

Estimating healthcare expenditures after becoming divorced or widowed using propensity score matching

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Session IV - Room 13, 1st floor

Theme: Healthcare expenditure

Chair: Erik Koffijberg

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Outline

1. **Introduction**
2. **Data and Methods**
3. **Results**
4. **Conclusions**

Background

- Marital status has been found to a significant predictor in many studies on healthcare expenditure.
- Divorce and the death of a spouse are ranked as the most stressful life events (Social Readjustment Scale of Holmes and Rahe) and may result in a series of negative events (e.g. higher chance of depression).

Background

- Marital status has been found to a significant predictor in many studies on healthcare expenditure.
- Divorce and the death of a spouse are ranked as the most stressful life events (Social Readjustment Scale of Holmes and Rahe) and may result in a series of negative events (e.g. higher chance of depression).
- Mixed findings on the impact of **widowhood/divorce** on **healthcare utilisation/expenditure** have been found in the literature:
 - Increases healthcare utilisation/expenditure;
 - Decreases well-being but has no impact on healthcare expenditure;
 - Smaller impact of becoming divorced compared to widowed after controlling for age
- The role of *socio-economic status* is still unclear (e.g. wealth may positively affect widowers' mental health, but not widows').

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- **Primary:** explore differences in **healthcare expenditures** between individuals whose marriages have been dissolved and **matched** individuals who remained married.
- **Secondary:** gain more insight into the relationship between **becoming divorced/widowed** and **healthcare expenditure**.
 - 1 Differences between recent change in marital status and long-term divorce/widowhood;
 - 2 Differences between divorce/widowhood;
 - 3 The variation by age and socio-economic status, the effect of remarriage, the attribution of specific types of care

Data

- **Target population:** Individual level **healthcare claims data** (health insurance companies) and *socio-demographics* (personal records database and system of social-statistical files) for the population aged 25-79 in the Netherlands who married at least once.
- **Research group:** "**recently divorced/widowed**" - individuals who remarried once (2014-2017) and "**long-term divorced/widowed**" - no change in marital status after divorce/widowhood (2009-2017).
- **Control group:** - "**long-term married**" - no change in marital status after marriage (2009-2017).

Measures

- **Healthcare expenditure:** sum of total healthcare expenditures in euros for 2014 to 2017 covered by mandatory health insurance (e.g. medical care, home care, hospitalisation).
- **Marital status change:** annually registered marital status, operationalised as married (statutory marriage & registered partnership) divorced or widowed.
- **Matching variables:** age (five-year categories); sex (male/female); highest education (low, low-moderate, moderate-high, high-moderate, high); household income 2013 (quintiles); healthcare expenditures 2012 (euros)

Methods: Propensity Score Matching (PSM)

- **Objective:** Reduce any pre-existing differences in *individual characteristics* between **divorced/widowed** and **married individuals**.
- **Matching:** *One-to-one nearest neighbour PSM without replacement* based on age, sex, household income in 2013, highest education for 2013 and healthcare expenditures in 2012.

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- **Objective:** Reduce any pre-existing differences in *individual characteristics* between **divorced/widowed** and **married individuals**.
- **Matching:** *One-to-one nearest neighbour PSM without replacement* based on age, sex, household income in 2013, highest education for 2013 and healthcare expenditures in 2012.
- **Main statistical analysis:** *Generalised linear models (GLMs)* with gamma distribution and log link fitted to matched sample (differences in healthcare expenditures in rate ratios).
- **Additional analyses:** stratified analyses, separate analyses by type of expenditures by means of *two-stage model* (logistic regression + GLM) due to many individuals having no spending for some types of care.

Study population

- **Data cleaning:** Nearly 4 million individuals excluded because outside age range or with incomplete data on income/education:
 - "recently divorced" (n=29,873), "recently widowed" (n=7,202), "long-term divorced" (n=382,825), "long-term widowed" (n=50,001), "long-term married" (n=1,951,805).
 - After PSM n=469,901 individuals "long-term married" kept.
- **EDA:**
 - Women were more likely to experience a change in marital status, especially widowhood ($\approx 69\text{-}76\%$);
 - Divorced individuals were more likely to remarry within four years after marital dissolution than widowed individuals (12.5% vs 4.5%);
 - All widowed/divorced groups had higher mean sum of total healthcare expenditures (€9459 – €14544) than matched married group (€7948 – €12822).

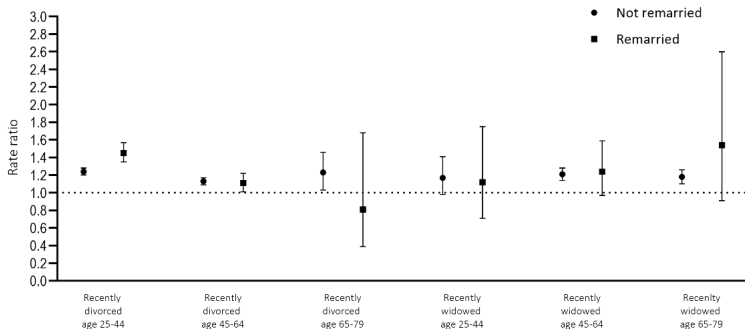
Main Analysis: impact of becoming widowed/divorced

Table: Rate ratios (and 95% CI) of sum of total healthcare expenditures for the research vs control groups by age.

	Age 25-44		Age 45-64		Age 65-79	
	RR	95% CI	RR	95% CI	RR	95% CI
Full sample	1.27	(1.26;1.29)	1.20	(1.20;1.21)	1.12	(1.11;1.14)
Recently widowed/divorced	1.26	(1.23;1.30)	1.15	(1.12;1.18)	1.19	(1.12;1.26)
Recently divorced	1.27	(1.23;1.31)	1.13	(1.09;1.16)	1.20	(1.01;1.42)
Recently widowed	1.17	(0.99;1.38)	1.21	(1.14;1.28)	1.18	(1.11;1.27)
Long-term widowed/divorced	1.28	(1.26;1.29)	1.21	(1.20;1.22)	1.12	(1.10;1.13)
Long-term divorced	1.28	(1.26;1.29)	1.21	(1.21;1.22)	1.12	(1.10;1.14)
Long-term widowed	1.24	(1.14;1.34)	1.14	(1.12;1.17)	1.12	(1.10;1.15)

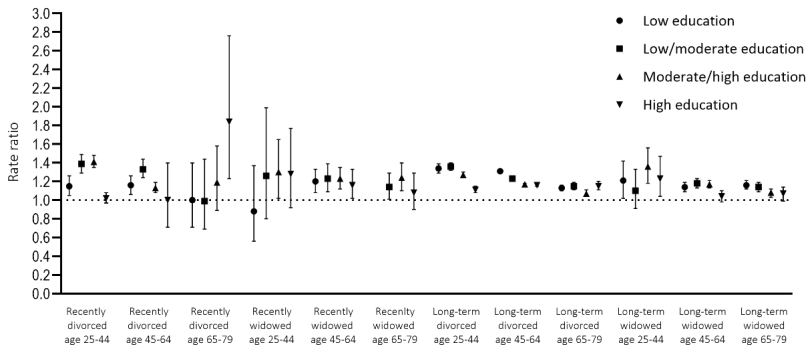
- No consistent differences were observed between divorce/widowhood but were greatest among the youngest people.

Additional Analysis: the role of remarriage



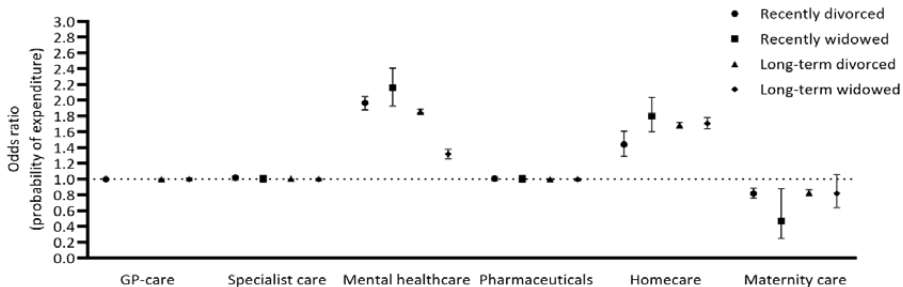
- Only divorced people aged 25-44 who remarried were associated with higher RR compared to those who did not.

Additional Analysis: the role of education



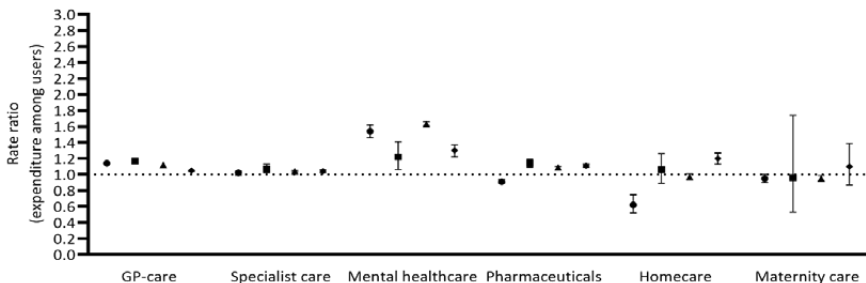
- No consistent gradient/variation in the differences between research and control group.
- Highly educated people had generally the smallest difference.

Additional Analysis: OR of using care



- Higher probability of mental health/home care use, a lower probability of maternity care use.
- No difference in GP-care, specialist care and pharmaceuticals.

Additional Analysis: RR of those using care



- Higher mental healthcare expenditures.
- Long-term groups had higher RR for GP and pharmaceuticals.
- Recently divorced had lower RR for homecare and pharmaceuticals.

Discussion

- **Main analysis:** the study found that individuals who have been **divorced/widowed** have consistently higher (12-27%) healthcare expenditures than individuals who **remained married** .

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- **Main analysis:** the study found that individuals who have been **divorced/widowed** have consistently higher (12-27%) healthcare expenditures than individuals who **remained married** .
- **Secondary analyses:**
 - No differences between divorce/widowhood or recent/long-term marriage loss status.
 - Differences in healthcare expenditures between research and control group did not increase with **age** (25-79).
 - No differences in healthcare expenditures associated with **remarriage** .
 - Healthcare expenditure generally higher for research compared to control group across **all income** and **educational levels** .
 - Differences may be due to higher probability of **mental healthcare** and **home care use** and a higher expenditures on **mental healthcare** conditional on use.

Discussion

• Pros

- Large registry data with PSM to limit the chance of a "selection effect".
- A comprehensive overview of healthcare expenditure after marital dissolution.
- Guideline for policy and further research (e.g. focus on poor mental health to reduce health expenditures).

• Cons

- Limited number of matching variables (5) does not control for many possible confounders (e.g. ethnicity).
- Exclusion of long-term care expenditures may underestimate differences between age groups.
- Large proportion of data (50%) not used because not available at most disaggregated level – **possible bias due to missing values**.
- Exclusion of individuals who died within 4/7 years after marital dissolution may underestimate health expenditures in last years of life.

Comments & Feedback

- Overall a really nice job!

- A very interesting and well-written paper, easy to follow and which provides a valid research and policy contribution - **good stuff!!!**

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- A couple of clarifications

- PSM and plotting/summary done in R but statistical analysis in SPSS ?
- For some type of care analyses (appendix) there was insufficient power to fit the model ? was this due to the splitting of the dataset in 1) complete cases; 2) different sub-strata; 3) zeros vs non-zeros HE?
- Lots of data "discarded" because of incompleteness: was missingness creating problems mostly in the outcome (e.g. HE for a type of care) or in the covariates (e.g. education/income)?
- I would assume long-term care (e.g. nursing and personal) expenses could be informative of changes in HE between the groups, especially among the oldest. Were these included?

Comments & Feedback

• Comments and suggestions

- 1-1 PSM is the standard approach but here causes large losses of data. Have you consider more than 1-1 matching? or perhaps even **Inverse Probability Weighting** (IPW) to retain more observed data?
- GLM - gamma with log-link. In some sub-analyses small positive values may make computation hard on the log scale. Did you encounter such problems compared to, say, using an identity link?
- Two-step models do not distinguish true from false zeros. If caused by different processes then better to combine the two steps via 2-mixture models to obtain aggregated results (**hurdle models**)
- Possible bias due to missingness is a potential serious problem. Why not checking which variables substantially associated with missing outcome data (e.g. logistic regression) and include these into the model to make **MAR more plausible**?
- I would perform at least some **sensitivity analysis** to missing data assumptions: IPW, MI or even best-worst case scenarios.