujot, 2014; Kreyenfeld and Konietzka, 2017). As a result, the proportion of older adults in the population without children will increase significantly in coming years, as baby boomers and their children age (Carrière *et al.*, 2008; Lin and Brown, 2012).

Together, increases in the prevalence of childlessness and the ageing of the population have generated research into the link between childlessness and the mental health and wellbeing of middle-aged and older adults (e.g. Zhang and Hayward, 2001; Bures *et al.*, 2009; Hansen *et al.*, 2009; Umberson *et al.*, 2010; Gibney *et al.*, 2017). This includes a focus on its implications for feelings of loneliness (e.g. Koropecjy-Cox *et al.*, 2007; Hansen *et al.*, 2009; van den Broek *et al.*, 2019). Children are widely theorised as being critically and increasingly important as sources of social support and care (instrumental, emotional) as people age (Bengtson *et al.*, 2000). Consequently, there is concern that increasing rates of childlessness will result in deficits in older adults' support networks (Wenger *et al.*, 2007; Heylen, 2010; Penning and Wu, 2014; Zoutewelle-Terovan and Liefbroer, 2018), with negative implications for feelings of loneliness and other aspects of mental health and wellbeing among older adults (Křenková, 2018).

Yet, research addressing the implications of childlessness for loneliness remains limited and the findings contradictory. Some have found childless older adults to be at greater risk of loneliness than those with children (Iecovich *et al.*, 2004; van den Broek *et al.*, 2019). Others report no differences (e.g. Zhang and Hayward, 2001; Hansen *et al.*, 2009; Hank and Wagner, 2013). However, differences in the dimensions of loneliness appear important to consider. Although often considered unidimensional, loneliness has also been conceptualised as multi-dimensional, with both emotional and social components (Weiss, 1973). There are also reasons to expect that the implications of childlessness may differ depending on contextual factors, including age, gender and marital/partner status (Umberson *et al.*, 2010). This raises the possibility that some subgroups may be more vulnerable to the impact of childlessness than others and that this may differ depending on the type of loneliness being assessed. Research has yet to address this issue. The objective of this study is therefore to assess the implications of childlessness, including contextual differences defined by age, gender and marital/partner status, for reports of loneliness (overall, emotional, social) in middle and later life. Understanding these implications is increasingly important given ongoing changes in family structures and relationships.

Background

Theories of intergenerational relationships continue to inform us of the importance of family ties and, especially, of relationships with children, as major sources of support and assistance that are critical to health and wellbeing throughout the life-course and, particularly, in later life. From an intergenerational solidarity perspective, for example, parent-child relationships are viewed as major sources of affective

and other forms of solidarity that are associated with the provision of support considered central to individual social and psychological wellbeing (Bengtson *et al.*, 2000). Similarly, a convoy model asserts that individuals move through life surrounded by a dynamic personal convoy or network of social relationships with whom they are emotionally close and exchange social support (Antonucci *et al.*, 2011, 2014). Thus, the convoy serves as a protective base, enhancing mental health and wellbeing. Parent–child relationships are considered to be among the most important components of the convoy. Although convoys are said to be relatively stable over the lifecourse, as people age the size of the convoy may decline through losses of social ties through death, illness and disability. Consequently, proponents of the model have noted that in later life exchanges of support tend to become increasingly family-focused and intergenerational in composition (Antonucci *et al.*, 2011).

A frequent corollary of the view that adult children assume considerable and increasing importance for the support networks and wellbeing of older adults is that childlessness can be conceptualised as a deficit. Childless older adults are often considered disadvantaged and at risk of negative outcomes, including social isolation and feelings of loneliness (Koropecj-Cox and Call, 2007; Dykstra and Hagestad, 2007a, 2007b). Increasingly, however, such assumptions are being challenged by feminist and other arguments that they ignore non-kin networks, focus on the quantity rather than quality of ties, and reflect outdated normative and pro-natalist views regarding the primacy of the nuclear family while ignoring contemporary changes in social norms governing the acceptability and desirability of childlessness and other diverse family arrangements (Koropecj-Cox *et al.*, 2007; Bures *et al.*, 2009; Kreyenfeld and Konietzka, 2017; Lynch *et al.*, 2018).

For its part, empirical research has also challenged such assumptions, particularly with respect to subjective assessments of wellbeing such as feelings of loneliness. Despite some contradictory findings (Iecovich *et al.*, 2004; van Tilburg *et al.*, 2004; Vozikaki *et al.*, 2018; Zoutewelle-Terovan and Liefbroer, 2018), studies comparing childless adults with parents often find limited evidence of reduced subjective wellbeing, including feelings of loneliness (Zhang and Hayward, 2001; Kendig *et al.*, 2007; Koropecj-Cox *et al.*, 2007; Bures *et al.*, 2009; Hansen *et al.*, 2009; Vikström *et al.*, 2011). This has led some researchers to posit that childlessness may now be inconsequential and entail few deficits for feelings of loneliness or other aspects of subjective wellbeing in later life (Koropecj-Cox *et al.*, 2007; Hansen *et al.*, 2009).

However, conclusions regarding the implications of childlessness for loneliness may be premature. For the most part, research has relied on single-item and uni-dimensional measures when studying loneliness (Hyland *et al.*, 2019). Yet, it has been argued there is more than one type of loneliness, introducing the possibility that childlessness may have a greater impact on some types of loneliness than others. One of the most widely cited multi-dimensional definitions was first proposed by Weiss (1973: 17), who conceptualised loneliness as perceived social isolation that results from ‘being without some definite needed relationship or set of relationships’, whether it be a close intimate relationship (*e.g.* a spouse/partner or close friend) or a broader set of social relationships (*e.g.* with acquaintances or others in the community). Weiss subsequently drew a distinction between

emotional loneliness – a condition resulting from the loss or absence of close or intimate emotional attachments – and social loneliness – a condition arising from the loss or absence of a broader, engaging or supportive social network.

Given this distinction, it may be that childlessness is differentially associated with feelings of emotional and social loneliness. For example, some research evidence suggests that older adults are more likely to rely on children and others in their kin network for instrumental support and assistance, relying more heavily on friends, spouses/partners and other non-kin for emotional support (Chen and Feeley, 2014). If this is the case, having children available may be less important when it comes to emotional rather than social loneliness. However, studies addressing the importance of children for social and/or emotional loneliness in middle and/or later life are few in number and the findings inconclusive. Researchers in Belgium report finding that parenthood is associated with lower levels of social loneliness among middle-aged and older adults, at least at the bivariate level (Heylen, 2010). Similarly, a study of older day centre attendees in Northern Ireland reports finding that older adults living with adult children have the lowest levels of social loneliness. However, they also report the highest levels of emotional loneliness (Hagan *et al.*, 2020). These researchers conclude that although co-residence with adult children may help meet social needs and needs for practical assistance, it cannot resolve the issue of emotional loneliness. Finally, research conducted in the Netherlands reports evidence of a significant relationship between parenthood and both social and emotional loneliness, but only among women (Dykstra and de Jong Gierveld, 2004).

Age, gender and marital status differences in childlessness and loneliness

The implications of childlessness for social and emotional loneliness may also differ in conjunction with contextual factors, with some subgroups being more vulnerable to the impact of childlessness than others (Dykstra and Hagestad, 2007a, 2007b; Dykstra, 2009; Umberson *et al.*, 2010). Age, gender and marital/partner status are among the main contextual factors that may shape experiences with parenthood and childlessness (Antonucci *et al.*, 2007; Umberson *et al.*, 2010). Each has also been linked to feelings of loneliness.

Although some evidence suggests little or no association or a curvilinear U-shaped association with age (Pinquart and Sörensen, 2001; Jylhä, 2004), loneliness is often reported to be more common among older than middle-aged adults (Routasalo and Pitkala, 2003; Hawkey *et al.*, 2019) and as increasing with age among older adults (Victor and Yang, 2012; Hansen and Slagsvold, 2016; Luhmann and Hawkey, 2016; Hawkey and Kocherginsky, 2018; von Soest *et al.*, 2018). It has also been suggested that childlessness may have more negative implications for older age groups since they often have greater needs for support from children (Hansen *et al.*, 2009) and belong to cohorts that adhere more strongly to pronatalist norms and are less accepting of childlessness (Dykstra and Hagestad, 2007a, 2007b). Although some have noted that the implications of childlessness may also be problematic in midlife, particularly if childlessness is involuntary (Hansen *et al.*, 2009), prior research has found no relationship between childlessness and loneliness within this age group, particularly when marital/

partner status and other factors are controlled for (Koropeckyj-Cox *et al.*, 2007; Dykstra and Keizer, 2009). Further, one study that directly assessed differential vulnerability by age among adults aged 40–80 in Norway found no evidence that age modified associations between parenthood and overall feelings of loneliness (Hansen *et al.*, 2009).

Research on age-related differences in social and emotional loneliness is limited, tends to focus on older age groups in Europe and the findings are contradictory (Heylen, 2010; Dahlberg and McKee, 2014; Fierloos *et al.*, 2021; Wolfers *et al.*, 2022). As well, whether and how age influences relationships between childlessness and social *versus* emotional loneliness is unclear. However, if having children available is more important to social than emotional loneliness, it might well be that with advancing age, people become more vulnerable to the implications of childlessness for feelings of social rather than emotional loneliness. Research has yet to address this issue.

When it comes to gender, loneliness has also been reported as being more common among older women than men (Dykstra *et al.*, 2005; Aartsen and Jylhä, 2011; Dahlberg *et al.*, 2015; van den Broek *et al.*, 2019), although others report the reverse (Dykstra and Fokkema, 2007; Vikström *et al.*, 2011) or find no difference (Maes *et al.*, 2019). As well, childlessness is often considered a greater source of vulnerability for women than men given women's greater investment in familial relationships and the socially constructed importance attributed to motherhood (Wenger *et al.*, 2007). However, others have reported that women, including childless women, tend to have more and better quality relationships with others, particularly friends, than do men, and these relationships protect them from loneliness (Dykstra and Hagestad, 2007b; Heylen, 2010). Thus, it is older men who are often said to be more vulnerable than older women, particularly if they are not currently married (Zhang and Hayward, 2001; Dykstra and de Jong Gierveld, 2004; Dykstra and Hagestad, 2007b). This reflects the fact that men tend to have smaller support networks, often relying on women, particularly their spouses/partners, to establish and maintain social network ties (Zhang and Hayward, 2001). For its part, the few studies that directly address gender differences in the implications of childlessness for loneliness provide little evidence of differential vulnerability (Koropeckyj-Cox, 1998; Hansen *et al.*, 2009). Thus, Koropeckyj-Cox (1998: S308) concludes that 'childlessness does not represent a statistically significant, universal disadvantage in terms of greater loneliness ... for either men or women, net of other factors'.

Once again, however, one might expect gender differences in the impact of childlessness to be more evident when social and emotional loneliness are examined separately. Research suggests that whereas middle-aged and older men in general tend to report higher levels of social loneliness, women often report similar or higher levels of emotional loneliness (Dykstra and Fokkema, 2007; Heylen, 2010; Dahlberg and McKee, 2014; Fierloos *et al.*, 2021; Wolfers *et al.*, 2022). If, as suggested, older men's social networks tend to be more constricted than those of women, the absence of children from their already more limited networks may well be associated with higher levels of social loneliness. On the other hand, to the extent that older men rely primarily on a spouse/partner for emotional support, childlessness may well be less consequential for their feelings of emotional

loneliness, at least when a spouse/partner is available (Dykstra and de Jong Gierveld, 2004). The opposite may be the case for older women, for whom adult children have also been said to represent an important source of emotional support (de Jong Gierveld *et al.*, 2006). On the other hand, given women's generally broader and more extensive social networks, the importance of having children available to provide such support may well be reduced. To date, empirical evidence remains limited. Dykstra and de Jong Gierveld (2004) report findings suggesting that parenthood is, in fact, significantly related to both social and emotional loneliness, but only among older women. In their study, childless women were found to be less socially and emotionally lonely than those with children (particularly those who did not interact frequently with their children) once marital status, social embeddedness and other factors were taken into account.

Finally, research focusing on marital/partner status also provides some evidence that loneliness tends to be greater among those without a spouse/partner (Dykstra *et al.*, 2005; Aartsen and Jylhä, 2011; Dahlberg and McKee, 2014; Dahlberg *et al.*, 2015) and that the presence or absence of an intimate relationship appears especially important among older men (Dykstra and de Jong Gierveld, 2004; Wright and Brown, 2017). However, research that addresses the implications of childlessness for loneliness often reveals no relationship regardless of marital/partner status (Koropeckyj-Cox *et al.*, 2007; Hansen *et al.*, 2009). According to Zhang and Hayward (2001), this may reflect the fact that any effects of childlessness on wellbeing are apparent only within the joint context of marital status and gender. Supporting this view, they found childlessness was associated with higher rates of loneliness, but only among unmarried (divorced, widowed, never married) men. They and others attribute such findings to the more general inadequacy of the support networks (beyond the spouse and children) that are often available to men, particularly those without a spouse/partner. In contrast, childless women, including those who are unmarried/unpartnered, are often found to have larger and more diversified support networks, thereby potentially mitigating feelings of loneliness (Dykstra and Hagestad, 2007b; Wenger *et al.*, 2007; Maes *et al.*, 2019).

Once again, however, it may be important to distinguish between social and emotional loneliness. There is a lack of research into whether the implications of childlessness for feelings of social and emotional loneliness differ across marital/partner status groups. However, to the extent that children are more relevant to social than emotional loneliness, it would seem likely that unmarried childless men will be more vulnerable to feelings of social rather than emotional loneliness. For older women, the implications of intersections involving union status and parenthood are somewhat less clear. Findings indicating that childless women, whether married or not, tend to have larger and more diversified support networks, including confidantes, suggest that there may be little difference in either social or emotional loneliness (Dykstra and Hagestad, 2007b; Wenger *et al.*, 2007). However, there are also indications that widowed women may be uniquely vulnerable to the presence or absence of children, *e.g.* it has been suggested that childless spouses tend to rely primarily on one another for support and, consequently, when the partner dies, widowed women also experience a social and emotional void (Dykstra, 2009).

The current study

Theoretical and empirical ambiguity regarding the relationship between childlessness and loneliness points to a need for further attention to this relationship. Here, we consider the importance of three main contextual factors (age, gender, marital/partner status) in shaping the impact of childlessness on different types of loneliness (overall, emotional, social), thereby resulting in differential vulnerability to the different types of loneliness. We address three main research questions:

- (1) Is there a relationship between childlessness and feelings of loneliness among middle-aged and older adults?
- (2) To what extent does the relationship between childlessness and feelings of loneliness vary depending on the type of loneliness involved?
- (3) Finally, does the relationship between childlessness and feelings of loneliness vary depending on differences in age, gender and marital/partner status?

Methods

Data and sample

This study pooled data from the 2007, 2012 and 2018 General Social Surveys (GSS-21, 26, 32) conducted by Statistics Canada (2019). The GSS programme is an annual, cross-sectional survey that collects individual- and household-level data on social trends, monitors the living conditions and wellbeing of Canadians, and provides information relevant to selected policy issues. Each cycle has a particular thematic focus – Cycle 21 focused on family, social support and retirement; Cycles 26 and 32 focused on care-giving and care receiving. The target population of the 2007 survey included persons aged 45 and older whereas the 2012 and 2018 surveys included Canadians aged 15 years and older residing in private households in the ten Canadian provinces. Residents of institutions and those living in the northern territories were excluded. In the current study, the three years of GSS data (all with similar sampling strategies and measures) were combined to increase the sample size and improve the reliability of the regression estimates. The advantages of pooling these surveys therefore included reductions in sampling, coverage and measurement errors (Schenker and Raghunathan, 2007).

Data were collected through computer-assisted telephone interviews (2007, 2012) or both telephone interviews and self-completed online questionnaires (2018). Respondents were interviewed in English or French (Canada's two official languages). When respondents did not speak either official language or were unable to participate in the survey because of an age-related health condition, proxies were used (for further information on methodology, see Statistics Canada, 2019). The overall response rates for the three surveys ranged from 52.8 (2018) to 65.7 (2012) per cent. Since our focus was on adults in middle and later life, we restricted our study sample to respondents aged 45 and older across the three datasets. We also removed cases with missing values on the dependent variables, including proxy respondents (since proxy responses were not allowed for questions on loneliness). With these restrictions, our final study sample included 49,892 respondents (21,977 for the 2007 GSS, 14,498 for the 2012 GSS and 13,417 for the 2018 GSS).

Measures

Loneliness was assessed using the six-item de Jong Gierveld–van Tilburg Loneliness Scale (de Jong Gierveld and van Tilburg, 2006), a shortened version of the widely used 11-item scale (de Jong Gierveld and Kamphuis, 1985). The scale has two inter-related dimensions: emotional loneliness (experiencing a general sense of emptiness, missing having people around, often feeling rejected) and social loneliness (not having many/enough people to rely on when one has problems, that one can trust or feel close to), but can also be used as a uni-dimensional scale. For each item, respondents were asked to indicate whether it described their feelings (yes, more or less, no). Originally developed and validated for use in the Netherlands (de Jong Gierveld and van Tilburg, 2006, 2010), the overall scale has been found to be reliable and valid (Dykstra and de Jong Gierveld, 2004), and appropriate for use with older adults in several countries, including Canada (van Tilburg *et al.*, 2004; Penning *et al.*, 2014). Translations of its shortened version, also originally validated for use in the Netherlands (de Jong Gierveld and van Tilburg, 2006), have also been tested among older adult populations in several other countries including France, Germany, Russia, Bulgaria, Georgia and Japan (de Jong Gierveld and van Tilburg, 2010). Here we employed both the overall measure and each of the two subscales, drawing on mean scores of the constituent items for each. Each scale ranged from a low of 1 to a high of 3. Higher mean scores correspond with higher levels of loneliness. Using the pooled data, we obtained reliability coefficients (Cronbach's alpha) of 0.714 for the overall scale, 0.581 for the emotional loneliness subscale and 0.766 for the social loneliness subscale. The two subscales were only moderately correlated with one another ($r = 0.31$; $p < 0.001$).

The core independent variables in our analyses were childlessness, age, gender and marital/partner status. Childlessness was defined as the respondent having no birth, step- or adopted children at the time of the survey. Those fitting these criteria were contrasted with those reporting having at least one birth, step- or adopted child (reference category). Gender was a dummy variable (women = 1, men = 0). Age was a categorical variable with four levels reflecting early and late middle and older age: 45–54 (reference category), 55–64, 65–74 and 75+. Although middle and older age are not clearly or consistently defined, those aged 45–64 are often considered to be middle-aged whereas those aged 65 and over are considered older (e.g. Dolberg and Ayalon, 2018). Distinctions are also frequently noted between early and late middle age (Fischer and Beresford, 2015) as well as early and late older age (Li *et al.*, 2013). Finally, marital/partner status was a five-level categorical variable: co-habiting, widowed, separated/divorced, never married and married (reference category).

Our analyses also controlled for a number of demographic, socio-economic and health variables previously found to be related to childlessness and/or to feelings of loneliness (e.g. Zhang and Hayward, 2001; Hansen *et al.*, 2009; Hawkey *et al.*, 2019). Immigrant status was a dummy variable, indicating whether the respondent was born outside Canada (yes = 1). Religion was a categorical variable with four levels: Catholic, Protestant, other and no religion (reference category). Region of residence was also a dummy variable, contrasting respondents who resided in the

French-speaking province of Quebec (yes = 1) to those residing in other regions of the country (reference category).

In terms of socio-economic factors, educational attainment was an ordinal variable, ranging from less than a high school education (1) to a university degree or higher (7). Employment status was a three-level categorical variable: employed (outside home), other (e.g. unemployed) and retired (reference category). Finally, household income contrasted respondents who did not report household incomes and those with low (<\$29,999 in 2012 Canadian dollars) and medium (\$30,000–\$99,999) household incomes to those with high (\$100,000+) household incomes (reference category).

Finally, we also included two health status indicators in the analyses. Self-rated health was coded on a five-point scale, ranging from poor (1) to excellent (5). Second, respondents were asked whether, during the past 12 months, they needed help or care for a long-term health condition, physical or mental disability, or problems related to ageing. Those who reported having a problem were then asked whether their condition was mild, moderate or severe. A three-level categorical variable contrasted those who reported having a mild/moderate (1) or severe (2) health condition to those reporting no conditions (reference category).

Analytic strategy

After examining the descriptive characteristics of those in the analytic sample among those with and without children, multivariate analyses were conducted using ordinary least squares (OLS) regression procedures. We began by regressing each of the three loneliness measures on gender, age group and marital/partner status, along with the control variables. We also included a control for survey year, contrasting 2007 and 2012 respondents to those who responded to the 2018 survey (reference category). Next, we added the three two-way interaction terms (*i.e.* gender $\times$ childless, age $\times$ childless, marital status $\times$ childless) to each of the models. Finally, we examined the impact of age $\times$ childless and marital status $\times$ childless interactions within categories of gender.

Missing data for most variables were minimal (under 2%) and were imputed (Little and Rubin, 2002). Since multiple imputation cannot adequately deal with the large share of missing household incomes (about 14% of respondents), we followed Statistics Canada's practice and treated missing family income as a separate category in the categorical household income variable (Hou, 2014). Finally, survey estimates were weighted to represent all persons in the target population. In both descriptive and regression analyses, the weights were standardised so that the sum of the standardised weights equalled the sample size within each survey year. To ensure each survey year contributed equally to the estimates, the standardised weights were further adjusted so the sum of the standardised weights was the same in each survey year and equalled the sample size of the smallest survey year (Hou, 2014).

Results

Table 1 reports the weighted characteristics of the study sample. Overall, 16.6 per cent ($N = 8,301$) of those in the pooled sample were childless. Older adults and

Table 1. Weighted frequency distribution or means for variables included in the regression models: Canadian population aged 45+

	Childless		Parents		<i>t</i> -Test		χ^2	
	Mean (SD)	%	Mean (SD)	%				
Overall loneliness	1.43 (0.46)		1.36 (0.41)		14.0	***		
Emotional loneliness	1.36 (0.49)		1.33 (0.47)		4.7	***		
Social loneliness	1.51 (0.62)		1.39 (0.54)		16.9	***		
Female		48.3		52.6			36.5	***
Age group:							181.9	***
45–54		41.8		35.5				
55–64		33.3		30.8				
65–74		15.5		20.2				
75+		9.4		13.5				
Marital/partner status:							9913.3	***
Co-habiting		14.2		7.9				
Widowed		4.8		9.6				
Separated or divorced		8.3		10.9				
Never married		38.6		2.4				
Married		34.2		69.3				
Foreign born		19.3		24.6			76.0	***
Religion:							179.9	***
Catholic		42.0		41.8				
Protestant		23.4		28.1				

Other	15.7	17.2			
None	18.9	12.8			
Living in Quebec	27.8	24.1	35.2	***	
Education	3.77 (2.02)	3.32 (1.94)	9.9	***	
Employment status:			27.9	***	
Employed	54.8	52.8			
Other	15.1	13.6			
Retired	30.2	33.6			
Household income:			390.9	***	
Not reported	13.6	14.1			
Low	18.0	11.0			
Medium	48.5	44.7			
High	20.0	30.2			
Self-rated health	3.56 (1.09)	3.60 (1.05)	4.9	***	
Chronic condition:			5.6		
Mild or moderate	10.3	10.5			
Severe	4.7	4.0			
None	85.1	85.5			
Survey year:			13.3	***	
2007	32.33	33.5			
2012	32.24	33.5			
2018	35.43	33.0			
Sample size	8,301	41,591			

Note: SD: standard deviation.
Source: Canadian General Social Surveys 2007, 2012 and 2018.
Significance level: *** $p < 0.001$ (two-tailed test).

women were less likely to be childless than were middle-aged adults and men. Over two-thirds (69.3%) of those with children were married compared to just over one-third (34.2%) of those who were childless. In contrast, childless individuals were significantly more likely to report having never been married (38.6% *versus* 2.4%) or to be co-habiting (14.2% *versus* 7.9%) than those with children, who were more likely than those who were childless to report being separated/divorced (10.9% *versus* 8.3%) or widowed (9.6% *versus* 4.8%).

Bivariate analyses revealed that average levels of overall, emotional and social loneliness were significantly higher among those who were childless than among those who were parents (Table 1). In contrast, multivariate analyses revealed positive associations between childlessness and both overall and social loneliness but not emotional loneliness (Table 2). Although prior evidence suggests that there is little difference in the impact of childlessness on biological and non-biological or step-parents (Zhang and Hayward, 2001; Bures *et al.*, 2009), we compared these findings to those obtained when focusing only on biological and adopted children. These analyses (not reported here), conducted using the 2007 and 2012 survey data only (since these had the necessary information), supported the robustness of our findings.

Gender, age and marital/partner status also emerged as significant correlates of loneliness (Table 2; for bivariate results, *see* Table S1 in the online supplementary material). Net of controls, women reported somewhat lower levels of both overall and social loneliness than men but did not differ with regards to average levels of emotional loneliness. As well, with the exception of those aged 55–64 who did not differ from those aged 45–54 (reference category) when it came to emotional loneliness, those in the older age groups reported somewhat lower levels of overall, emotional and social loneliness. Finally, in terms of marital/partner status, those who were co-habiting, widowed, separated/divorced or never married all reported higher mean levels of overall and emotional loneliness compared to those who were married (reference category). With regard to social loneliness, the results were similar, with the exception that those who were widowed did not differ from those who were married.

Table 3 reports the results of analyses that include two-way interactions involving gender, age group or marital/partner status and childlessness in relation to levels of loneliness. The results reveal significant negative interactions involving gender (women) and childlessness in relation to both overall and social loneliness, but not emotional loneliness. Women reported lower levels of loneliness in conjunction with childlessness compared to men. The results, portrayed graphically in Figure 1a for overall loneliness, show that the higher levels of loneliness evident when comparing those with and without children were primarily evident among men. Significant interactions with age group were also evident. Although older adults in general reported lower levels of loneliness compared to the reference category (aged 45–54), net of controls, childlessness was associated with higher levels of overall and social loneliness among older than younger adults. Thus, the difference in levels of loneliness evident when comparing those with and without children was greater in the older age groups (Figure 1b). Alternatively, no significant age group $\times$ childlessness interactions were evident when emotional loneliness was the outcome variable. As well, few significant interactions emerged between

Table 2. Ordinary least squares regressions of loneliness on childlessness

	Overall loneliness			Emotional loneliness			Social loneliness		
	Coefficient		SE	Coefficient		SE	Coefficient		SE
Intercept	1.675	***	0.011	1.557	***	0.013	1.792	***	0.016
Childless (1 = yes)	0.033	***	0.006	−0.002		0.006	0.068	***	0.008
Female (1 = yes)	−0.027	***	0.004	−0.007		0.004	−0.046	***	0.005
Age group (Ref. 45–54):									
55–64	−0.012	**	0.004	−0.008		0.005	−0.015	*	0.006
65–74	−0.042	***	0.006	−0.042	***	0.007	−0.042	***	0.008
75+	−0.075	***	0.007	−0.048	***	0.008	−0.101	***	0.010
Marital/partner status (Ref. Married):									
Co-habiting	0.025	***	0.006	0.016	*	0.007	0.033	***	0.009
Widowed	0.074	***	0.007	0.158	***	0.008	−0.011		0.009
Separated or divorced	0.097	***	0.006	0.084	***	0.007	0.110	***	0.008
Never married	0.067	***	0.008	0.066	***	0.009	0.069	***	0.011
Foreign born (Ref. Canadian born)	0.093	***	0.004	0.094	***	0.005	0.093	***	0.006
Religion (Ref. None):									
Catholic	−0.011	*	0.006	0.052	***	0.006	−0.075	***	0.008
Protestant	−0.020	***	0.006	0.024	***	0.006	−0.064	***	0.008
Other	0.020	***	0.006	0.065	***	0.007	−0.024	**	0.009
Living in Quebec (1 = yes)	−0.009		0.005	0.021	***	0.005	−0.038	***	0.006

(Continued)

Table 2. (Continued.)

	Overall loneliness			Emotional loneliness			Social loneliness		
	Coefficient		SE	Coefficient		SE	Coefficient		SE
Education	0.005	***	0.001	−0.010	***	0.001	0.021	***	0.001
Employment status (Ref. Retired):									
Employed	0.013	*	0.005	0.004		0.006	0.022	**	0.007
Other	0.067	***	0.006	0.072	***	0.007	0.061	***	0.008
Household income (Ref. High):									
Low	0.110	***	0.007	0.121	***	0.008	0.100	***	0.010
Medium	0.055	***	0.004	0.058	***	0.005	0.051	***	0.006
Self-rated health	−0.101	***	0.002	−0.095	***	0.002	−0.107	***	0.003
Chronic condition (Ref. None):									
Mild or moderate	0.053	***	0.006	0.062	***	0.007	0.043	***	0.008
Severe	0.112	***	0.009	0.148	***	0.010	0.075	***	0.012
Survey year (Ref. 2018):									
2007	−0.065	***	0.004	0.014	**	0.005	−0.144	***	0.006
2012	−0.032	***	0.004	0.016	***	0.005	−0.081	***	0.006
R ²	0.144			0.127			0.104		

Notes: Coefficients are unstandardised. All models include a dummy variable for missing household income. SE: standard error. Ref.: reference category.

Source: Canadian General Social Surveys 2007, 2012 and 2018.

Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test).

Table 3. Ordinary least squares regressions of loneliness on childlessness and interactions

	Overall loneliness			Emotional loneliness			Social loneliness		
	Coefficient		SE	Coefficient		SE	Coefficient		SE
Intercept	1.676	***	0.011	1.556	***	0.013	1.795	***	0.016
Childless (1 = yes)	0.025	*	0.011	0.004		0.012	0.046	**	0.015
Female (1 = yes)	−0.024	***	0.004	−0.004		0.004	−0.043	***	0.005
Age group (Ref. 45–54):									
55–64	−0.018	***	0.005	−0.011	*	0.005	−0.024	***	0.006
65–74	−0.048	***	0.006	−0.041	***	0.007	−0.055	***	0.009
75+	−0.080	***	0.008	−0.044	***	0.009	−0.116	***	0.011
Marital/partner status (Ref. Married):									
Co-habiting	0.032	***	0.007	0.023	**	0.008	0.041	***	0.010
Widowed	0.070	***	0.007	0.153	***	0.008	−0.013		0.010
Separated or divorced	0.097	***	0.006	0.082	***	0.007	0.112	***	0.009
Never married	0.080	***	0.012	0.067	***	0.014	0.094	***	0.017
Female × childless	−0.022	*	0.010	−0.016		0.011	−0.027	*	0.014
Age × childless:									
55–64 × childless	0.039	***	0.011	0.018		0.013	0.060	***	0.016
65–74 × childless	0.046	**	0.014	−0.007		0.016	0.100	***	0.020
75+ × childless	0.045	*	0.018	−0.029		0.020	0.120	***	0.025
Marital/partner status × childless:									

(Continued)

Table 3. (Continued.)

	Overall loneliness			Emotional loneliness		Social loneliness	
	Coefficient		SE	Coefficient	SE	Coefficient	SE
Co-habiting × childless	−0.031	*	0.016	−0.027	0.018	−0.036	0.022
Widowed × childless	0.052	*	0.024	0.053	0.027	0.052	0.033
Separated or divorced × childless	−0.002		0.018	0.021	0.021	−0.026	0.025
Never married × childless	−0.022		0.016	−0.002	0.018	−0.043	0.022
<i>R</i> ²	0.144			0.127		0.106	

Notes: Coefficients are unstandardised. All models include independent variables shown in Table 2. SE: standard error. Ref.: reference category.
Source: Canadian General Social Surveys 2007, 2012, 2018.
Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test).

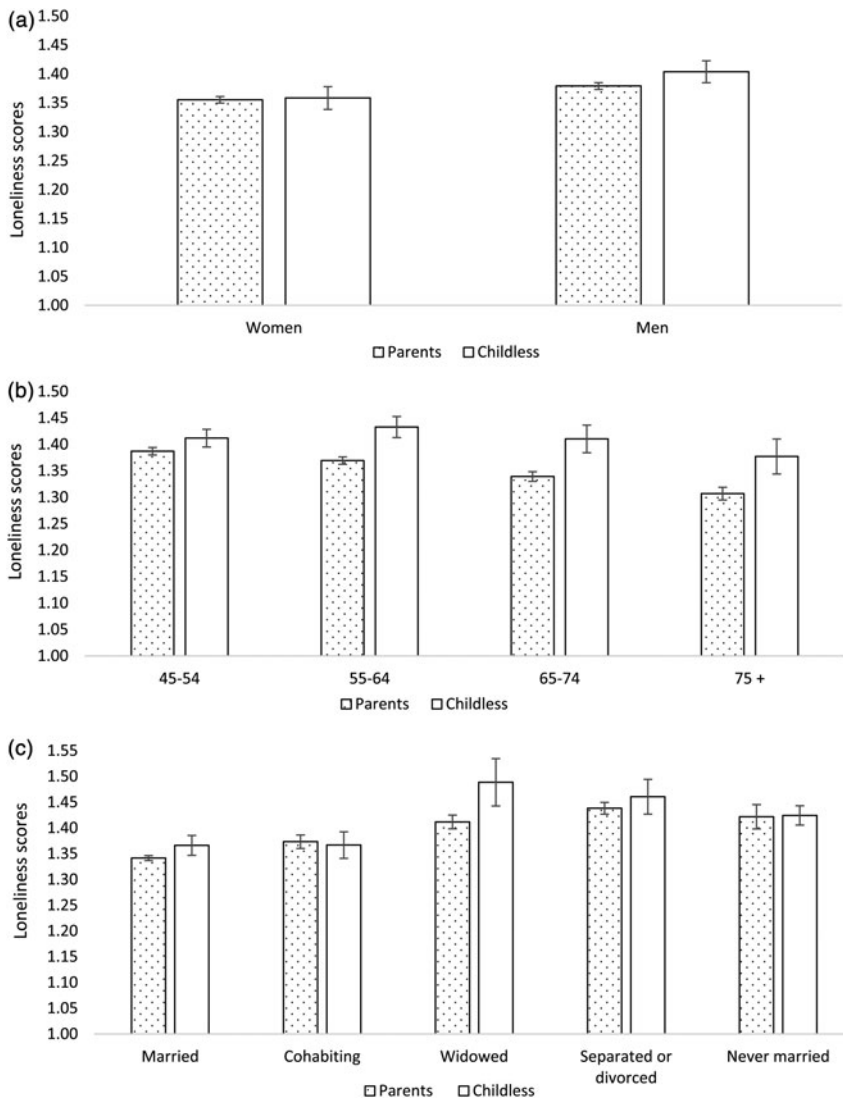


Figure 1. Ordinary least squares regression estimates of interaction effects of (a) gender and childlessness, (b) age and childlessness and (c) marital status and childlessness, on overall loneliness, individuals aged 45+.

Note: Confidence intervals are shown.

Source: Table 3, model 1 (Overall loneliness).

marital/partner status and childlessness. Where found, they revealed that the relationship between childlessness and overall (but not social or emotional) loneliness differed somewhat when comparing those who were co-habiting and widowed to those who were married. Subsequent analyses showed the difference between co-habiting individuals with and without children was not statistically significant

Table 4. Ordinary least squares regressions of loneliness on childlessness and interactions, by gender

	Men						Women					
	Overall loneliness		Emotional loneliness		Social loneliness		Overall loneliness		Emotional loneliness		Social loneliness	
Coefficients												
Intercept	1.637	***	1.485	***	1.789	***	1.691	***	1.619	***	1.764	***
Childless (1 = yes)	0.007		−0.006		0.020		0.019		−0.006		0.043	*
Age group (Ref. 45–54):												
55–64	−0.025	***	−0.024	**	−0.026	*	−0.012		0.001		−0.024	**
65–74	−0.049	***	−0.033	**	−0.066	***	−0.047	***	−0.046	**	−0.048	***
75+	−0.077	***	−0.030	*	−0.124	***	−0.084	***	−0.053	*	−0.115	***
Marital/partner status (Ref. Married):												
Co-habiting	0.018		0.004		0.033	*	0.044	***	0.039	***	0.049	***
Widowed	0.091	***	0.200	***	−0.018		0.067	***	0.143	***	−0.008	
Separated or divorced	0.083	***	0.072	***	0.094	***	0.106	***	0.087	***	0.125	***
Never married	0.057	**	0.046	*	0.068	*	0.097	***	0.081	***	0.113	***
Age × childless:												
55–64 × childless	0.035	*	0.010		0.060	*	0.044	**	0.028		0.060	**
65–74 × childless	0.054	*	−0.001		0.109	***	0.043	*	−0.008		0.093	***
75+ × childless	0.088	***	0.007		0.168	***	0.018		−0.052		0.087	**
Marital/partner status × childless:												
Co-habiting × childless	−0.004		−0.004		−0.003		−0.055	*	−0.044		−0.066	*

Widowed × childless	0.011	−0.021	0.043	0.060	*	0.072	*	0.047
Separated or divorced × childless	0.049	0.075	*	0.022	−0.042	−0.019	−0.065	*
Never married × childless	0.024	0.035	0.012	−0.056	**	−0.026	−0.087	**
R ²	0.138	0.121	0.097	0.152		0.135		0.112

Notes: Coefficients are unstandardised. All models include independent variables shown in Table 2. Ref.: reference category.

Source: Canadian General Social Surveys 2007, 2012, 2018.

Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test).

($p > 0.05$). Alternatively, as shown in [Figure 1c](#), childlessness was associated with significantly higher mean levels of overall loneliness among those who were either widowed or married.

In order to explore these relationships further, [Table 4](#) reports associations between age $\times$ childlessness and marital status $\times$ childlessness interactions and loneliness (overall, emotional, social) separately by gender (for gender-based analyses that do not include the interaction terms, see [Table S2](#) in the online supplementary material). Once again, age moderated associations between childlessness and both overall and social loneliness, but not emotional loneliness. For the most part, this appeared to be the case regardless of gender. Thus, net of controls and among men as well as women, childlessness was linked to higher levels of overall and social loneliness among older adults. The sole exception occurred among women aged 75 and older, for whom childlessness was positively associated with social loneliness only. Finally, with regard to the marital status $\times$ childlessness interaction, among men, childlessness was associated with higher levels of emotional loneliness among those who were separated/divorced (compared to married). However, no other interactions involving marital status and childlessness were significant among men. Among women, in contrast, childlessness was associated with lower levels of social loneliness among those who were separated/divorced (relative to married). Similarly, being never married or co-habiting and childless were associated with lower levels of overall and social, but not emotional, loneliness among women. In contrast, among widowed women, childlessness was linked to higher levels of loneliness (overall and emotional but not social).

Discussion

Theoretical and empirical accounts often lead to different conclusions regarding the importance of children in the lives of older adults, including their role in mitigating feelings of loneliness. On the one hand, intergenerational solidarity and convoy theories, among others (*e.g.* hierarchical compensatory model; Cantor, 1979), point to the central importance of children for the support and wellbeing of individuals as they age. Yet, research evidence regarding the implications of having or not having children for feelings of loneliness is less supportive, leading some to conclude that whether or not children are available seems to be inconsequential for such outcomes (Koropeckyj-Cox *et al.*, 2007). Drawing on data from a representative sample of Canadian adults aged 45 and older, our study addressed this contradiction empirically, focusing on the importance of several contextual factors (age, gender, marital/partner status) to the link between childlessness and loneliness (overall, emotional, social) in middle and later life.

Overall, our findings support the conclusion that whether or not children are available is linked to loneliness in middle and later life but that the relationship is contingent on both the type of loneliness (overall, social, emotional) involved and the social contexts (age, gender, marital/partner status) within which childlessness/parenthood is experienced. In particular, they suggest that having children assumes greater importance when it comes to social rather than emotional loneliness. Although consistent with previous literature pointing to the significance of adult children in the lives of middle-aged and older adults (*e.g.* Bengtson *et al.*,

2000; Deindl and Brandt, 2017), its focus tends to be on their role as sources of instrumental (Zhang and Hayward, 2001) and/or emotional support (Suanet and Antonucci, 2017). However, our findings suggest that children also appear important for meeting needs for social engagement in middle and later life. In contrast, other social ties (e.g. spouses/partners, friends) may well assume greater importance for emotional support and wellbeing (Pinquart and Sörensen, 2001). Findings of this nature suggest the need for a more detailed specification of the relationships between childlessness and loneliness at both the theoretical and empirical levels. For example, it may be that one of the reasons for previous findings indicating no relationship between childlessness and feelings of loneliness is that the measures used primarily reflected emotional rather than social loneliness. Our findings suggest the need to consider both domains.

Secondly, our findings also speak to the importance of contextual factors (including gender, age and marital/partner status) with regard to relationships between childlessness and loneliness. They also suggest that their importance differs depending on the type of loneliness involved. With regard to gender, for example, our findings support prior research (Dykstra and Fokkema, 2007; Vikström *et al.*, 2011) indicating that middle-aged and older women report lower levels of loneliness than similarly aged men. However, they also suggest that this is specific to social loneliness. With relevant socio-demographic, economic and health covariates taken into account, there is little evidence of a gender difference in emotional loneliness. As well, the findings provide limited support for generalisations regarding the greater importance of access to children for mitigating loneliness in the lives of women rather than men (Wenger *et al.*, 2007). Instead, they support conclusions that middle-aged and older childless women tend to be less vulnerable to loneliness than similarly aged childless men and that this is primarily the case with regard to social loneliness (Dykstra and Fokkema, 2007; Dykstra and Hagestad, 2007b). This is consistent with literature suggesting that childless women tend to have more and better quality relationships with friends and other informal network ties, and that these relationships protect them from experiencing loneliness (Dykstra and Hagestad, 2007b; Heylen, 2010). In contrast, as they age, men tend to have smaller informal social networks and often rely on immediate family members (particularly spouses/partners) to provide support and to establish and maintain social network ties (Zhang and Hayward, 2001; McLaughlin *et al.*, 2010; Schwartz and Litwin, 2018).

When focusing on the implications of marital/partner status for feelings of loneliness, our study echoes previous research reporting that, in general, loneliness (overall, emotional, social) appears to be greater among those without a spouse/partner (Dykstra *et al.*, 2005; Aartsen and Jylhä, 2011; Dahlberg and McKee, 2014; Dahlberg *et al.*, 2015). However, consistent with previous studies (Zhang and Hayward, 2001; Koropecjy-Cox *et al.*, 2007; Hansen *et al.*, 2009), we found only limited evidence that the implications of childlessness for loneliness differ depending on marital/partner status. Instead, as reported by Zhang and Hayward (2001), childlessness appeared to be linked to loneliness primarily within the joint context of marital status and gender. The intersection of childlessness and marital/partner status was unrelated to feelings of overall and social loneliness among men. As well, only older childless separated/divorced men reported greater emotional loneliness (for

similar findings, *see* Dykstra and Fokkema, 2007). Findings of this nature make sense in light of previous research indicating that older men tend to rely primarily or exclusively on their spouses/partners rather than on children or others for emotional support (Stevens and Westerhof, 2006). Perhaps in the face of separation/divorce and the loss of emotional support that they previously received from their spouses, middle-aged and older men with children do turn to them for emotional support whereas childless men in similar situations have no one else to turn to. Why similar patterns were not evident among widowed men is less clear.

On the other hand, findings indicating that separated/divorced as well as co-habiting and never married childless women experienced lower levels of overall and/or social loneliness compared to their married counterparts appear consistent with literature suggesting the comparatively advantaged position of unmarried/unpartnered childless women when it comes to the size, diversity and quality of their support networks (Dykstra and Hagestad, 2007b; Heylen, 2010). In doing so, the findings provide further support for feminist critiques that call into question assumptions that those without children, particularly women, are inherently lacking and that this will become manifest in negative outcomes, including heightened levels of loneliness (Kreyenfeld and Konietzka, 2017; Lynch *et al.*, 2018). Importantly, however, this advantage did not extend to emotional loneliness. As well, our findings suggest that among women, it is those who are widowed who appear to be uniquely vulnerable to the absence of children when it comes to emotional loneliness. This is in line with assertions that whereas childless spouses tend to rely primarily on one another for emotional support, when a partner dies, widowed women may experience a social and emotional void (Dykstra, 2009). Why this was not the case with regard to social loneliness, where widowed women did not differ from those who were married, is less clear. The relationship between social and emotional loneliness warrants further investigation as does the joint impact of childlessness and contextual factors on this relationship.

Co-habitation relationships also seem to matter. Relevant literature suggests that co-habitation relationships are increasingly serving as an alternative to marriage as well as remarriage following divorce or widowhood among older adults (Brown and Wright, 2017). However, the comparative implications of these relationships for loneliness among those with and without children remain largely unexamined. Yet, our findings suggest that the implications of childlessness/parenthood for co-habiting and married adults are not the same. Despite limited evidence of interaction between childlessness and co-habitation in relation to feelings of social or emotional loneliness in the sample as a whole, once again, there was evidence that the joint implications of marital/partner status and childlessness for reports of loneliness were gendered. Along with several other categories of unpartnered (*i.e.* never married, separated/divorced but not widowed) childless women, childless co-habiting women reported lower levels of social but not emotional loneliness compared to those who were married. Thus, it may be that middle-aged and older co-habiting women, like never married and separated/divorced women, tend to have access to a broader range of social network ties that effectively mitigate feelings of social loneliness among those without children.

Finally, despite the importance often attributed to intersections of parenthood and marital status in relation to reports of loneliness in previous research

(Dykstra and de Jong Gierveld, 2004; Dykstra and Fokkema, 2007), we found that it was intersections involving age and childlessness that appeared to be the most consequential. For both men and women, the differences between those with and without children with regard to overall and social loneliness were generally greater among those in older than middle-aged groups (with childlessness linked to higher levels of overall and social loneliness among older adults). As well, they were more evident among men than women aged 75+. Moreover, this was the case regardless of age-related differences in marital/partner status, health or other factors. In part, these findings could reflect cohort differences, with earlier cohorts being more tightly connected to close kinship networks compared to the greater salience of non-kin networks among later cohorts (Suanet and Antonucci, 2017). However, in a recent longitudinal study, Suanet and van Tilburg (2019) report finding that despite a small cohort effect (with more recent birth cohorts reporting lower levels of loneliness than those born earlier), age effects (showing loneliness increasing with age) were considerably stronger.² To the extent that this is the case, our findings appear consistent with theoretical arguments that as people age, their social networks tend to become smaller (due in part to the loss of spousal and other key sources of social support) and increasingly focused around close intergenerational relationships (e.g. children), as suggested by proponents of convoy and intergenerational solidarity theories. This, in turn, poses problems for maintaining social engagement and thereby avoiding social loneliness among those without such relationships. The finding that this was not the case for emotional loneliness once again suggests that childlessness appears less consequential for emotional than social loneliness.

Several methodological issues should be considered when interpreting our findings. First, our data were cross-sectional and, therefore, preclude causal inferences regarding relationships between childlessness and loneliness. Despite theoretical grounds for focusing on the implications of parenthood/childlessness for feelings of loneliness in middle and later life, empirically, the potential for a reciprocal relationship between childlessness and loneliness and other aspects of subjective well-being has also been noted (Albertini and Arpino, 2018). If this is the case, the result may be some overestimation (if childless individuals have certain unobserved attributes that make them more susceptible to loneliness) or underestimation (if childless individuals have unobserved attributes that make them less susceptible to loneliness) of the effects of childlessness within our analyses. In addition, our data should be interpreted within a Canadian social context. Prior research suggests that both the prevalence and implications of childlessness may vary across national contexts (e.g. Fokkema *et al.*, 2012; Zoutewelle-Terovan and Liefbroer, 2018). Supporting this view, de Jong Gierveld *et al.* (2015) report that prevalence rates for loneliness among older adults appear to be somewhat lower in Canada than in several other countries. Whether the implications differ is less clear and warrants comparative investigation. With regard to sampling, the survey excluded institutionalised individuals. Importantly, those without children appear more likely to be institutionalised than those with children and those in institutions have been reported to have higher levels of loneliness (Gardiner *et al.*, 2020). By excluding these individuals, we may have underestimated the negative implications of childlessness (Koropeczyk-Cox and Call, 2007). Similarly, since older adults, women and

those who are unmarried/unpartnered also tend to be over-represented among those in institutional settings, this may have further influenced findings regarding the joint implications of childlessness and these contextual factors for loneliness.

With regard to measurement, like many studies, we were restricted to treating childlessness and parenthood as dichotomous, despite the heterogeneity of both groups. For example, we could not differentiate between childlessness or parenthood by choice and/or by circumstance or between biological and social parenthood (e.g. stepchildren). Yet, their implications may differ (Zhang and Hayward, 2001; Albertini and Arpino, 2018), potentially resulting in inaccurate (over or under) estimates of the association between childlessness and loneliness. Further, the extent to which childlessness and parenthood are voluntary or involuntary is likely to differ across age cohorts, becoming more voluntary among more recent cohorts (Albertini and Mencarini, 2014). Also, we were unable to consider the impact of differences associated with the number and ages of children or between those who were always childless and those who experienced childlessness through the death of a child. However, although the chances of outliving one's children is likely to increase with age and possibly lead to increased feelings of loneliness (see Murphy *et al.*, 2006), the overall probability of this occurring and affecting our results is likely to be quite low.

These and other limitations attest to the need for further in-depth research into the implications of childlessness for feelings of loneliness in middle and later life. However, despite these limitations, our findings also suggest that childlessness is not uniformly consequential or inconsequential when it comes to loneliness in middle and later life. Nor do childless adults necessarily fare worse than those with children when it comes to such outcomes. Instead, the implications of childlessness appear contingent on the social contexts and the type of loneliness involved. Overall, our findings support the need for continued theoretical, empirical and policy-related attention to the implications of childlessness for both social and emotional loneliness. This will become increasingly important as the ageing of the population continues, lifecourse experiences and family structures become increasingly diverse, and the prevalence of childlessness increases.

Notes

1 The concept of 'childlessness' remains contentious. On the one hand, it has been linked to pronatalist assumptions that those without children, particularly women, are inherently 'less' or lacking (Kreyenfeld and Konietzka, 2017). In response, feminist and other scholars have called for use of the term 'childfree' to show that not having children is often a voluntary and positive choice (Lynch *et al.*, 2018). The distinction is an important one, albeit not necessarily straightforward (Tanturri *et al.*, 2015). Evidence suggests that the experiences of parents as well as of both 'voluntarily' and 'involuntarily' childless adults are both complex and diverse (Berrington, 2017; O'Driscoll and Mercer, 2018). In this study, the term childlessness is used to refer to those who do not have children (whether voluntary or involuntary), with no assumptions made regarding either.

2 In exploratory analyses, we added birth cohort to the models reported in Table 3. Birth cohorts were grouped into three categories: those born before 1945, 1945–1954, and 1955 or later. The addition of the cohort effect reduced the main effect of age, but did not affect the interaction terms between age group and childlessness. This suggests that the observed stronger effect of childlessness in older age groups was independent of cohort effects. We did not present the models including cohort effects because a strong assumption has to be made about homogeneity within each age group and broad cohort in order to break the linear dependence of cohort, age and period effects.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S0144686X22000824>.

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Conflict of interest. The authors declare no conflicts of interest.

Ethical standards. Analyses were based on secondary data for which ethics approval was not required.

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