Modelling the Episodes of Care for IDA Patients in a Secondary Care Centre Using Continuous- Time Multistate Markov Chain

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Introduction:

Despite the high prevalence of gastro-intestinal (GI) cancer in iron deficiency anaemia (IDA), some IDA patients do not complete all the necessary GI investigations at the initial referral due to informed patient preference, concurrent illness, or major co-morbidity including frailty. As a result, existing cancers are diagnosed at a later referral with worse prognosis. The potential to detect GI cancer early depends on minimizing the delay time spent between the two consecutive referrals, where a patient did not complete investigations at the first referral, but at the second is diagnosed with positive GI cancer. This retrospective longitudinal study aims to highlight the proper methods to model these referrals.

Methods:

Using anonymised data of 168 episodes of care for IDA patients at an IDA clinic that was established under the supervision of the Gastroenterology Department at General Hospital, continuous-time multi-state Markov chain is employed to determine the transition rates between three observed states for IDA patients at the IDA clinic; "incomplete investigations", "negative GI cancer", and "positive GI cancer" and to estimate the delay time.

Results:

Once in the state of incomplete investigations, an estimated mean delay time of 3.1 years (95% CI: 1.2, 5) is spent before being diagnosed with positive GI cancer. The probability that the "positive GI diagnosis" is next after the state of "incomplete investigation" is 0.17 (95% CI: 0.03, 0.54) compared with 11% (95% CI: 0.02,0.39) when it is followed the state of negative GI cancer. The survival rate of IDA patients with negative GI diagnosis is always higher than those with incomplete investigations (Figure 1). Finally, being diagnosed with positive GI cancer is always preceded by the prediction of being considered "very high risk" at the earlier visit.
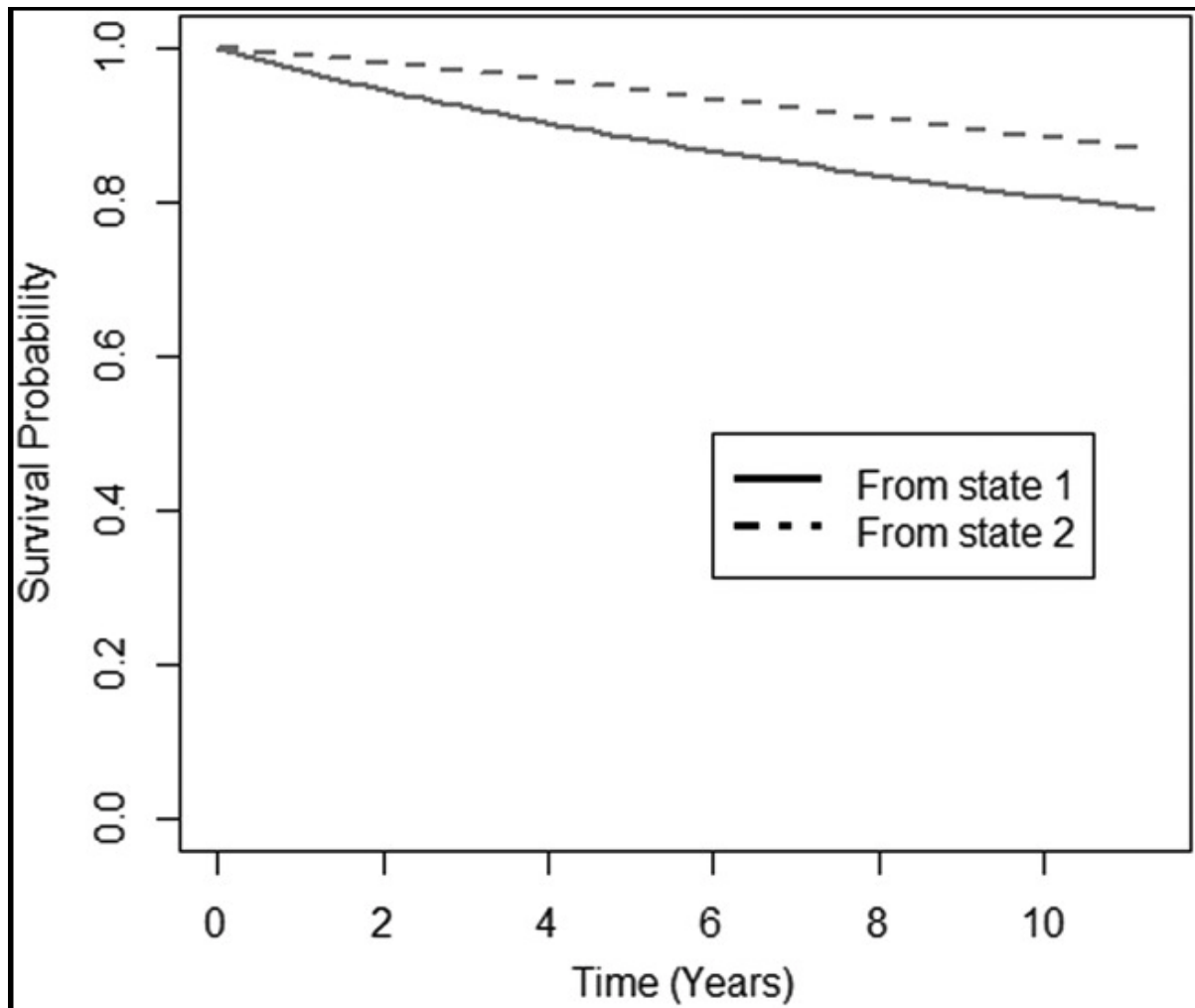
Figure 1. Survival plot. Survival is defined as not being in the state of "positive GI cancer". State 1 means being observed with incomplete investigations. state 2 means being observed with negative GI cancer.

Conclusion:

A baseline model was developed to represent episodes of care for IDA patients at a secondary care centre. The suggested methodology in this study can be used in the future to help policy makers establishing what is the maximum delay time, a confirmed IDA patient, should not be allowed to stay in before investigated for GI cancer, and what are the measures that could be put in place to reduce this time.