Centre for Epidemiology & Biostatistics
Leeds Institute of Genetics, Health & Therapeutics

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Using Clinical Attendance Patterns to Define Cancer Survivorship (Colorectal Cancer, Hodgkin's Lymphoma and Multiple Myeloma) in England

[1]Katie Harris (k.harris@leeds.ac.uk), [1]H Nai, [2]J Wells, [2]T Welchman, [3]J Flynn ,[3] J Richie -Campbell, [4]D Forman , [2]A Woolmore, [5]K Edwards

[1]Division of Biostatistics, Centre for Epidemiology & Biostatistics, University of Leeds, LIGHT, Leeds, UK. [2]Monitor Group, London, UK. [3]Macmillan, UK. [4]IARC, France. [5]School of Clinical Sciences, University of Nottingham

Background

The population of cancer survivors is growing. This is due to a rise in cases of cancer and a reduction in deaths. It is necessary therefore to investigate and understand the needs of this growing population.

Our study considers the pattern of and reasons for service usage, to reflect the lives of patients beyond a diagnosis of cancer. The patterns of clinical attendance ('NHS footprints') are determined for a population of survivors, thus enabling 'types' of cancer survivor to be described. Three distinct cancer sites are examined; Colorectal Cancer, Hodgkin's Lymphoma and Multiple Myeloma.

Data

Data for this study has been sourced from the National Cancer Intelligence Network hosted National Cancer Data Repository, linking Cancer Registry data with inpatient Hospital Episodes Statistics (HES). Patients included in this study were diagnosed in England with Colorectal Cancer in Q2 2001, and Hodgkin's Lymphoma and Multiple Myeloma in 2001 and 2002. Data from these patients has been extracted from the period April 1997 until March 2009. This allows for pre and post diagnosis information to be included in the analysis.

Methodology

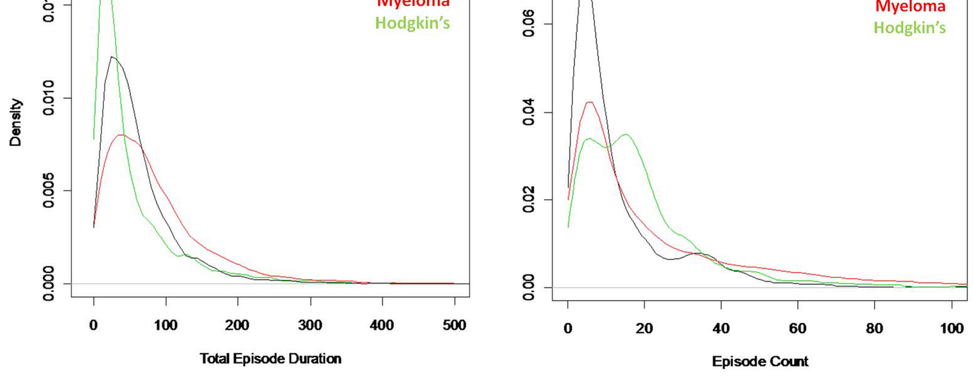
The count, duration and interval of each patients' inpatient hospital episodes are used to define 'NHS footprint'. Differences between cancer sites were explored by fitting density and scatter plots to the data for each cancer site separately.

Patterns of cancer survivors (for each site) were explored using cluster analysis. Cluster analysis partitions the patients (data) into groups. The patients in this study are described by a set of variables of interest (listed below). Clusters of patients are formed whereby individuals in a cluster are alike in some respect and different from those individuals in other clusters. A major advantage of cluster analysis is that no prior knowledge is assumed of the number of clusters or what clusters may exist.

Variables of interest

The clusters are defined by a combination of demographic, treatment and clinical characteristics. Also included are a number of outcomes of concern to this patient group. The outcomes were determined by the project team and a group of clinical experts and derived from the ICD10 codes provided in HES.

- **Demographic –** Age at diagnosis, Sex
- **Clinical –** Total episode count, Total episode duration, Mean interval between epiosdes , Survival days, Emergency admission 6 months prior to diagnosis, Stage (Colorectal only)
- **Treatment –** Chemotherapy, Radiotherapy, Surgery (Colorectal only)
- **Outcomes –** Dead/Alive, No cancer related inpatient activity for 12 months, Cardiovascular problems, Intestinal problems, Infection, Renal problems, Metastatic cancer, Other primary cancer



Both distributions for total episode duration (left) and count (right) are skewed to the right with very long tails representing the few patients with large count and duration. The graphs show that patients with Hodgkin's typically have more frequent shorter episodes, whereas Myeloma patients have fewer longer episodes.

Cluster Analysis – Results

The characteristics of each cancer site were further explored using cluster analysis. The optimum number of clusters was determined by considering a balance of statistical fit , interpretability and clinical meaning. After due consideration 5 clusters was deemed optimum for Colorectal, 3 clusters for Myeloma and 2 clusters for Hodgkin's.

The time a patient survived following a cancer diagnosis is the most important characteristic which defines the clusters for all cancer sites. This is illustrated for Colorectal cancer in the boxplot below. .

Within the Colorectal clusters females generally had a better outcome compared with males. Patients who survived longest tended to experience fewer hospital episodes and shorter stays than those who died in the range 1 to 5 years. The patients alive more than 5 years were younger at diagnosis and presented at an early stage.

Typically surgery was the choice of treatment for patients who lived 1-3 years post diagnosis and a combination of radiotherapy and chemotherapy for the patients alive post 5 years.

There were no significant features in relation to the outcomes in the models for colorectal cancer, however patients with Myeloma surviving 1 to 2 years post diagnosis experienced many of the outcomes (secondary cancer and cardiovascular and renal problems). The patients alive post 5 years with Myeloma generally did not experience acquired morbidities.

The major distinction between the Hodgkin's groups is that older patients at diagnosis (median age 70) had poorer survival than those who were younger at diagnosis (median age 48). Patients in the poor survival group had significantly shorter duration in hospital than those who lived more than 5 years, though no difference in the number of visits. The boxplots of duration (left) and count (right) illustrate these features.

Conclusions and future prospects

This study uses the valuable resource of Cancer Registry and HES data to determine groups of cancer survivors. Assessing differences in cancer survivors may facilitate identification of a variety of support requirements for this population, as well as identifying associated adverse events.

A future aim is to generalise these methodologies for all cancer sites. Furthermore, General Practice and HES outpatient data would be a useful additional resource for this project . Inclusion of GP and outpatient episodes would be informative about other levels of care.

Acknowledgments

Many thanks go to staff at NYCRIS and Cancer Epidemiology Group, University of Leeds, in particular Dr. Eva Morris, Mr. James Thomas and Professor John Wilkinson. Valuable discussions with clinical experts in the fields of colorectal and haematological cancer, in particular Dr. Alastair Munro, Dr. Steven Oliver and Dr. Hamish Ross. Thanks also go to colleagues at NCIN and GPRD.

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