Supplementary Material

Japanese National Dementia Plan Is Associated with a Small Shift in Location of Death: An Interrupted Time Series Analysis

Jandoc methodological [1] and reporting recommendations for interrupted time series studies

Title and abstract

1. Indicate the study design (interrupted time series) in the title or abstract.

Japanese national dementia plan is associated with a small shift in location of death: An Interrupted Time Series Analysis

Introduction

2. Background/rationale

Provide background regarding the intervention and setting under investigation to support the study rationale and methods

Japan has the highest proportion of hospital deaths in the world. It is well known that hospitalization is highly detrimental to persons with dementia and extremely stressful for informal caregivers. Japan implemented in April 2013 a five-year national dementia plan, the Orange Plan, aimed to maximize time in the community for persons with dementia.

3. Objectives

    (a) State specific objectives and any pre-specified hypotheses

The aim of this study is to evaluate whether the Orange Plan is associated with a decrease in hospitals deaths for persons with dementia.

(b) Distinguish between primary and secondary objectives.

N/A

Methods

4. Intervention

Define the intervention time point(s) used in the analysis.

In an ITS outcome data is taken from regularly spaced intervals and is divided by an interruption point, in this case the introduction of the National Dementia Orange plan implementation on April 1, 2013.

5. Participants

(a) List eligibility criteria and methods of selection

All older Japanese adults 65 year and older

(b) Define subgroups

ICD10, tenth revision, codes for dementia; Dementia in Alzheimer's disease: F00.0, F00.1, F00.2, F00.9; Vascular dementia: F01.0, F01.1, F01.2, F01.3, F01.8, F01.9; Dementia in other diseases classified elsewhere F02.0, F02.1, F02.2, F02.3, F02.4, F02.8; Unspecified dementia F03; Alzheimer disease G30.0, G30.1, G30.8, G30.9

(c) Consider including a comparison group not exposed to the intervention as a secondary group of Participants

No comparison group available

6. Data sources and measurement

    (a) List data source(s)

This population-based study used death certificate data from the entire Japanese population, collected by vital statistics Japan. The data included monthly repeated cross-sectional, national aggregated data on location of death of the Japanese population 65 year and over.

    (b) Comment on data completeness, validity, and changes in data coverage over time

The data was anonymized and publicly available, repeated cross-sectional, national aggregated data on location of death (hospital, nursing home, home, elsewhere). The data covered the entire Japanese population over 65 years and older.

7. Variables

    (a) Define all variables

_ Outcome variable(s)

The primary outcome variable was location of death based on the death certificate categorized by hospital (reference category), nursing home, home, and elsewhere.

_ Descriptive and stratifying variable(s)

Explanatory variables included a *Time* variable in cumulative quarters, a *Reform* dummy variable coded as 0 pre-reform period and 1 as post-reform period, calendar quarters as a categorical variable to control for seasonality and sex as a covariate.

    (b) Comment on change in variable coding over time

N/A

(c) Consider including details of variable coding in supplemental material, for example, appendix or research Web site

N/A

8. *Statistical methods*

    (a) Report all statistical methods

_ Study time intervals, for example, monthly, quarterly

quarterly

_ Regression model, for example, ARIMA, linear, segmented

Multinomial logistic regression model

_ Number of pre-intervention, post-intervention, and between intervention data points

Pre-intervention points: 21

Post-intervention points: 19

No between intervention points

    (b) Indicate how autocorrelation, non-stationarity, and seasonality were tested and handled

Calendar quarters were included as a categorical variable in the model to account for seasonality

    (c) Consider a lag period if intervention effects are gradual or delayed

The time point of the reforms was set immediately after the reforms (enacted on April 1, 2013).

    (d) Define and distinguish between primary and secondary or sensitivity analyses

We conducted sensitivity analysis on adjustment for seasonality by including calendar months, yearly quarters, and Fourier terms (sine cosine functions).

    (e) Consider use of comparison outcome(s) and/or population(s) not exposed to the intervention(s) as secondary analyses.

No comparison group available

(f) Report statistical software used for analysis.

Stata version 16 was used for all analyses.

RESULTS

9. Participants

(a) Report the number of individuals and/or observations in each group analyzed.

Dementia was the registered underlying cause of death for 149,638 individuals during the study period. Before the Orange Plan introduction, the average proportions by location of death were hospital 54.9%, nursing home 21.7%, home 12.1%, and elsewhere 11.3%. Post-implementation, the average proportions by location of death were hospital 50.0%, nursing home 26.7%, home 10.9%, and elsewhere 12.4%. Table one presents yearly unadjusted ratios of location of death. N/A

(b) Describe characteristics and indicate missing data.

We have no info on missing data, data consisted of total Japanese population >65 years.

10. Outcome data

(a) Report the number of outcomes examined over the study period.

149,638 deaths over the study period

(b) Report the average, minimum, and maximum number of outcomes across time intervals.

Average, minimum, and maximum ranges per quarter were 17045, 257 to 126625.

(c) Report on data variability

NA

(d) Comment on outliers and ceiling or floor effects where relevant

N/A

11. Main results

(a) Present results using a graphical display with intervention time point(s) clearly defined.

See Fig. 1.

(b) Consider including forecasted results graphically.

We did not provide counterfactual in the figure.

(c) Report absolute and/or relative change(s) and their significance, for example, clinical or
policy and statistical.

Pre-reform estimates indicated, compared to hospital deaths, a relative increase in death in
nursing homes (aRRR 1.08, 95% CI 1.06-1.09, p<0.001) and elsewhere (aRRR 1.07, 95% CI
1.05-1.10, p<0.001) (Fig. 1 and Table 2). There was no significant pre-reform change in dying at
home. After the implementation of the Orange Plan, an acceleration (increased slope) in nursing
home deaths (aRRR 1.08, 95% CI 1.07-1.08, p<0.001) and death elsewhere (aRRR 1.05, 95% CI
1.05-1.06, p<0.001) occurred over time. There was no significant slope change for home death.
Females compared to males were more likely to die in nursing home (aRRR 2.84, 95% CI 2.76-
2.92, p<0.001), home (aRRR 1.52, 95% CI 1.47-1.58, p<0.001), and elsewhere (aRRR 2.21,
95% CI 2.13-2.30, p<0.001) than in hospital.

12. Other analyses

Report additional results (secondary and sensitivity analyses) in the article, appendix, or research
Web site

N/A

Discussion

13. Key results

Summarize key results with reference to study objectives.

This study provides evidence that the Orange Plan is associated with a small increase in death for persons with dementia in nursing homes and elsewhere compared to hospital. We did not find a significant change over time in home deaths compared to hospital deaths. Hospital remained the primary location of death for persons with dementia.

14. *Context*

(a) Provide context related to possible confounding

_ Discuss relevant co-interventions that occurred during the study period.

N/A

_ Comment on the stability of participant characteristics over time

Limitations include death certificates underestimating the number of deaths from dementia.

_ Comment on the stability of outcome coding over time

N/A

   (d) Discuss results of comparison analyses or provide a rationale if no comparison group was

     considered.

N/A

15. Limitations

(a) Discuss limitations of the study.

There was no data available from death certificates if persons transferred location short before their death. Also, no sociodemographic and health related factors were included in the analysis as these were not available.

(b) Comment on data variability and appropriateness of the number of data points

10 years of quarterly data, resulting in 40 data points.

(c) Comment on ceiling or floor effects and outliers where relevant.

N/A

16. Interpretation

Provide overall interpretation of results considering objectives, limitations, results from similar studies, and other relevant evidence.

The Orange Plan was characterized by enabling persons with dementia to maximize their time in the community. However, the reform included few end-of-life strategies. Results of this study show that the Orange Plan had a modest effect on location of death in persons with dementia, as proportions of hospital death slightly decreased, moving towards death in nursing home and elsewhere, while proportions of home death remained relatively unchanged. This may imply that end-of-life strategies in national dementia policy must be expanded to extend time in the community until death.

Other information

17. Funding

List funding source(s) and role of funders

18. References

Reference methodological articles that support statistical methods used

Bernal JL, Cummins S, Gasparrini A (2017) Interrupted time series regression for the evaluation of public health interventions: a tutorial. *Int J Epidemiol* **46**, 348-355.

REFERENCE

[1]   Jandoc R, Burden AM, Mamdani M, Lévesque LE, Cadarette SM (2015) Interrupted time series analysis in drug utilization research is increasing: systematic review and recommendations. *J Clin Epidemiol* **68**, 950-956.