

The Co-twin Control Method for Assessing the Effect of Widowhood on Mortality

*Analisi dell'Effetto della Vedovanza sul Rischio di Morte
attraverso le Coppie di Gemelli Dissimili rispetto allo Stato Civile*

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Riassunto: Lo studio si è proposto di valutare la relazione tra perdita del partner e rischio di morte attraverso un metodo di analisi estremamente potente (*co-twin control method*). Il data set utilizzato è costituito dalle coppie di gemelli danesi ultrasettantenni intervistate tra il 1995 e il 2001 durante il Longitudinal Study of Ageing Danish Twins. La forza del co-twin control method consiste nel confrontare il rischio di morte dei gemelli che hanno perso il coniuge durante il periodo di partecipazione al panel con il rischio di morte dei gemelli ancora coniugati. Lo studio ha dimostrato che nel breve periodo dopo la morte del coniuge i gemelli vedovi hanno un rischio di morte significativamente più alto dei gemelli ancora coniugati. Tale effetto risulta particolarmente pronunciato per i gemelli di sesso maschile.

Keywords: elderly twin pairs, short and long-term widowhood, survival analysis

1. Introduction

In this study we aim to assess the causal effect of widowhood by time spent in bereavement through the *co-twin control method* (Kaprio 1994), which is one of the most powerful designs for carrying out matched control analyses. This purpose comes from the observation that, although it is well known that widowed people have higher mortality rates than the married persons of the same age, there are conflicting findings about the mortality risk by bereaved time after the loss. While some studies have found that the risk of dying after the spousal loss is more marked in the first months or years after the loss (Bowling, 1987), other studies report both short-term and long-term excess mortality (Mellsrom et al., 1981). On the one hand, it seems that the stressful event may precipitate the onset of physical disorders. On the other hand, the unhealthy behaviours taken after the spousal loss can accumulate their effects over time contributing to an increased risk even in the long-term.

With regard to gender differences, generally studies find that men suffer greater health deterioration after conjugal bereavement and that they exhibit higher mortality risk during the mourning process (Helsing & Szklo, 1981). However, other studies have found an increased mortality risk also for women until 1 year after the loss (Schefer et al., 1995).

The ambiguity in the effects of widowhood may depend on the difficulties in accessing good control groups. Especially at very old ages it is difficult, in fact, to find data set composed by persons very similar. The co-twin control method is one of the best possible types of control group since it is based on identical and fraternal twins same sex. It follows that persons in the data set have not only lived the same event (the marriage), but they are also identical for age and gender and they shared the family history and related cultural heritage until they left the parental home. In addition, monozygotic twins enhance the power of the method as they allow us to control for the genetic limits of life span, which represent a substantial confounding factor in studies on old people.

Specifically, the study aims to verify whether widowed twins have a risk of dying higher than their still married co-twins in the short-period, in the long-term period or independently from the time since spousal loss. Additionally, we want to assess these effects by sex.

2. Data

The data used in our study come from the Longitudinal Study of Ageing Danish Twins (LSADT), a panel survey based on the Danish Twin Registry. The Danish Twin Registry was established in 1954 as the first nationwide twin registry in the world and includes all twin pairs born in Denmark between 1870 and 1910 and all same-sex pairs born between 1911 and 1930 (Christensen et al. 1999; Christensen 2001).

LSADT began in 1995, by including all cooperating twins aged 75 and over on January 1995, regardless of whether the co-twin was still alive. The assessment was repeated in 1997, 1999 and 2001, by including respondents at previous surveys as well as new samples of younger twins. LSADT-1997 included an additional sample of twins aged 73 and 76 at time of interview whereas from 1999 the assessment was also performed by twins aged 70 years old and over.

The sample, including identical and fraternal twins same sex (Table 1), was composed of single twins (i.e. twins whose co-twin was either dead or did not participate to the follow-up) or by two-twin in a pair (i.e. intact pairs).

Table 1: *Sample by zygosity and waves. LSADT from 1995 to 2001.*

Waves	MZ twins	DZ twins	All twins
LSADT-1995	764	1383	2147
LSADT-1997	696	1301	1459
LSADT-1999	931	1682	921
LSADT-2001	855	1560	639

3. Method

To perform the co-twin control design, we selected the pairs where both twins participated to the LSADT in order to have information on two-twin's marital status. Afterwards, we selected the twin pairs discordant for marital status, namely the pairs where one of the two-twin was married and the other was either long-term or short-term

widowed at the same questionnaire occasion. The long-term bereaved were already widowed when the follow-up started, the short-term bereaved became widowed during the follow-up. In the first case, the start time point was represented by the beginning of the follow-up. In the latter case, it was represented by the survey date when one of the two-twin was recorded as widowed.

Table 2 lists the number of discordant twin pairs selected across the Longitudinal Study of Aging Danish Twins. Overall, the data set was composed by 262 pairs (i.e. 524 individuals).

Table 2: *Twin pairs by zygosity selected for the co-twin control method.*

Start time point	MZ twin pairs	DZ twin pairs	All twin pairs
LSADT-1995	63	67	130
LSADT-1997	19	31	50
LSADT-1999	35	47	82
Total	117	145	262

Regarding the gender, the sample included 87 male twin pairs (i.e. 174 individuals) and 175 female twin pairs (i.e. 350 individuals) (Table 3).

Table 3: *Twin pairs by sex selected for the co-twin control method.*

Start time point	Male twin pairs	Female twin pairs
LSADT-1995	47	83
LSADT-1997	14	36
LSADT-1999	26	56
Total	87	175

Once selected the sample, we applied techniques of survival analysis. In particular, we applied the Gompertz model that proved to be the best fitting model to the observed survival curve.

4. Results

The causal effect of widowhood by time spent in bereavement has been analysed for the whole sample first and then for males and females separately.

Table 4 shows the hazard estimates from the co-twin control analyses. We observe that the short-term widowed have a risk of dying significantly higher than their still married co-twins. On the other hand, results for the long-term widowed suggest that if the bereaved twins survived after becoming widowed, their risk of dying is actually lower than the risk for the still married co-twins. The change from the higher to lower risk when time goes by since bereavement might be explained with the theory that stressful life events impair the immune system and increase susceptibility to infection and disease. This effect might be responsible for the immediate rise in the risk of death after widowhood. We could also explain the reduction in death risk for long-term widowed

by saying that the bereavement accelerates deaths that otherwise would occur at a later date.

With respect to gender differences, the coefficients for the time since bereavement are significant only for men. This result suggests that the spousal bereavement is more important for men, who are more vulnerable to the selection process after losing the partner.

In conclusion, our research findings suggest that losing the partner is a risk factor for old male twins. This result appears intriguing, as an event in life course seems to make a difference in terms of mortality risk among persons very similar. We must underline, however, that the sample size lead us to be cautious in generalising these results.

Table 4: *Gompertz model. Co-twin method for spousal bereavement.*

	Models		
	All twins	Male twins	Female twins
	β	β	β
Constant	-5.91	-5.68	-5.90
Male (vs. Female)	0.41**	-	-
Age 80+ (vs. Age75-79)	0.66***	0.62**	0.69***
Long-term widowed (vs. Co-twins married)	-0.81*	-1.12**	-0.04
Short-term widowed (vs. Co-twins married)	0.90**	1.65***	-0.18
Fair Health (vs. Good Health)	0.40	0.49	0.42
Bad Health (vs. Good Health)	1.45**	1.43***	1.43***
χ^2	45.09	28.53	21.98
df	6	5	5

Sample size: 524.

Source: LSADT 1995-2001.

*** p < 0.01 level, ** p < 0.05 level, * p < 0.1 level.

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