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Predicting mortality based on the database combining health and long-term care: An indicator of quality in community integrated care systems

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Preferred presentation method: Poster Display

Are you a first time presenter at an ISQua Conference?: Yes

Have you presented this abstract at an ISQua Conference before?: No

Objectives: This study aims to establish a model to predict mortality of community-dwelling older adults who receive long-term care (LTC) and healthcare services as an outcome quality indicator.

Methods: In a retrospective cohort study, the authors extracted data from all subjects 65 years and older with history of using LTC services between October 2010 and September 2011 in Kyoto prefecture, Japan. Subjects were tracked until September 2014. LTC insurance and National Healthcare Insurance claims data were used to identify enrollees' illnesses and days of hospitalization during the registration period, and the newly diagnosed disease and LTC use in the baseline month of October 2010. RandomForest was used to measure the accuracy of the diagnosed illness and the newly diagnosed disease. A Kaplan-Meier survival analysis was conducted to examine number of days before death. Cox regression models were used to examine the effects of newly diagnosed disease on death adjusted by sex, age, illness in the past one year, living alone, days of hospitalization, and LTC usage in October 2011.

Results: The mean follow-up duration was 959 days for all subjects, 962 days for subjects without newly diagnosed disease, and 696 days for subjects with newly diagnosed disease in October 2011. Male, older age, higher care needs level, more than 3 weeks' facility care service use in October 2011, and longer hospitalization days during the year before the registration month were statistically significant regarding mortality of older adults. Living alone showed a negative relationship to death. Except for acute myocardial infarction and femur fracture, all other illnesses during the year before the registration month were related to older adults' mortality. Cancer during the year before the registration month was the strongest predictor of mortality in subjects, followed by kidney failure, diabetes mellitus, pneumonia, heart failure, pneumonitis due to inhalation of food and vomit, and dementia. Additionally, receiving general anesthesia during the past one year before the registration month was negatively related to death. Among all newly diagnosed diseases, bronchus or lung cancer showed the highest hazard ratio (HR: 8.59, 95% C.I.:5.64-

13.09), followed by liver cancer; stomach or sigmoid colon or rectum cancer; pneumonitis due to inhalation of food and vomit; pneumonia; heart failure; and cerebral infarction. Cancers were the most prevalent causes of death regardless of previous year or newly diagnosed illness. The C-statistic of the model was higher than 0.7. Male, older age, higher care needs level, more than 3 weeks' facility care service in October 2011, longer hospitalization days during the year before the registration month, presence of cancer, and newly diagnosed diseases were associated with a higher risk of death over a 3-year period. Among newly diagnosed diseases, cancer had a higher impact on death compared to other variables, especially bronchus or lung cancer. A proper assessment and screening to identify the problems or factors affecting LTC users' health conditions is important, as newly diagnosed diseases showed the influence on mortality prediction given the relatively short life expectancy of LTC users once they were diagnosed with new diseases.

Conclusion: This study established a model to predict mortality with high accuracy. After removing service use variables such as LTC and healthcare use from the model, risk-adjusted mortality in each region can be calculated as an outcome quality indicator of community integrated care systems.

Predicting mortality based on the database combining health and long-term care: An indicator of quality in community integrated care systems

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Objective

This study aims to establish a model to predict mortality of community-dwelling older adults who receive long-term care (LTC) and healthcare services as an outcome quality indicator.

Participants

- In a retrospective cohort study, the authors extracted data from all subjects 65 years and older with history of using LTC services between October 2010 and September 2011 in Kyoto prefecture, Japan.
- Subjects were tracked until September 2014. LTC insurance and National Healthcare Insurance claims data were used to identify enrollees' illnesses and days of hospitalization during the registration period, and the newly diagnosed disease and LTC use in the baseline month of October 2011.

Data Analysis

- RandomForest was used to measure the importance related to mortality of the diagnosed illness and the newly diagnosed disease.
- A Kaplan-Meier survival analysis was conducted to examine number of days before death.
- Cox regression models were used to examine the effects of newly diagnosed disease on death adjusted by sex, age, illness in the past one year, living alone, days of hospitalization, and LTC use categories in October 2011.

Results

- 84,417 samples were analyzed.
- The mean follow-up duration was 959 days for all subjects, 962 days for subjects without newly diagnosed disease, and 696 days for subjects with newly diagnosed disease in October 2011.
- Male, older age, higher care needs level, more than 3 weeks' facility care service in October 2011, longer hospitalization days during the year before the registration month, presence of cancer, and newly diagnosed diseases were associated with a higher risk of death over a 3-year period.
- Living alone showed a negative relationship to death.
- Except for acute myocardial infarction and femur fracture, all other illnesses during the year before the registration month were related to older adults' mortality. Cancer during the year before the registration month was the strongest predictor of mortality in subjects, followed by kidney failure, diabetes mellitus, pneumonia, heart failure, pneumonitis due to inhalation of food and vomit, and dementia. Additionally, receiving general anesthesia during the past one year before the registration month was negatively related to death.
- Among all newly diagnosed diseases, bronchus or lung cancer showed the highest hazard ratio, followed by liver cancer; Colorectal (stomach or sigmoid colon or rectum) cancer; Aspiration pneumonitis (due to inhalation of food and vomit); pneumonia; heart failure; and cerebral infarction. Cancers were the most prevalent causes of death regardless of previous year or newly diagnosed illness.
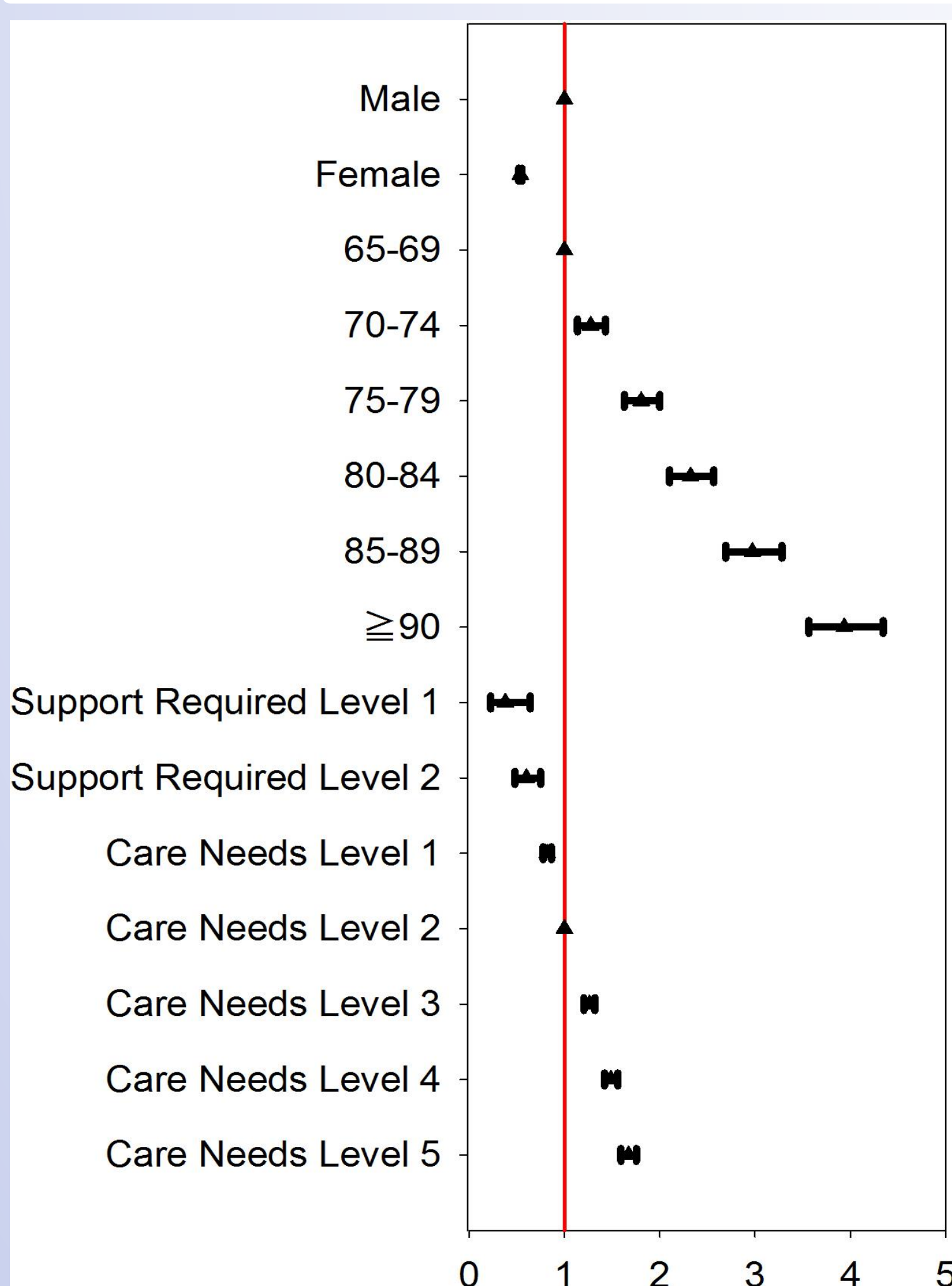- The C-statistic of the model was 0.727 (95% confidence interval: 0.723-0.731).

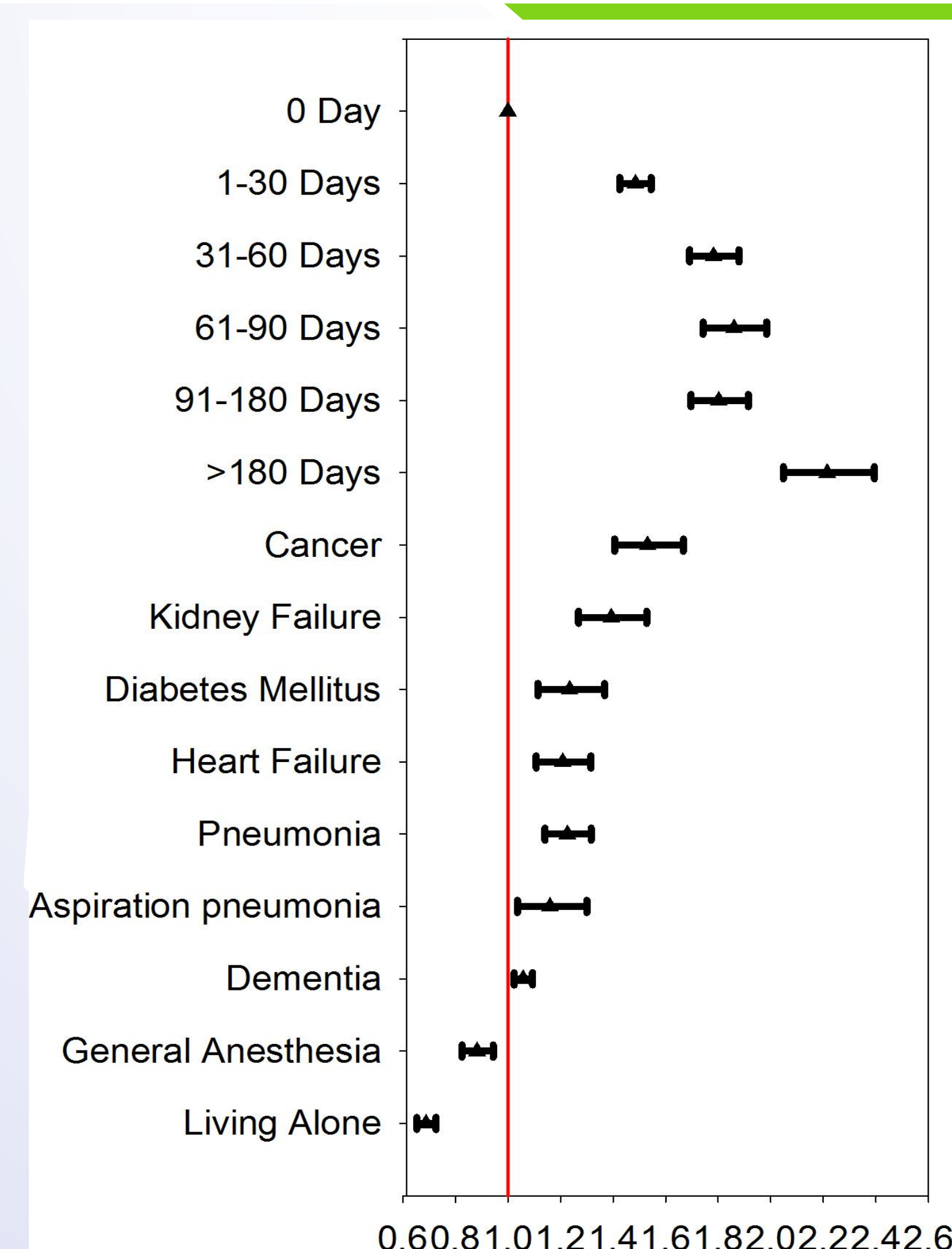Fig 1. Odds Ratio of characteristics in October 2011.

Fig 2. Odds Ratio of factors between October 2010 and September 2011.
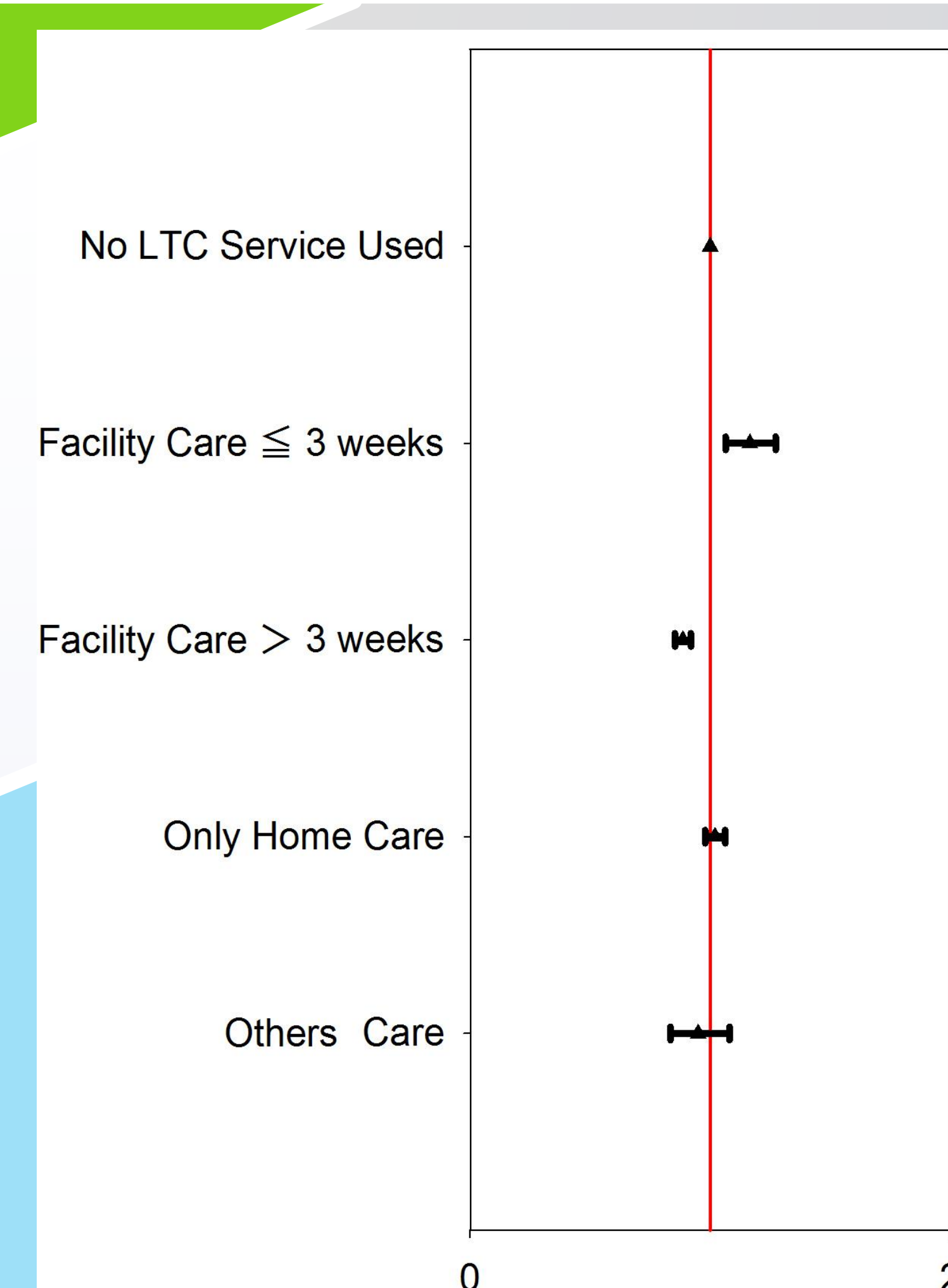
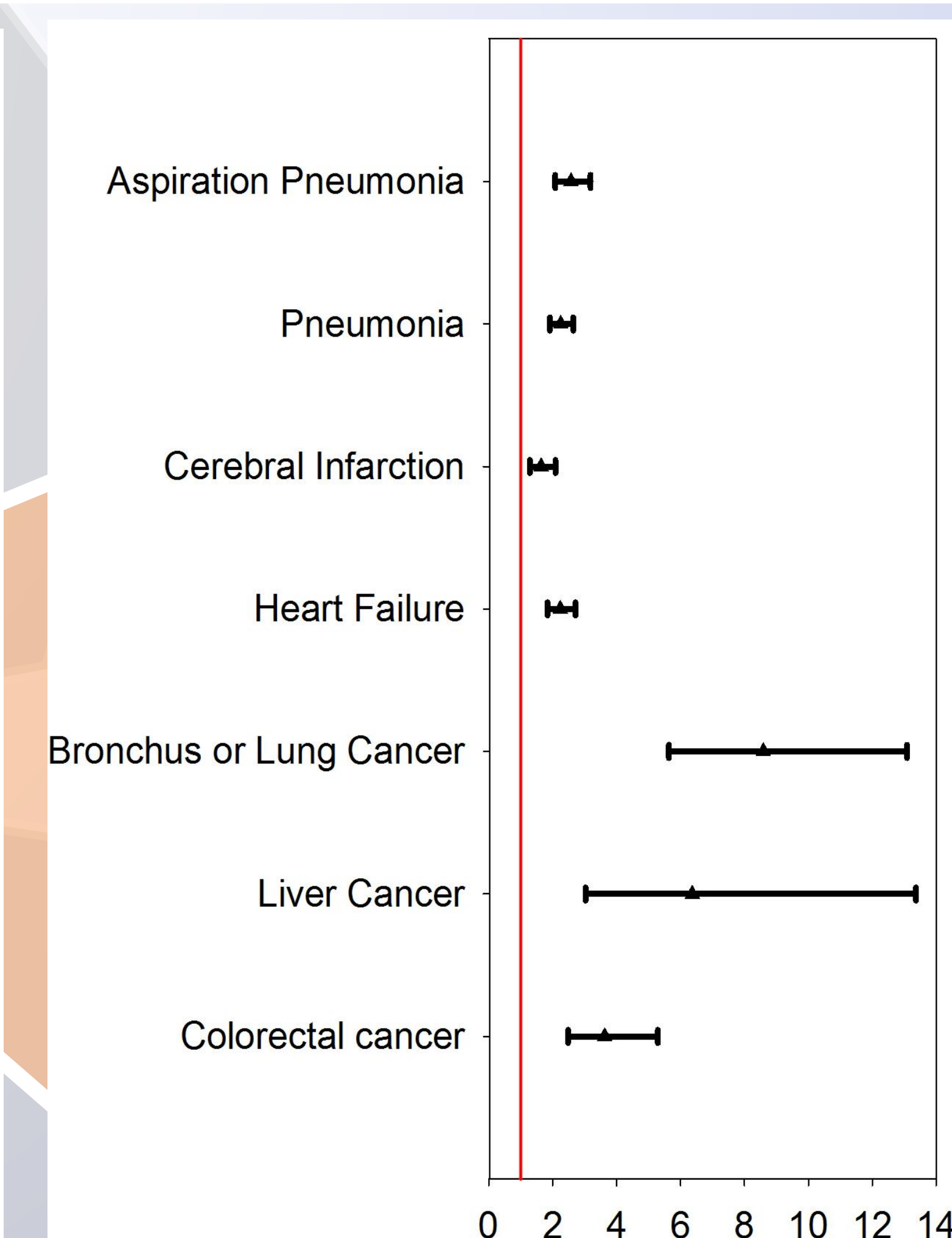Fig 3. Odds Ratio of LTC service used in October 2011.

Fig 4. Odds Ratio of newly diagnosed disease in October 2011.

Discussion

- Since higher care needs level would indicate lower ADL, our result was in line with former study which implied ADL associated with death[1].
- The trend of days of hospitalization was same to former study that longer length of hospitalization days may imply older and had more comorbidities to increase risk of mortality[2].
- This study demonstrated predthat cancer, pneumonia, heart failure, and cerebral infarction of newly diagnosed disease were related to mortality. Previous study indicates that cardiovascular disease, cancer, diabetes mellitus and dementia lead to shorter survival in older adults [3]. We found that even the ranking of diseases were different, community-dwelling older adults and LTC users were suffered from the same diseases related to death.
- The average length of stay for facility care was longer than 1 year [4], facility care service used no more than 3 weeks would imply to discharge.

Conclusion

- This study established a model to predict mortality of community-dwelling older adults with high accuracy.
- After removing service use variables such as LTC and healthcare use from the model, risk-adjusted mortality in each region can be calculated as an outcome quality indicator of community integrated care systems.

Reference

1. Sung, K., *Predictive Factors associated with Death of Elderly in Nursing Homes.* Asian Nursing Research, 2014. **8**(2): p. 143-149.
2. Sud, M., et al., *Associations Between Short or Long Length of Stay and 30-Day Readmission and Mortality in Hospitalized Patients With Heart Failure.* JACC Heart Fail, 2017. **5**(8): p. 578-588.
3. Prince, M.J., et al., *The burden of disease in older people and implications for health policy and practice.* Lancet, 2015. **385**(9967): p. 549-62.
4. Department Minister's Secretariat of Social Statistics Division Statistics and Information. *Survey of Institutions and Establishments for Long-term Care for 2016.* 2016 [cited 2018 5th September]; Available from: https://www.mhlw.go.jp/english/database/db-hss/dl/siel-2016-02.pdf.

Conflict of Interest (COI)