ERC Starting Grant 2023
Part B2[1]
(<u>not</u> evaluated in Step 1)

Sections (a) and (b) of Part B2 should not exceed 14 pages. References do not count towards the page limits.

Section a. State-of-the-art and objectives

Widowhood is a critical life event entailing profound grief and consequences in the short-term and long-term. It remains one of the prime life course risks in contemporary societies. This is certainly the case for surviving spouses of any age; however my research will concentrate on marital spousal loss among adults age 50 and older. Most research demonstrates that spousal loss commonly leads to an immediate decline in both mental health (Stroebe et al., 2007) and economic wellbeing (Gillen & Kim, 2009). However, existing evidence is mixed as to whether widows and widowers recover from grieving quickly or remain chronically and clinically depressed for years (Carr & Utz, 2020; Kristiansen et al., 2019). Moreover, it is unclear whether the financial consequences of spousal death are short lived or push large numbers of widows and widowers into a persistent state of old-age poverty (Bound et al., 1991; Vartanian & McNamara, 2002). In the United States, nearly 15 percent of older widows and widowers live beneath the federal poverty line, compared to only 5 percent of married older adults.[2]

Widowhood not only has negative consequences for those who experience it, but spousal loss is also a frequent experience. As many countries grow older, the number of marriages ending with the death of a spouse is increasing dramatically, despite high separation rates (Mayol-García et al., 2021). As an example, roughly 85,000 divorces were recorded in Italy in 2019 compared to just under 270,000 spousal deaths, roughly 20,000 more than a decade earlier.[3] Although widowhood remains a common and a high-risk life event, many countries have cut or even abolished survivor benefit schemes targeted at securing the wellbeing of widows and widowers. The consequences of reduced coverage and less generous survivor benefits for post-bereavement wellbeing remain unknown.

Even with its high prevalence and far-reaching consequences, social science research has been less interested in widowhood than other disruptive life events, such as job loss or divorce. For example, ten studies on widowhood were published in sociological journals in 2020, compared to over 35 studies on divorce.[4] *This ground-breaking research will establish a social demography of widowhood that will realize innovative conceptual and methodological approaches to examine: (1) the risk and the consequences of widowhood, (2) their social inequalities, (3) country differences, and (4) past and future change over time.*

State-of-the-Art on Research into Widowhood

Previous research on the risk of widowhood has established that older women are at the highest risk of becoming widowed in contemporary societies. The risk of widowhood has been conceptualized and estimated as a function of the probability that wives outlive their husbands, the mean age and period of widowhood, and life expectancy at that estimated age and period, i.e. the duration of widowhood in years (Goldman & Lord, 1983). Therefore, women's higher risk of widowhood stems from their advantage in life expectancy. A limitation of traditional estimates of widowhood risk is that the probability of spousal loss and duration of widowhood is conditioned on being married. While this is intuitive, conditioning on marital status may lead to bias in contexts characterized by high rates of singlehood and divorce as well as variation in life expectancy by marital status. Other than age and gender, demographic research provides little information on whether other social groups are at an increased risk of being widowed (see Umberson, 2017 for race differences in the US), despite widespread empirical documentation of socially stratified mortality and marriage rates. Similarly, cross-national and -temporal differences in the risk of widowhood remain understudied, despite evidence of country and time differences in mortality and marriage selection.

Previous research on the consequences of widowhood conceptualizes widowhood as a two-stage process consisting of (1) the widowhood period, i.e. the year of spousal death, and (2) the post-widowhood period starting one year after death. The widowhood period is often considered the most intense part of the process,

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both emotionally and financially. The spousal death event generally entails immediate affective, cognitive, and behavioural reactions, but also physiological-somatic symptoms (Stroebe et al., 2007). Emotional reactions may range from short-term yearning, pining and longing for the deceased spouse, to chronic and complicated grief, including trouble accepting the spouse's death, inability to trust others, excessive bitterness or anger, uneasiness to move on, detachment, and feeling that life is empty and the future bleak. In terms of financial wellbeing, surviving spouses in numerous countries without obligatory insurance are immediately confronted with funeral and burial costs following the death of their spouse, but all surviving spouses must manage with a drop in labour or retirement incomes from the deceased.

The post-widowhood period for mental health is thought to be characterized by a partial if not full recovery (Carr & Springer, 2010; Carr & Utz, 2020). The resilience of surviving spouses partly reflects an automatic and physiological stress response that gradually shifts constant stimuli caused by widowhood into the background (Brickman & Campbell, 1971; Soloman & Corbit, 1974). Although active coping processes foster adaptation, recovery often remains incomplete (Diener et al., 2009; Headey, 2008). In a recent review Carr and Utz (2020) conclude that older bereaved spouses are vulnerable to depression, but that most return to pre-loss levels within two years. However, a recent meta-analysis of the clinical literature by Kristiansen and colleagues (2019) found that a considerable number of widows and widowers exhibited depressive symptoms well after two years. Some of these differences are attributable to studies' window of observation as well as their ability to include control samples and pre-loss measures. Studies on depression often use prospective longitudinal data to follow widows and widowers, although the follow-up rarely extended past two years (e.g., Ha, 2008; Mullan, 1992; Utz et al., 2012) or two waves of data (e.g., Arbuckle & de Vries, 1995; Domingue et al., 2021).

In contrast to mental health, the economic burden of bereavement is thought to be more persistent in the post-widowhood period, although also here findings are mixed. Research has shown that large decreases in household income and increased risk of poverty following bereavement are due to the loss of spousal annuities and pensions that are not offset by life insurance or wealth holdings (e.g., Gillen & Kim, 2009). The relative cost of fixed expenditures, such as housing costs, increase as surviving spouses cope with the loss of income. However similar to studies on mental health, most prospective longitudinal studies on widowhood and surviving spouses' economic wellbeing compared only two time points (e.g., Angel et al., 2007; Haveman et al., 2003; Hungerford, 2001; Morgan, 1981; Sevak, 2004).

A vast body of research on variation in the mental health consequences, and to a lesser extent the economic consequences, of spousal loss addresses the question of why individuals differ in their resilience to widowhood (Stroebe et al., 2007). Numerous protective and risk factors that either mitigate or exacerbate the consequences of widowhood have been identified in the literature. These range from the situation and circumstances surrounding death, for example pre-bereavement caregiver strain and relationship quality, intra- and inter-personal factors, such as pre-bereavement socioeconomic status or mental wellbeing, religious beliefs and meaning systems, to social support and cultural settings. However, there is less interest in systematic variation in the consequences of widowhood across social groups attributable to differential access to protective factors and differential exposure to risk factors. While numerous studies consider gender and age variation in the mental health and economic consequences of widowhood, *previous research on social inequalities* across other groups in society, such as by race-ethnicity or nativity are rare (see Angel et al., 2007 for race differences in economic wellbeing in the US). Most research on race differences focus on the consequences of spousal loss for surviving spouses' mortality (Donnelly et al., 2020; Elwert & Christakis, 2006; Liu et al., 2020).

Finally, *previous research on cross-national differences and change over time* is scarce. The cross-national studies that have been conducted concentrate on the United States and Europe, and have attributed country differences to welfare state generosity (Hungerford, 2001), survivor pensions (Bíró, 2013), and bequest regulations (Nicholas & Baum, 2019). This stands in contrast to other established subfields of social demography, such as fertility or mortality, which focus heavily on cross-national differences and social inequalities in the risks and consequences of demographic transitions. A social demography of widowhood will be a first step to supplement fragmented evidence with systematic and comprehensive estimates on risk and vulnerability.

A Social Demography of Widowhood across Ageing Societies

My project will move beyond the state-of-the-art to establish a social demography of widowhood. The foundation of this social demography is an innovative conceptual and methodological approach to estimate the risk – i.e. the probability of losing one's spouse and duration of widowhood – and the vulnerability of widowhood – i.e. the mental health and economic consequences of spousal loss. As in Figure 1, three pillars

Figure 1: The Structure of a Social Demography of Widowhood
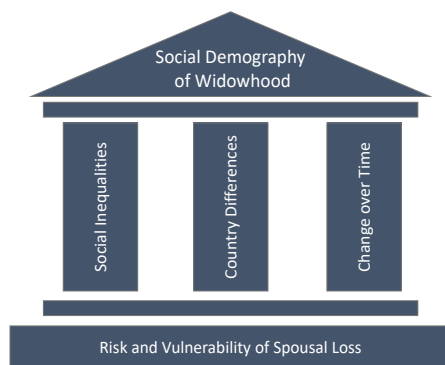
build on that foundation to create a comprehensive social demography of widowhood. The first pillar assesses social inequalities in the risk and vulnerability to widowhood by focusing on how the probability and consequences of spousal loss vary by socioeconomic status, race-ethnicity and nativity, and networks of social support, as well as gender and age. A second pillar zooms in on cross-national differences in the risk and vulnerability to widowhood and their social inequalities. The third and final pillar expands the comparative aspect of the project to examine both past and future change over time in the size and composition of the widowed population.

The geographic scope of this project spans middle- and high-income countries with ageing populations varying in demographic trends and welfare systems, because these countries are more susceptible to changes in the size and composition of the widowed population as well as the social gradients in the risks and vulnerabilities to widowhood. Therefore, my research will be as comprehensive as possible and analyse all data sources from these countries that can be harmonized, which includes, for example, European and East Asian countries, the United States, Canada, Australia and New Zealand.

1) The Risk and Vulnerability to Widowhood

This section introduces two of the most important concepts within a social demography of widowhood: the risk of widowhood and the vulnerability to widowhood. As will be outlined below, the risk of widowhood subsumes not only the probability of spousal loss but also the duration of remaining widowed. The concept of vulnerability broadly denotes the consequences of widowhood from the onset of spousal terminal health decline well into the post-widowhood period for those who expect as well as those who do not expect the loss of their spouse. My research will consider two types of outcomes: mental health and economic wellbeing. Mental health, as is common in the social scientific literature on older adults, will be measured by elements of the Center for Epidemiological Studies Depression score, such as feeling sad, lonely, and happy or being able to enjoy life. Other grief-related psychological measures may include feelings of anxiety or distress as well as insomnia. Economic wellbeing will be measured by means of household income and wealth, as well as whether households fall under the relative poverty threshold. My research on the consequences of widowhood will concentrate on mental health and economic wellbeing, because these are commonly studied outcomes. Therefore, my findings on social inequalities, country differences, and change over time will be able to speak with an existing literature. However, my conceptual and methodological framework will be easily adaptable to other outcomes, such as physical health, social relationships or life satisfaction.

What is the risk of widowhood?

My research will expand the conceptualization of widowhood risk to encompass the lifetime risk of widowhood, next to two other traditional measures of widowhood risk. Therefore, my research on the risk of widowhood will assess three dimensions. The first dimension is *1) the lifetime risk of widowhood*, specifically the overall probability that an individual becomes a widow or widower in older age. Next to life expectancy, selection into marriage, divorce and remarriage will be major contributing factors in determining an individual's lifetime risk. This measure will enable me to examine social inequalities in the risk of widowhood and how they vary across countries and time in a more nuanced manner. The traditional measures that I will analyse – *2) the conditional probability of widowhood* and *3) the expected duration of widowhood* – are less apt to uncover social inequalities and contextual differences, because they remove individuals who never marry, or did not remarry after divorce, from the risk set. *I expect that life expectancy and selection into marriage, divorce, and remarriage will be positively associated with the lifetime risk of widowhood, while life expectancy will be positively associated with the conditional probability of widowhood and the expected duration of widowhood.* Note that for brevity, I will use the risk of widowhood below to refer to all three dimensions.

What is the vulnerability to widowhood?

Next to the risk of widowhood, my project also poses a new framework for conceptualizing the consequences of widowhood. This framework builds on previous research by recognizing that widowhood is

not only an event but also a process. Widowhood typically is not caused by a sudden unexpected death, but is preceded by declining health that often last several years. This has two implications. First, widowhood should be conceptualized as a three-stage process that includes a pre-widowhood period. Second, the consequences of widowhood must be assessed relative to meaningful comparison groups. The following section introduces this framework by (A) reviewing the first stage of the process, i.e. the pre-widowhood period, (B) how it relates to the widowhood- and post-widowhood periods, and (C) how matching on the event and process results in two meaningful comparison groups.

A) The Pre-Widowhood Period

The pre-widowhood period is defined by the process leading up to the event of spousal loss. *In the case of widowhood, the pre-widowhood process is commonly understood as the spouse's terminal health decline (THD)*. It is important to clarify some aspects of this period. First, it may be entirely absent. This applies to all cases in which the death is not health-related, e.g. traumatic death and to cases in which health problems that cause the death accumulate suddenly or in ways that are not noticeable to those affected. *In these cases of unexpected widowhood, no pre-widowhood effects should arise and the model collapses into a two-stage model consisting of only the widowhood and post-widowhood periods. In contrast, in cases of expected widowhood when a THD is present, pre-widowhood effects should arise and the model expands to a three-stage model consisting of the pre-widowhood, the widowhood, and the post-widowhood periods.*

Second, the three-stage model of expected widowhood links changes observed during the pre-widowhood period to a spouse's THD. The model therefore separates process-related changes in mental health or economic wellbeing, i.e. those changes that are caused by the THD, from other changes, such as global shocks during the period. Third, *the start of the pre-widowhood period is defined as the onset of the THD*. Some declines are rapid; some are gradual and may involve extended periods of disease. If the observation window opens only a few years before widowhood, the THD may already be at an advanced stage. Therefore, a long window of observation, e.g. five to ten years, is needed to fully capture the THD. Finally, the process of a spouse's THD is often not defined prospectively during the pre-widowhood stage, because the terminal nature of a health decline may only be known after death. Some people may be entirely or initially unaware of their spouse's THD, while others may be fully aware from the onset of the decline and its terminal nature. One implication is that theoretical ideas about anticipatory coping (Coelho & Barbosa, 2017) apply only to some of the bereaved, even if widowhood is preceded by THD.

The pre-widowhood period entails numerous substantive and THD-related changes in mental health and economic wellbeing that should be included in the assessment of the consequences of the widowhood process (Vable et al., 2015). Considering mental health, spouses may face several challenges in the pre-widowhood period, including difficult caregiving duties that task them physically and psychologically (Keene & Prokos, 2008). Spousal health decline may also be met with increased emotional and social isolation from both family and friends (Williams et al., 2008). Moreover, those who experience their spouse's THD may neglect their own physical and mental health due to increased labour market participation to cover the financial burden of illness and the physical and emotional burden of caregiving duties. However, if the grieving process starts already when people become aware that their spouse's health decline is terminal (Coelho & Barbosa, 2017), anticipatory grieving may shift some of the negative effects on mental health to the pre-widowhood period. This could potentially promote recovery in the periods that follow. Couples who are aware of the THD may also have the chance to resolve "unfinished business" (Carr & Utz, 2001), and have the time and opportunity to say goodbye.

Considering economic wellbeing, financial strain during the pre-widowhood period is caused by three main factors. First, out-of-pocket medical and long-term care expenses may make it difficult to make ends meet. Second, if dying spouses still work for pay, the THD may cause reduced work hours and an earlier withdrawal from the labour market. Third, if surviving spouses perform caregiving duties, further costs may be incurred by forgone labour income. Moreover, couples may need to consume wealth holdings prematurely to cover financial gaps.

B) The Widowhood and Post-Widowhood Period

As outlined above, *the widowhood period is defined as the death event and the year that follows, while the post-widowhood period starts one year after death*. If the widowhood period is not preceded by a pre-widowhood period, a sudden loss may be an especially traumatic and disruptive experience to the surviving spouse, which could result in a larger immediate mental health and financial shock. Conversely, if widowhood follows a pre-widowhood period, mental health effects may be alleviated by anticipatory grief and stress relief, in particular for caregiving spouses. As the pre-event baseline of mental health is already

lowered, the additional loss may be less severe. Yet, the immense amount of energy spent might also leave the bereaved with depleted mental resources and unable to cope with the loss of their spouse.

In financial terms, the absence of a THD means less economic hardship and reduced cumulative costs of widowhood prior to spousal loss, but may result in larger sustained losses in the post-widowhood period. For example, an absent pre-widowhood period deprives the bereaved of the time and opportunity needed to make financial arrangements. However, labour incomes may already have been reduced partly or entirely in the presence of a pre-widowhood period, which leaves less room for additional declines compared with cases in which a pre-widowhood period is absent.

<p style="text-align: center;"><u>C) Comparison Groups: Matching on Process and Event</u></p>

As in other critical life events, whether people's mental health and economic wellbeing recovers partly or fully depends on the comparison. In the presence of a pre-widowhood period, the before-after comparisons made by previous studies may be misleading given that the widowhood process already lowers the pre-widowhood baseline of mental health. The same problem applies to assessing the economic impact of widowhood. Studies on the consequences of life events have made substantial progress in the selection of reference groups beyond pre- and post-event contrasts. Initial studies on widowhood compared widowed individuals to a reference group of married individuals in cross-sectional data. After the advent of panel data shifted the comparison to before-after assessments of the same individuals, the inclusion of continuously married individuals was limited to improving the estimation of time-varying control variables and was no longer of substantive interest.

More recent work on the consequences of life course events began to use matching techniques to create a reference group similar on observable characteristics to the group of individuals that experienced the event under study (Yap et al., 2012). Later work added a focus on the process by defining a common starting point at which groups were matched (van Scheppingen & Leopold, 2019). The reference groups in these studies are endowed with fictive events that occurred in the years of their matches. Although this approach creates a reference group of individuals observed across the entire, albeit fictitious, process, the presence of a pre-event process obscures the comparison. Specifically, a reference group that is matched on experiencing an event implicitly matches on the event's preceding process. In the case of widowhood, a reference group of continuously married individuals matched with a group of widowed individuals will also be implicitly matched on the widowhood process. The reference group of continuously married individuals will therefore show similar spousal health declines as the groups of widows and widowers, but without a spousal death.

However, this comparison is not meaningful if the research interest lies in the consequences of the entire process rather than only in the event. For this purpose, a meaningful reference group consists of those who are similar at the starting point but experience neither the process nor the event. To create meaningful comparison groups, the matching idea needs to be broadened to include process and event. Theoretically, four groups can be defined by matching on (a) the event of widowhood and (b) the preceding THD process, which are displayed in Table 1. Taken together, these four groups allow six comparisons (A vs. B, A vs. C, A vs. D, B vs. C, B vs. D, C vs. D) to assess the consequences of widowhood for economic wellbeing and mental health for different scenarios. Yet, not all groups and comparisons are theoretically meaningful, in particular the comparison of C and D as well as all comparisons involving group C, in which the presence and duration of the spouse's THD remains speculative.

Table 1: Overview of Theoretical Event-by-Process Groups

		Event	
		Widowhood	No Widowhood
Process	Terminal Health Decline	Group A	Group C
	No Terminal Health Decline	Group B	Group D

The focus of my research lies in two comparison groups: *unexpected* and *expected widowhood*. The B vs. D comparison estimates the consequences of unexpected widowhood by comparing the bereaved group of persons who experience a widowhood event without a THD (group B) to the reference group of persons who experience neither a widowhood event nor a THD (group D). It follows the logic of a research design leveraging an exogenous death, e.g. a traffic accident, to estimate the consequences of widowhood. The unexpected widowhood comparison represents a two-stage process modelled as the scenario of a sudden widowhood event followed by a post-widowhood adjustment phase. A pre-widowhood THD is absent.

The A vs. D comparison estimates the consequences of expected widowhood by comparing the bereaved group of persons who experience both a THD and a widowhood event (group A) to the reference group of persons who experience neither a widowhood event nor a THD (group D). As a three-stage process model, it differs from unexpected widowhood in that the groups share neither the event of spousal loss nor the

preceding process of spousal THD. The resulting comparison resembles the demographically prevalent scenario of a widowhood event that is preceded by a THD.

1) It is expected that there will likely be no pre-widowhood period consequences for the unexpected widowhood comparison group, but large pre-widowhood period consequences for the expected widowhood comparison group. 2) It is likely that the widowhood period consequences will be larger for the unexpected widowhood comparison group than for the expected comparison group. 3) Moreover, the post-widowhood consequences will likely persist longer for the unexpected comparison group than for the expected comparison group. 4) The total vulnerability – defined as the sum of the differences between the two groups across the three stages of the widowhood process – to widowhood may be larger for the expected comparison group than for the unexpected comparison group.

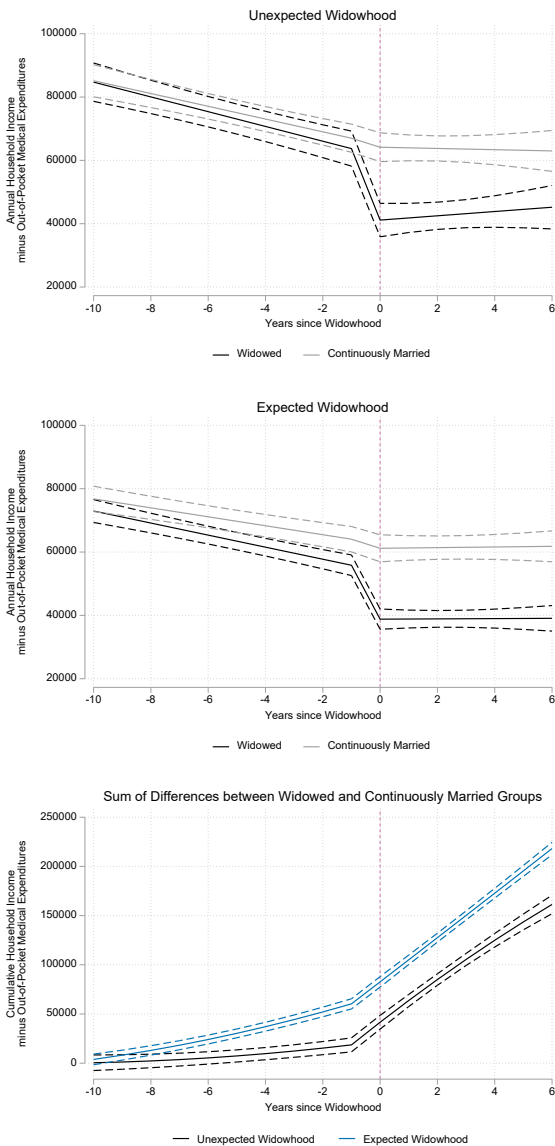*Figure 2: A Processual Framework for Widowhood Consequences and Vulnerability*

Figure 2 shows the results from a proof-of-concept study using data from the United States Health and Retirement Study (see Van Winkle & Leopold, 2022 and section 1B of the methodology section for more details). The top and middle panels of Figure 2 display how average economic wellbeing, measured as total household income minus medical expenditures, evolves across the process of spousal loss for widowed men and women (black line) and a group of continuously married individuals (grey line). The spouses of the to-be-widows and -widowers in the top panel did not experience a decline in self-rated health in the ten years leading up to death. In contrast, the spouses of the to-be-widows and -widowers in the middle panel did experience declines prior to death. The continuously married group in both panels did not experience any health declines. Otherwise, the widowed and continuously married groups are similar on a number of observables ten years prior to spousal death.

There are indeed no pre-widowhood income differences between widowed and continuously married individuals for the unexpected widowhood group. In contrast, considerable differences emerge between both groups six years prior to spousal death for the expected widowhood group. In the year of widowhood, the drop in income is roughly $10,000 larger for the expected compared to unexpected widowhood group. Neither group seems to experience a recovery in economic wellbeing in the six years following widowhood. The lower panel of Figure 2 shows that the vulnerability – the running total of the income differences between the widowed and continuously married groups – are larger for the expected compared to unexpected comparison groups. However, this proof-of-concept study still leaves many questions open, as will be discussed below.

## 2) Social Inequalities in the Risk and Vulnerability to Widowhood

I will focus on dimensions of social stratification that are relevant for social inequalities, especially among older adults within the geographic scope of my project. Specifically, my research will concentrate on three dimensions of social stratification: (1) socioeconomic status, e.g. higher vs. lower educational and occupational attainment, (2) race-ethnicity and nativity, e.g. majority-white vs. race-ethnic minority or native born individuals vs. individuals with a background of migration, and (3) social support networks, e.g. childless adults vs. parents or larger vs. smaller extended family networks. As indicated above, socioeconomic status will be measured in this project in terms of educational attainment, e.g. school and

vocational certificates, and occupational attainment, e.g. job prestige and income levels. The measurement of race-ethnicity, and to a lesser extent nativity, will be context dependent. Ideally, social support networks would be operationalized through the number of close and extended living family members as well as friends, but due to data limitations the number of living children and siblings will be the most common measure. Not only are these dimensions standard elements of social stratification across the life course, but they are also tightly intertwined with the risk of widowhood and individual wellbeing following spousal loss. For brevity, social groups will be referred to as advantaged, e.g. high educational attainment, or disadvantaged, e.g. those belonging to the minority race-ethnicity groups.

It is important to highlight that gender and age will be assessed throughout the project as crosscutting factors that influence the risk of widowhood and its consequences. This is necessary from an analytical standpoint, because women are at a greater risk of losing their spouse. When assessing how the risk of widowhood varies, for example, women will continue to be at a higher risk of widowhood compared to men, regardless of socioeconomic status. However, gender and age gaps in the risk of widowhood may vary in interesting ways within and between social groups. For example, the socioeconomic difference in the risk of widowhood may be larger for men than women if the gender gap in life expectancy decreases with higher socioeconomic status. In this manner, addressing issues surrounding widowhood also addresses gender inequalities in older age.

Are there social inequalities in the risk of widowhood?

Currently, we lack an understanding and documentation of whether the risk of widowhood varies across social groups. Social inequalities in the risk of widowhood should emerge if selection into marriage, divorce, and remarriage and/or life expectancy differs, for example, by socioeconomic status, race-ethnicity and nativity, or social support networks. This is displayed in Figure 3, where overlapping and intersecting differences between socioeconomic status, race-ethnicity and nativity, and social support networks in terms of differential selection into marriage, divorce, and remarriage and/or differential life expectancy generates group differences in the risk of widowhood.

Figure 3: Social Inequalities in the Risk of Widowhood
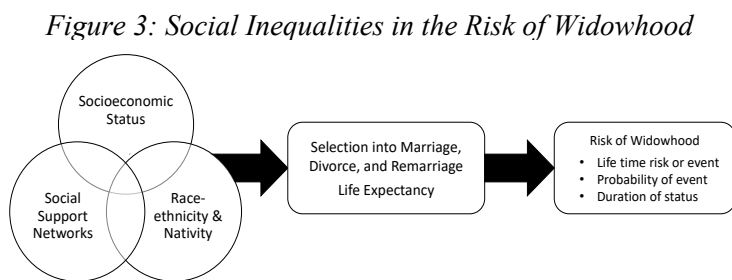
There is indeed amble evidence for differential selection into stable marriage and mortality across the lines of socioeconomic status, race-ethnicity and nativity, and social support networks. For example, higher socioeconomic status early in life has been shown to be associated with a higher probability of marriage (e.g., Kalmijn, 2013), a lower likelihood of divorce (e.g., Härkönen & Dronkers, 2006; Matysiak et al., 2014), and longer life expectancy (e.g., Hendi, 2015, 2017; Sasson, 2016). Research on race-ethnic minorities often demonstrates a lower probability of marriage (e.g., Wiik, 2022), a higher likelihood of divorce (e.g., Choi et al., 2020; Milewski & Kulu, 2014) and shorter life expectancy (e.g., Bohacek et al., 2015). In addition, the number of siblings increases the likelihood of marriage (e.g., Suanet & Bras, 2014), while the presence of children tends to decrease the probability of divorce (e.g., Van Winkle & Leopold, 2021) and increase life expectancy (e.g., Barclay & Kolk, 2019; Modig et al., 2017). It is important to note that these associations not only vary starkly across countries, as will be discussed below, but also interact with one another as well as with gender and age. For example, socioeconomic differences in the probability of marriage and divorce vary starkly by race-ethnicity and gender (e.g., Aughinbaugh et al., 2013; Bloome & Ang, 2020; Chang et al., 2015). However, advantaged social groups tend to marry more often, divorce less and live longer, which may translate into a higher risk of widowhood. *Therefore, it could be expected that older adults from advantaged social groups will be at a higher risk of widowhood compared to those from disadvantaged social groups.* However, this may not always be the case. For example, ethnic minorities and migrant groups have higher marriage rates and lower separation rates in many countries (Wiik, 2022), which could lead to the expectation that older adults from some disadvantaged social groups will be at a higher risk of widowhood compared to those from certain advantaged social groups.

Are there social inequalities in the vulnerability to widowhood?

Similarly, there are reasons to expect considerable social inequalities in the mental health and economic vulnerability to widowhood. As discussed above, research has identified numerous protective factors that

ameliorate and risk factors that exacerbate the consequences of widowhood. As displayed in Figure 4, social inequalities in the vulnerability to widowhood may emerge if there are group differences in access to protective factors or relief from risk factors.

Figure 4: Social Inequalities in the Vulnerability to Widowhood
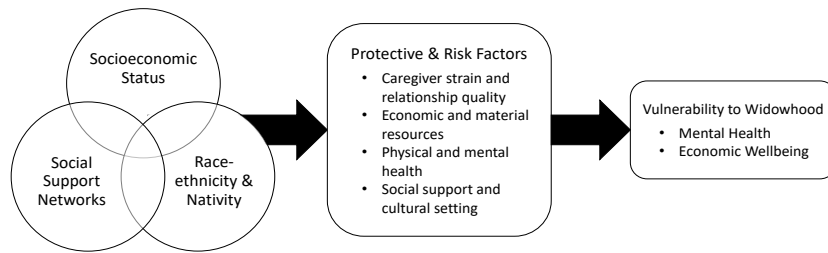
Primary mitigating factors for the mental health and economic consequences of widowhood is mental health and economic wellbeing before the process of widowhood begins (e.g., Martikainen & Valkonen, 1998; Morgan, 1981; Raphael et al., 2001). Research has shown that minority race-ethnicity groups and migrants not only have fewer economic resources in older age (e.g., Borjas, 2009; O'Neil & Tienda, 2015), but also are more likely to have experienced mental health issues (e.g., Aichberger et al., 2010; Spence et al., 2011). Compared to older adults without children, parents tend to have more economic and material resources (e.g., Van Winkle & Monden, 2021) and higher psychological wellbeing (e.g., Bures et al., 2009; Zhang & Hayward, 2001). Another important risk factor, caregiver strain, can be outsourced given adequate financial means, but a larger kinship network or the presence of familial norms in certain cultural settings may reduce the burden by distributing caregiving tasks. Overall, advantaged social groups are more likely to be equipped with the economic and social resources to reduce their vulnerability to spousal loss. *Therefore, older adults from advantaged social groups may be less vulnerable to widowhood compared to those from disadvantaged social groups.*

3) Country Differences in the Risk and Vulnerably to Widowhood

My research will have already pushed the state-of-the-art forward simply by documenting cross-national variation in the unequally distributed risk of spousal loss and vulnerability. However, a central objective is to understand why those country differences arise in the first place. My project will approach country differences in two ways. The first approach will assess how population differences, especially regarding selection into marriage, divorce, and remarriage as well as differential mortality, results in cross-national variation in the unequal distribution of widowhood risk. The second approach will assess how policy differences, especially regarding survivor benefits systems, translates into cross-national variation in the unequal distribution of mental health and economic vulnerabilities to widowhood.

Are there country differences in the risk of widowhood?

Countries differ in terms of marriage, divorce, and remarriage rates as well as life expectancy. Therefore, it should be expected that countries would differ in the overall risk of widowhood. In countries with higher marriage rates, lower divorce rates, and longer life expectancies, the overall risk of widowhood should also be higher. However, social inequalities in the risk of widowhood should also arise if there is cross-national variation in the differential selection into marriage or divorce, or variation in longevity. Indeed, there is amble evidence that the socioeconomic selection into marriage and divorce as well as socioeconomic differences in life expectancy vary starkly across countries (e.g., Bohacek et al., 2015; Kalmijn, 2013; Matysiak et al., 2014). Other research shows cross-national differences in the life expectancy of migrants, with migrants living longer than natives in the United States (e.g., Dupre et al., 2012), but shorter in European countries (e.g., Reus-Pons et al., 2017). *Therefore, it can be expected that the country-specific risk of widowhood may increase with higher marriage and remarriage rates, lower divorce rates, and longer life expectancies. Moreover, social inequalities in the risk of widowhood are likely smaller in countries where marriage, divorce, and remarriage rates as well as life expectancies are less socially stratified.*

Are there country differences in the vulnerability to widowhood?

There are two – albeit tightly related – policy instruments for countries to mitigate the consequences of widowhood for older adults: old-age pensions systems and survivor benefit regimes (see James, 2009 for an overview). Old-age pensions systems have been broadly categorized as either (1) residence-based and funded by governments, (2) contribution-based under public management, (3) contribution-based under private management, or (4) a mixture of the three. In addition, pensions can be categorized as more or less generous. Systems with less generous pensions often aim to avoid old-age poverty, while systems with more generous

pensions additionally aim to smooth consumption levels and standard of living following retirement. Old-age pensions systems are particularly relevant for post-retirement widowhood, and especially for widows in countries with high female labour market participation rates. There may be no need for additional survival benefit regimes to secure the economic wellbeing of spouses after retirement in countries with universal and generous old-age pension systems. In contrast, the wellbeing of retired spouses may depend on survivor benefits to avoid poverty and retain their standard of living in countries with less generous pensions or where access is restricted.

There is less systematic literature that attempts to categorize survivor benefit regimes compared to old-age pension schemes. Moreover, few indicators aside from social expenditure on survivor benefits exist that measure more detailed aspects of survivor benefit regimes. One reason for this gap might lie in the complexity of survivor benefits. For example, survivor benefits differ at least in their (1) administration, (2) financing, (3) target population, (4) benefit type, (5) duration, and (6) eligibility. Survivor benefits are managed publically in most countries, while others, such as Denmark, the Netherlands, and Switzerland, have mandatory private schemes. These tend to differ in terms of financing through social contributions and taxes on the one hand, and private insurance on the other. Moreover, while widows and widowers are targeted in most countries, others, such as Latvia, only target orphans. The duration of benefits for widows and widowers also varies. For example one-time payments are distributed following death in the Czech Republic and Denmark. In most countries men and women can benefit equally from survivor benefit regimes, but there are restrictions for men in others, such as Switzerland until an upcoming reform is implemented. There are no age limits on survivor pension recipients in countries such as Austria, Ireland, Norway, and Spain, but younger widows and widowers are barred from benefits in countries such as Estonia, Belgium, and Portugal. Pension and social benefits are reduced after receiving survivor benefits in Hungary and Slovakia, and there are earning restrictions in Germany and Poland. In addition, there are eligibility differences between marriages, civil unions, and cohabitation as well as following divorce or remarriage.

There is a great need to develop a systematic categorization and more detailed indicators for survivor benefit regimes. Two dimensions of survivor benefits – coverage and generosity – are integral to the economic wellbeing of widows and widowers. Where survivor benefits are meagre and access is restricted to certain groups, for example means-based eligibility, the focus tends to lie on poverty reduction and may miss vulnerable social groups. In contrast, where survivor benefits are generous and access is universal, widows and widowers will be more likely to maintain their standard of living and it is unlikely that social groups will be neglected. *Therefore, it can be expected that the vulnerability to widowhood may be smaller in countries with more universal and generous pension and survivor benefit schemes. Moreover, social inequalities in the vulnerability to widowhood are likely smaller in countries with more universal and generous pension and survivor benefit schemes.*

4) Change over Time in the Risk and Vulnerably to Widowhood

The final project segment will assess cross-temporal change in the risks and vulnerabilities to widowhood on the individual level but also on the population level. On the individual level, this can be thought of as an extension of the cross-national comparative framework. Past change in the risk of widowhood can be attributed to temporal change in selection into marriage, divorce, and remarriage and/or life expectancy. Similarly, past change in vulnerability can be accounted for, at least in part, by reforms in pension and survivor benefit schemes. Moving to the aggregate level entails using information on the risk of widowhood and applying it to past and current population data with the ultimate goal of projecting change in the size and composition of the widowed population.

Have the risks and vulnerabilities to widowhood changed over time?

As outlined above, change in the overall risk of widowhood requires temporal change in either selection into marriage, divorce and remarriage and/or change in life expectancy. Change in social inequalities requires in addition change in differential selection and/or life expectancy across social groups. There is indeed evidence for such changes, such as an increasingly negative socioeconomic gradient in divorce (Härkönen & Dronkers, 2006) and even life expectancy (Hendi, 2015). Temporal change in the overall vulnerability to widowhood would most likely be caused by reforms in pension and survivor benefit systems, which tie access to benefits to prior labour market activity and income. This could prove to be especially detrimental for social groups that have a higher likelihood of falling into unemployment or earning low wages just above the poverty threshold. *Therefore, it could be expected that the risk of widowhood and the vulnerability to widowhood have likely increased and will likely continue to increase over time. Moreover, social*

inequalities in the risk of widowhood and the vulnerability to widowhood have likely increased and will likely continue to increase over time.

Has the size and composition of the widowed population changed over time?

One of the riskiest undertakings of this project will be to extend the cross-temporal comparisons at the individual level to the population level. A key area of demographic research – and its use beyond academia research – is population projections and forecasts. Demographers are especially interested in forecasting trends in population as well as fertility and mortality. These estimates allow societies, for example, to increase or decrease early childcare and school capacities in advance. Adaption based on population projections have numerous positive effects, such as reducing unnecessary state spending or facilitating parental, especially maternal, employment. The current state of widowhood research is not sufficiently developed to allow for forecasts or projects on how the size and composition, beyond age and sex, of the widowed population will develop in the future.

Across all ageing societies, it can be expected that the size of the widowed population will increase as larger birth cohorts, such as the so-called Baby Boomer generation, reach older age where spousal loss becomes more likely. However, whether the widowed population becomes more or less diverse in terms of the relative size of social groups depends on whether the risk of widowhood diverges or converges in the future. As outlined above, there is reason to expect that the risk of widowhood will not only increase across all social groups, but that inequalities in the risk of widowhood will grow. *Therefore, there is reason to expect that the size composition of the widowed population has and will likely continue to increase and become more diverse over time.* However, marriage rates have also been declining, which could lead to decrease in an otherwise more diverse widowed population.

Section b. Methodology

Data and Methods

An overview of the data and methods that will be used in the project, and described below, are displayed in Table 2. The methodological foundation of this project lies in the estimation of the risk of widowhood (1A) and the vulnerability to widowhood (1B). As can be seen in Table 2, the data requirements and statistical models to calculate risk and vulnerability differ starkly, and have implications for estimating social inequalities (2A and 2B) as well as country differences and change over time (3A and 3B).

Table 2: Overview of Project Data and Methods

		A) Risk of Widowhood			B) Vulnerability to Widowhood		C) Widowed Population	
		Lifetime Risk	Probability	Duration	Unexpected	Expected	Size	Composition
1	Methods	Logistic regression	Life table analysis		Propensity score matching, random coefficient modelling, regressions incl. impact functions		Autoregressive Integrated Moving Average	
	Data	Harmonized cross-sectional data (International Social Survey Programme)			Harmonized longitudinal data (Gateway to Global Ageing)		Official Statistics (e.g., Eurostat, US Census)	
2	Social inequalities	Subpopulation-specific analyses or pooled analyses included interactions						
3	Country or period differences	Country- or period- specific analyses or pooled analyses including interactions						
	Accounting for country or period differences	Random effects regressions (Variance reduction following inclusion of macro-indicators and cross-level interactions)						

1A) Life Table Analysis for the Risk of Widowhood

The measurement of the risk of widowhood is one of the most important methodological aspects of my project. My research will estimate the risk of spousal loss using three approaches reflecting the three dimensions of risk defined above. The first dimension of the risk to widowhood – the lifetime risk of widowhood – can be estimated by regressing marital status, i.e. widowed or not widowed, on age using a logistic link function on the entire sample.

The estimation of the second dimension - the probability of spousal loss conditioned on being married - involves life table analysis, commonly used to estimate life expectancy based on observed age-specific death probabilities. Various family dynamics (Andersson et al., 2017), such as the hazard of divorce by marriage duration, have also been represented using life tables. These estimates, analogous to life expectancy, are based on data that either observe transitions from marriage to divorce or have reported information on the year of marriage and year of divorce. It is relatively straightforward to estimate the probability of

widowhood by marriage duration for older adults based on data that allow the reconstruction of marriage histories, such as the 2006 wave of the European Social Survey.

However, many data sources do not include information that allow inference on either the marriage start dor end dates. A majority of sources simply record marital status, including widowhood. Therefore, this project will also build on a Bayesian extension of Sullivan's method to obtain life table distributions (see Lynch & Brown, 2010). This approach has been used to estimate subpopulation differences healthy life expectancy based in cross-sectional data that do not observe the transition from healthy to unhealthy states. This project will adapt the multistate process to estimate the life table distributions of marital status with a special focus on age variation in the probability of widowhood. Finally, the duration of widowhood will be calculated based on Goldman & Lord's (1983) formula as a function of life tables estimates on the probability that one spouse outlives the other, the mean age and period of widowhood, and life expectancy at that estimated age and period, i.e. the duration of widowhood in years.

This methodological approach facilitates a large geographic scope covering most of Europe, North America and East Asia by including a wide range of cross-sectional surveys, specifically collective International Social Survey Programme data. I will estimate risk on a lower bound, i.e. guaranteed sample, of 40 countries[5] that have enough observations across ten waves of pooled ISSP data, although the upper bound, i.e. the ambition, is to use other datasets to reach 60 countries.

1B) Matching on Event and Process for the Vulnerability to Widowhood

Next to the risk of widowhood, translating the conceptual framework for the vulnerability to widowhood into a measurement is a vital aspect of my project. To estimate vulnerability in line with the processual framework introduced above, data sources need to be relatively long-running longitudinal panels that allow the observation of the THD process as well as the widowhood event. This project will rely to a great extent on longitudinal data sources found within the Gateway to Global Ageing harmonization programme, such as the Survey of Health, Ageing, and Retirement in Europe. I will estimate risk on a lower bound, i.e. guaranteed sample, of 20 countries that have enough observations across five waves (ten years) of panel data, although the upper bound, i.e. the ambition, is to augment the observation window of other studies with retrospective information to reach 35 countries.[6]

The analytical strategy to calculate the consequences vulnerability to spousal loss will proceed in four steps (see Van Winkle & Leopold, 2022 as proof-of-concept). The first step will create an indicator variable for whether an individual experiences a widowhood event or remains married. For this split, individuals should be observed at least five years prior to spousal loss. Second, random coefficient models will be used to create an indicator variable for whether a spousal THD is present or absent in the widowed and continuously married groups. For this distinction, data from observed trajectories of spousal self-rated health across the first five years of observation will be relied upon. The presence of a spousal THD will be indicated by steeper declines in spousal self-rated health. The absence of a pre-widowhood process will be indicated by flatter declines, stable patterns, or even improvements in spousal self-rated health.

The event indicator created in the first step (event present or absent) and the process indicator created in the second step (pre-widowhood process present or absent) will empirically categorize the sample by the groups defined above in Table 1 (A, B, C, D). In a third step, propensity score matching will be used to create the two comparison groups of interest: unexpected widowhood and expected widowhood. To ensure that the matching took place before a potential THD started, the matching will be carried out at a measurement point that preceded widowhood, as observed in the widowed group, at least five years prior to spousal loss. In a fourth step, regression models including impact functions will be used to estimate the cross-sectional consequences and total vulnerability to widowhood for mental health and economic wellbeing (Ludwig & Brüderl, 2021).

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[5] Australia, Austria, Bulgaria, Canada, Chile, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Mexico, the Netherlands, New Zealand, Norway, the Philippines, Poland, Portugal, Russia, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Turkey, the United States, Venezuela

[6] The United States (Health and Retirement Study), England (English Longitudinal Study of Ageing), South Korea (Korean Longitudinal Study on Ageing), and the following countries within the Survey of Health, Ageing, and Retirement in Europe: Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Greece, Italy, the Netherlands, Sweden, Israel, the Czech Republic, Ireland (with the Irish Longitudinal Study on Ageing), Poland, Estonia, and Slovenia

2A & 2B) Estimating Social Inequalities in Risk and Vulnerability to Widowhood

After estimating the risk and vulnerability to widowhood, the foundation of my project, the first major pillar lies in investigating social inequalities. The main approach will be to conduct the statistical analyses for the risk of widowhood, e.g. logistic regression and life table analysis, and the vulnerability to widowhood, e.g. matching on process and event, separately by (1) socioeconomic status (2) race-ethnicity and nativity, and (3) social support networks. All data sources that will be used in this project will have one or more indicators for each of these three dimensions. In addition, all analyses incorporate age as a model component and estimate models separately by gender. Point estimates will be compared and conclusions on differences across groups will be drawn based on conventional criteria of statistical and social significance (Bernardi et al., 2016). An alternative approach will be to include the dimensions of social stratification in pooled models with interactions between key predictor variables. A disadvantage of this approach, however, is that other influences, such as gender and age, are then assumed to have uniform affects across social groups.

3A & 3B) Estimating and Accounting for Country and Time Differences

The second and third pillars of the project aim at describing and accounting for country differences and change across time in average risk and vulnerability as well as their social inequalities. Analogous to the estimation of social inequalities, the main approach to address the descriptive aims will be to conduct the statistical analyses for risk and vulnerability separately by country or period, or within pooled models including interactions between key predictor variables.

Multilevel modelling will being used to account for country and period differences in average risk and vulnerability as well as their social inequalities. Rather than separate analyses by country or by period, these models will pool countries or periods and analyse them in a random effects framework, e.g. based on standard simultaneous maximum likelihood estimation (e.g., Rabe-Hesketh & Skrondal, 2012) or two-step approach estimated dependent variables model (Gelman, 2017; Lewis & Linzer, 2017). Therefore it can be assessed whether the inclusion of macro-level variables reduce country- or period-random intercepts, i.e. account for differences. In addition, it can be assessed whether macro-level variables moderate country- or period-differences in social inequalities by including indicators of social stratification as random coefficient and interacting them with the relevant macro-level variables.

Two sets of country-level indicators will be included in the models. The first reflects country differences in selection into marriage, divorce, and remarriage as well as differences in life expectancy across social groups. These factors should be especially relevant when accounting for differences in the risk of widowhood. The second set of factors relates to survivor benefit schemes, which are expected to be especially relevant for country differences in the mental health and economic vulnerability to widowhood. However, current data on survivor pensions, provided either by the World Bank or by the OECD, are either not up-to-date or are too coarse for use. Therefore, this project will build on current survivor pension information to create a set of indicators that reflect important aspects, such the (1) administration, (2) financing, (3) target population, (4) benefit type, (5) duration, (6) eligibility of survivor benefits.

C) Projection Modelling for Temporal Comparisons

The final aim of my project is to estimate future change in the size and composition of the widowed population. My research will use existing data provided by national statistics agencies and apply risk parameters estimated in previous segments to generate probabilistic projections on the evolution of widowed populations across countries. Standard demographic methods will be applied, such as Autoregressive Integrated Moving Average, which are commonly used for short-term projections based on historic time series data (e.g., Keilman et al., 2002). These methods have commonly been used for population projections that have assessed compositional differences by age, sex, labour force participation, place of residence, and education, but have rarely been applied to legal marital status including widowhood (Lutz et al., 1998). One reason may be that marital status has not been seen as a relevant source of demographic heterogeneity with an impact on the dynamics of the entire population system and little societal relevance. While this may have been the case during the mid-20th century when marriage was near universal and widowhood was concentrated among older women, growing heterogeneity in family forms now certainly impacts population dynamics, such as the social stratification of widowhood, and have societal consequences.

Work Stream, Team and Management Overview

This project is divided into four work streams that are tightly intertwined and reflect the four objectives. Each work stream begins with one year to access and prepare the data as well as develop the conceptual and methodological approaches described above. In the following two years, each work stream will produce at

least four articles to be published in internationally recognized peer-reviewed journals, such as *the Journal of Marriage and Family*, *Demography*, and *Population and Development Review*. An overview of the work stream time lines and planned publications is displayed in Figure 5.

Figure 5: Overview of Work Streams and Papers

	Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WS1 Risks & Vulnerability		P1		P2		P3		P4												
WS2 Social Inequalities				P1		P2		P3		P4										
WS3 Country Differences						P1		P2		P3		P4								
WS4 Change over Time								P1		P2		P3		P4						

Work Stream 1: The Risk and Vulnerability of Widowhood
  1. A conceptual and methodological approach to the risk of widowhood
  2. Documenting cross-national differences in the risk of widowhood
  3. A conceptual and methodological approach to the vulnerability of widowhood
  4. Documenting cross-national differences in the vulnerability to widowhood

Work Stream 2: Social Inequalities in the Risk and Vulnerability to Widowhood
  1. A conceptual and methodological approach to social inequalities and the risk of widowhood
  2. Documenting cross-national differences in social inequalities in the risk of widowhood
  3. A conceptual and methodological approach to social inequalities and the vulnerability to widowhood
  4. Documenting cross-national differences in social inequalities in the vulnerability to widowhood

Work Stream 3: Country Differences in the Risk and Vulnerably to Widowhood
  1. Accounting for cross-national variation in the risk of widowhood
  2. A systematization of pension and survivor benefits schemes
  3. Accounting for cross-national variation in the vulnerability to widowhood
  4. Accounting cross-national variation in social inequalities to widowhood risk and vulnerability

Work Stream 4: Change over Time in the Risk and Vulnerably to Widowhood
  1. Change over time in the risk of widowhood
  2. Change over time in the vulnerability to widowhood
  3. Change over time in social inequalities the risk and the vulnerability to widowhood
  4. Projections on the size and composition of the widowed population across countries

I am uniquely placed and qualified to lead this project as a scholar who has conducted independent, ground-breaking and creative research. My research has focused on the interaction between family demographic processes and social inequality from a life course and comparative perspective. In my research on the complexity of family and employment life courses across European countries and cohorts (e.g., Van Winkle, 2018; Van Winkle & Fasang, 2017), I developed and published policy databases that include important information on pensions, old-age social security, and eldercare (Van Winkle, 2019; Zagel & Van Winkle, 2020). Moreover, my research has been characterized by the use of retrospective and prospective information from SHARE as well as administrative data (Pöyliö & Van Winkle, 2019; Van Winkle, 2020). Other research on individual economic and social wellbeing following family demographic processes has to date concentrated on parenthood and divorce (Van Winkle & Fasang, 2020; Van Winkle & Struffolino, 2018). I have recently extended my interests to older age and widowhood. Currently, I am PI of an ANR funded project that seeks to assess the individual and societal economic consequences of Covid-19 induced widowhood in France. Together with my experience as a PI and co-PI on numerous projects as well as my knowledge of comparative family demography and social inequality, I have the required scientific expertise and capacity to successfully execute this project.

Each work stream will employ one PhD candidate with a background in demography, sociology, or a related discipline. PhD students will be provided with funding for methods training, international conferences. An expert committee will support my team's work throughout the project. The expert committee is composed of Thomas Leopold, Professor of Methods of Empirical Social Research at the University of Cologne, for the risk and vulnerability of widowhood (WS1), Matthijs Kalmijn, Professor of Demography at the Netherlands

Interdisciplinary Demographic Institute and the University of Groningen, for social inequalities (WS2), Aart-Jan Riekhof, Senior Researcher at the Finnish Centre for Pensions, for cross-national differences (WS3), and Ridhi Kashyap, Professor of Demography and Computational Social Science at the University of Oxford, for cross-temporal change (WS4).

My project will implement a state-of-the-art open-science workflow. All data will be stored in secure storage and analytical code will be hosted on on GitHub (https://github.com/) that will be public. Before submitting manuscripts for peer-review, I will upload working papers along with my code and data to a SocArxiv project (https://osf.io/preprints/socarxiv). During the peer-review process, all analytical code will be made available to editors and reviewers. This will make all project work open, transparent and reproducible by default. All PhD's will be given data management training and team work will be conducted with open and collaborative tools.

Risk Management

While my research promises to be of great use to the social scientific community and beyond by establishing a comparative social demography of widowhood, its ambitiousness is also comes with risks. One of the greatest risks lies in the wide range of data sources and methodological approaches that need to be mastered as well as a steep learning curve for PhD students. The project timeframe could be severely impacted if there are considerable delays in data access, preparation or analysis. As each project pillar builds on the next (see Figure 5), those delays could potentially accumulate across the duration of the project.

However, I designed my project with three elements in mind to mitigate that risk. First, I have used many of the data sources that will be used in the project for other research activities (see Van Winkle, 2018, 2019 for SHARE data; Van Winkle & Conley, 2021 for HRS data; for ISSP data Zagel & Van Winkle, 2020). Therefore, I am familiar with the variables and sample sizes included and project members will be able to build on my Stata and R code that is already published on my website. Second, I have used a number of the methodological approaches that will be applied in the project (see Van Winkle, 2020 for decompositions; Van Winkle & Fasang, 2017 for multilevel modelling) and will be able to guide team members in their application. In addition, I have conducted a proof-of-concept study for the processual framework on the mental health and economic vulnerability to widowhood (see Van Winkle & Leopold, 2022). Third, each project pillar begins with one year that is entirely focused on data access and preparation as well as methodological training for project members. That means that there is ample time for team members to access and prepare data that has not yet been used and to learn new methodological approaches. In sum, I gage the risk posed by the wide range of data and methods to be low, but the potential gain to be extremely high.

Impact and Valorisation

Establishing a social demography of widowhood is both ground-breaking and ambitious with a high potential impact, yet remains feasible. While the risks are high, my project's work stream time plan, team composition and risk management strategy are designed to ensure that the main objectives will be achieved. This research project will address important challenges surrounding the consequences of population aging across numerous countries, specifically the increasing frequency of spousal loss and its consequences for individuals and societies. If successful, my project will establish a new systematic field of research that will provide scholars with the conceptual and methodological tools for the further social demographic study of widowhood. The objectives are ambitious and go beyond the state-of-the-art by introducing novel concepts and methodological approaches to the risk and vulnerability to widowhood as well as documenting social inequalities, cross-national differences and change over time. A social demography of widowhood will supplement fragmented evidence with systematic and comprehensive estimates on risk and vulnerability, provide insights into the challenges facing a growing widowed population and their family members, and facilitate new research on sustainable pension and elder care systems.

References

Aichberger, M. C., Schouler-Ocak, M., Mundt, A., Busch, M. A., Nickels, E., Heimann, H. M., Ströhle, A., Reischies, F. M., Heinz, A., & Rapp, M. A. (2010). Depression in middle-aged and older first generation migrants in Europe: Results from the Survey of Health, Ageing and Retirement in Europe (SHARE). *European Psychiatry*, *25*(8), 468–475. https://doi.org/10.1016/j.eurpsy.2009.11.009

Andersson, G., Thomson, E., & Duntava, A. (2017). Life-table representations of family dynamics in the 21st century. *Demographic Research*, *37*, 1081–1230. https://doi.org/10.4054/DemRes.2017.37.35

Angel, J. L., Jimenez, M. A., & Angel, R. J. (2007). The Economic Consequences of Widowhood for Older Minority Women. *The Gerontologist*, *47*(2), 224–234. https://doi.org/10.1093/geront/47.2.224

Arbuckle, N. W., & de Vries, B. (1995). The Long-Term Effects of Later Life Spousal and Parental Bereavement on Personal Functioning. *The Gerontologist*, *35*(5), 637–647.

Aughinbaugh, A., Robles, O., & Sun, H. (2013). *Marriage and divorce: Patterns by gender, race, and educational attainment* (Monthly Labor Review). U.S. Bureau of Labor Statistics. https://www.bls.gov/opub/mlr/2013/article/pdf/marriage-and-divorce-patterns-by-gender-race-and-educational-attainment.pdf

Barclay, K., & Kolk, M. (2019). Parity and Mortality: An Examination of Different Explanatory Mechanisms Using Data on Biological and Adoptive Parents. *European Journal of Population*, *35*(1), 63–85. https://doi.org/10.1007/s10680-018-9469-1

Bernardi, F., Chakhaia, L., & Leopold, L. (2016). 'Sing Me a Song with Social Significance': The (Mis)Use of Statistical Significance Testing in European Sociological Research. *European Sociological Review*, jcw047. https://doi.org/10.1093/esr/jcw047

Bíró, A. (2013). Adverse effects of widowhood in Europe. *Advances in Life Course Research*, *18*(1), 68–82. https://doi.org/10.1016/j.alcr.2012.10.005

Bloome, D., & Ang, S. (2020). Marriage and Union Formation in the United States: Recent Trends Across Racial Groups and Economic Backgrounds. *Demography*, *57*(5), 1753–1786. https://doi.org/10.1007/s13524-020-00910-7

Bohacek, R., Crespo, L., Mira, P., & Pijoan-Mas, J. (2015). The educational gradient in life expectancy in Europe: Preliminary evidence from SHARE. In A. Börsch-Supan, T. Kneip, H. Litwin, M. Myck, & G. Weber (Eds.), *Ageing in Europe: Supporting policies for an inclusive society* (pp. 321–330). De Gruyter.

Borjas, G. (2009). *Economic Wellbeing of the Elderly Immigrant Population* (RRC NB09-02; NBER Working Paper). National Bureau of Economic Research. https://www.nber.org/programs-projects/projects-and-centers/retirement-and-disability-research-center/center-papers/rrc-nb09-02

Bound, J., Duncan, G. J., Laren, D. S., & Oleinick, L. (1991). Poverty Dynamics in Widowhood. *Journal of Gerontology*, *46*(3), S115–S124. https://doi.org/10.1093/geronj/46.3.S115

Brickman, P. D., & Campbell, D. T. (1971). Hedonic relativism and planning the good society. In M. H. Appley (Ed.), *Adaptation-level Theory*. Academic Press.

Bures, R. M., Koropeckyj-Cox, T., & Loree, M. (2009). Childlessness, Parenthood, and Depressive Symptoms Among Middle-Aged and Older Adults. *Journal of Family Issues*, *30*(5), 670–687. https://doi.org/10.1177/0192513X08331114

Carr, D., & Springer, K. W. (2010). Advances in Families and Health Research in the 21st Century. *Journal of Marriage and Family*, *72*(3), 743–761. https://doi.org/10.1111/j.1741-3737.2010.00728.x

Carr, D., & Utz, R. (2001). Late-life widowhood in the United States: New directions in research and theory. *Ageing International*, *27*(1), 24.

Carr, D., & Utz, R. L. (2020). Families in Later Life: A Decade in Review. *Journal of Marriage and Family*, *82*(1), 346–363. https://doi.org/10.1111/jomf.12609

Chang, M.-H., Molla, M. T., Truman, B. I., Athar, H., Moonesinghe, R., & Yoon, P. W. (2015). Differences in healthy life expectancy for the US population by sex, race/ethnicity and geographic region: 2008. *Journal of Public Health*, *37*(3), 470–479. https://doi.org/10.1093/pubmed/fdu059

Choi, Y., Kim, D.-S., & Ryu, J. (2020). Marital dissolution of transnational couples in South Korea. *Journal of Ethnic and Migration Studies*, *46*(14), 3014–3039. https://doi.org/10.1080/1369183X.2019.1585021

Coelho, A., & Barbosa, A. (2017). Family Anticipatory Grief: An Integrative Literature Review. *American Journal of Hospice and Palliative Medicine®*, *34*(8), 774–785. https://doi.org/10.1177/1049909116647960

Diener, E., Lucas, R. E., & Scollon, C. N. (2009). Beyond the Hedonic Treadmill: Revising the Adaptation Theory of Well-Being. In E. Diener (Ed.), *The Science of Well-Being: The Collected Works of Ed Diener* (pp. 103–118). Springer Netherlands. https://doi.org/10.1007/978-90-481-2350-6_5

Domingue, B. W., Duncan, L., Harrati, A., & Belsky, D. W. (2021). Short-Term Mental Health Sequelae of Bereavement Predict Long-Term Physical Health Decline in Older Adults: U.S. Health and Retirement Study Analysis. *The Journals of Gerontology: Series B*, *76*(6), 1231–1240. https://doi.org/10.1093/geronb/gbaa044

Donnelly, R., Umberson, D., & Pudrovska, T. (2020). Family Member Death and Subjective Life Expectancy Among Black and White Older Adults. *Journal of Aging and Health*, *32*(3–4), 143–153. https://doi.org/10.1177/0898264318809798

Dupre, M. E., Gu, D., & Vaupel, J. W. (2012). Survival Differences among Native-Born and Foreign-Born Older Adults in the United States. *PLoS ONE*, *7*(5), e37177. https://doi.org/10.1371/journal.pone.0037177

Elwert, F., & Christakis, N. A. (2006). Widowhood and Race. *American Sociological Review*, *71*(1), 16–41. https://doi.org/10.1177/000312240607100102

Gelman, A. (2017). Two-Stage Regression and Multilevel Modeling: A Commentary. *Political Analysis*, *13*(4), 459–461. https://doi.org/10.1093/pan/mpi032

Gillen, M., & Kim, H. (2009). Older Women and Poverty Transition: Consequences of Income Source Changes From Widowhood. *Journal of Applied Gerontology*, *28*(3), 320–341. https://doi.org/10.1177/0733464808326953

Goldman, N., & Lord, G. (1983). Sex differences in life cycle measures of widowhood. *Demography*, *20*(2), 177–195. https://doi.org/10.2307/2061234

Ha, J.-H. (2008). Changes in Support From Confidants, Children, and Friends Following Widowhood. *Journal of Marriage and Family*, *70*(2), 306–318. https://doi.org/10.1111/j.1741-3737.2008.00483.x

Härkönen, J., & Dronkers, J. (2006). Stability and Change in the Educational Gradient of Divorce. A Comparison of Seventeen Countries. *European Sociological Review*, *22*(5), 501–517. https://doi.org/10.1093/esr/jcl011

Haveman, R., Holden, K., & Wilson, K. (2003). Social security, age of retirement, and economic well-being: Intertemporal and demographic patterns among retired-worker beneficiaries. *Social Security*, *40*(2), 26.

Headey, B. (2008). Life Goals Matter to Happiness: A Revision of Set-Point Theory. *Social Indicators Research*, *86*(2), 213–231. https://doi.org/10.1007/s11205-007-9138-y

Hendi, A. S. (2015). Trends in U.S. life expectancy gradients: The role of changing educational composition. *International Journal of Epidemiology*, *44*(3), 946–955. https://doi.org/10.1093/ije/dyv062

Hendi, A. S. (2017). Trends in Education-Specific Life Expectancy, Data Quality, and Shifting Education Distributions: A Note on Recent Research. *Demography*, *54*(3), 1203–1213. https://doi.org/10.1007/s13524-017-0574-2

Hungerford, T. L. (2001). The Economic Consequences of Widowhood on Elderly Women in the United States and Germany. *The Gerontologist*, *41*(1), 103–110. https://doi.org/10.1093/geront/41.1.103

James, E. (2009). *Rethinking Survivor Benefits* (p. 85). World Bank.

Kalmijn, M. (2013). The Educational Gradient in Marriage: A Comparison of 25 European Countries. *Demography*, *50*(4), 1499–1520. https://doi.org/10.1007/s13524-013-0229-x

Keene, J. R., & Prokos, A. H. (2008). Widowhood and the end of spousal care-giving: Relief or wear and tear? *Ageing and Society*, *28*(4), 551–570. https://doi.org/10.1017/S0144686X07006654

Keilman, N., Pham, D. Q., & Hetland, A. (2002). Why population forecasts should be probabilistic—Illustrated by the case of Norway. *Demographic Research*, *6*, 409–454.

Kristiansen, C. B., Kjær, J. N., Hjorth, P., Andersen, K., & Prina, A. M. (2019). The association of time since spousal loss and depression in widowhood: A systematic review and meta-analysis. *Social Psychiatry and Psychiatric Epidemiology*, *54*(7), 781–792. https://doi.org/10.1007/s00127-019-01680-3

Lewis, J. B., & Linzer, D. A. (2017). Estimating Regression Models in Which the Dependent Variable Is Based on Estimates. *Political Analysis*, *13*(4), 345–364. https://doi.org/10.1093/pan/mpi026

Liu, H., Umberson, D., & Xu, M. (2020). Widowhood and mortality: Gender, race/ethnicity, and the role of economic resources. *Annals of Epidemiology*, *45*, 69-75.e1. https://doi.org/10.1016/j.annepidem.2020.02.006

Ludwig, V., & Brüderl, J. (2021). What You Need to Know When Estimating Impact Functions with Panel Data for Demographic Research. *Comparative Population Studies*, *46*. https://doi.org/10.12765/CPoS-2021-16

Lutz, W., Goujon, A., & Doblhammer-Reiter, G. (1998). Demographic Dimensions in Forecasting: Adding Education to Age and Sex. *Population and Development Review*, *24*, 42–58. https://doi.org/10.2307/2808050

Lynch, S. M., & Brown, J. S. (2010). Obtaining multistate life table distributions for highly refined subpopulations from cross-sectional data: A bayesian extension of sullivan's method. *Demography*, *47*(4), 1053–1077. https://doi.org/10.1007/BF03213739

Martikainen, P., & Valkonen, T. (1998). Do Education and Income Buffer the Effects of Death of Spouse on Mortality? *Epidemiology*, *9*(5), 530–534.

Matysiak, A., Styrc, M., & Vignoli, D. (2014). The educational gradient in marital disruption: A meta-analysis of European research findings. *Population Studies*, *68*(2), 197–215. https://doi.org/10.1080/00324728.2013.856459

Mayol-García, Y., Gurrentz, B., & Kreider, R. M. (2021). *Number, Timing, and Duration of Marriages and Divorces: 2016* (No. P70-167; Current Population Reports, p. 34). US Census Bureau. https://www.census.gov/content/dam/Census/library/publications/2021/demo/p70-167.pdf

Milewski, N., & Kulu, H. (2014). Mixed Marriages in Germany: A High Risk of Divorce for Immigrant-Native Couples. *European Journal of Population*, *30*(1), 89–113. https://doi.org/10.1007/s10680-013-9298-1

Modig, K., Talbäck, M., Torssander, J., & Ahlbom, A. (2017). Payback time? Influence of having children on mortality in old age. *Journal of Epidemiology and Community Health*, *71*(5), 424–430. https://doi.org/10.1136/jech-2016-207857

Morgan, L. A. (1981). Economic Change at Mid-Life Widowhood: A Longitudinal Analysis. *Journal of Marriage and the Family*, *43*(4), 899. https://doi.org/10.2307/351346

Mullan, J. (1992). The Bereaved Caregiver: A Prospective Study of Changes in Wellbeing. *The Gerontologist*, *32*(5), 673–683.

Nicholas, L. H., & Baum, M. Y. (2019). Wills, public policy, and financial well-being among surviving spouses. *The Journal of the Economics of Ageing*, 100211. https://doi.org/10.1016/j.jeoa.2019.100211

O'Neil, K., & Tienda, M. (2015). Age at Immigration and the Incomes of Older Immigrants, 1994–2010. *The Journals of Gerontology: Series B*, *70*(2), 291–302. https://doi.org/10.1093/geronb/gbu075

Rabe-Hesketh, S., & Skrondal, A. (2012). *Multilevel and Longitudinal Modeling Using Stata: Continuous Responses, Third Edition* (3rd ed., Issue vol. 1). Stata Press.

Raphael, B., Minkov, C., & Dobson, M. (2001). Psychotherapeutic and pharmacological intervention for bereaved persons. In *Handbook of bereavement research: Consequences, coping, and care* (pp. 587–612). American Psychological Association. https://doi.org/10.1037/10436-025

Reus-Pons, M., Kibele, E. U. B., & Janssen, F. (2017). Differences in healthy life expectancy between older migrants and non-migrants in three European countries over time. *International Journal of Public Health*, *62*(5), 531–540. https://doi.org/10.1007/s00038-017-0949-6

Sasson, I. (2016). Trends in Life Expectancy and Lifespan Variation by Educational Attainment: United States, 1990–2010. *Demography*, *53*(2), 269–293. https://doi.org/10.1007/s13524-015-0453-7

Sevak, P. (2004). The Economic Consequences of a Husband's Death: Evidence from the HRS and AHEAD. *Social Security Bulletin*, *65*(3), 14.

Soloman, R. L., & Corbit, J. D. (1974). An opponent-process theory of motivation: I. Temporal dynamics of affect. *Psychological Review*, *81*(2), 119–145.

Spence, N. J., Adkins, D. E., & Dupre, M. E. (2011). Racial Differences in Depression Trajectories among Older Women: Socioeconomic, Family, and Health Influences. *Journal of Health and Social Behavior*, *52*(4), 444–459. https://doi.org/10.1177/0022146511410432

Stroebe, M., Schut, H., & Stroebe, W. (2007). Health outcomes of bereavement. *The Lancet*, *370*(9603), 1960–1973. https://doi.org/10.1016/S0140-6736(07)61816-9

Suanet, B., & Bras, H. (2014). Sibling Position and Marriage Timing in the Netherlands, 1840–1922: A Comparison across Social Classes, Local Contexts, and Time. *Journal of Family History*, *39*(2), 126–139. https://doi.org/10.1177/0363199013506986

Umberson, D. (2017). Black Deaths Matter: Race, Relationship Loss, and Effects on Survivors. *Journal of Health and Social Behavior*, *58*(4), 405–420. https://doi.org/10.1177/0022146517739317

Utz, R. L., Caserta, M., & Lund, D. (2012). Grief, Depressive Symptoms, and Physical Health Among Recently Bereaved Spouses. *The Gerontologist*, *52*(4), 460–471. https://doi.org/10.1093/geront/gnr110

Vable, A. M., Subramanian, S. V., Rist, P. M., & Glymour, M. M. (2015). Does the "Widowhood Effect" Precede Spousal Bereavement? Results from a Nationally Representative Sample of Older Adults. *The American Journal of Geriatric Psychiatry*, *23*(3), 283–292. https://doi.org/10.1016/j.jagp.2014.05.004

van Scheppingen, M. A., & Leopold, T. (2019). Trajectories of life satisfaction before, upon, and after divorce: Evidence from a new matching approach. *Journal of Personality and Social Psychology*. https://doi.org/10.1037/pspp0000270

Van Winkle, Z. (2018). Family Trajectories Across Time and Space: Increasing Complexity in Family Life Courses in Europe? *Demography*, *55*(1), 135–164. https://doi.org/10.1007/s13524-017-0628-5

Van Winkle, Z. (2019). Family Polices and Family Life Course Complexity across 20th Century Europe. *Journal of European Social Policy*, *0*(0), 1–19. https://doi.org/10.1177/0958928719880508

Van Winkle, Z. (2020). Early Family Life Course Standardization in Sweden: The Role of Compositional Change. *European Journal of Population*. https://doi.org/10.1007/s10680-019-09551-y

Van Winkle, Z., & Conley, D. (2021). Genome-Wide Heritability Estimates of Family Life Course Complexity. *Demography*.

Van Winkle, Z., & Fasang, A. E. (2017). Complexity in Employment Life Courses in Europe in the Twentieth Century—Large Cross-National Differences but Little Change across Birth Cohorts. *Social Forces*, *96*(1), 1–30. https://doi.org/10.1093/sf/sox032

Van Winkle, Z., & Leopold, T. (2021). Family Size and the Persistency of Poverty following Divorce: The United States in Comparative Perspective. *Social Science Research*.

Van Winkle, Z., & Leopold, T. (2022). *The Cost of Widowhood: A Matching Study of Process and Event*. SocArXiv. https://doi.org/10.31235/osf.io/t8jef

Van Winkle, Z., & Monden, C. (2021). Family Size and Parental Wealth: The Role of Family Transfers in Europe. *European Journal of Population*.

Vartanian, T. P., & McNamara, J. M. (2002). Older Women in Poverty: The Impact of Midlife Factors. *Journal of Marriage and Family*, *64*(2), 532–548. https://doi.org/10.1111/j.1741-3737.2002.00532.x

Wiik, K. A. (2022). First union formation among the children of immigrants: A population-wide study in Norway. *Advances in Life Course Research*, *52*, 100480. https://doi.org/10.1016/j.alcr.2022.100480

Williams, B. R., Sawyer, P., Roseman, J. M., & Allman, R. M. (2008). Marital Status and Health: Exploring Pre-Widowhood. *Journal of Palliative Medicine*, *11*(6), 848–856. https://doi.org/10.1089/jpm.2007.0190

Yap, S. C. Y., Anusic, I., & Lucas, R. E. (2012). Does personality moderate reaction and adaptation to major life events? Evidence from the British Household Panel Survey. *Journal of Research in Personality*, *46*(5), 477–488. https://doi.org/10.1016/j.jrp.2012.05.005

Zagel, H., & Van Winkle, Z. (2020). Women's Family and Employment Life Courses Across Twentieth-Century Europe: The Role of Policies and Norms. *Social Politics: International Studies in Gender, State & Society*, *jxz056*. https://doi.org/10.1093/sp/jxz056

Zhang, Z., & Hayward, M. D. (2001). Childlessness and the Psychological Well-Being of Older Persons. *The Journals of Gerontology: Series B*, *56*(5), S311–S320. https://doi.org/10.1093/geronb/56.5.S311