

Harmonization of routine care data from hospitals in the Digital Oncology Network for Europe (DigiONE) into Observational Medical Outcomes Partnership (OMOP) databases reveals changes in the number of new primary cancers diagnosed and 12-month survival during COVID-19 lockdowns

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Background:

The curation, standardization, and harmonization of routine care data across hospitals is a challenging task due to its often unstructured, incomplete, and dissimilar nature. Harmonizing data across research centers is crucial for enabling a variety of oncology analyses and enhancing the overall reliability of the data. As part of the DigiONE project, data from five hospitals was harmonized into OMOP databases, which were used to conduct a proof-of-concept study to examine the impact of COVID-19 on new cancer diagnoses, encompassing the period before the pandemic, during peak lockdowns, and the subsequent recovery phases.

Methods:

Five academic, public, and general oncology treating DigiONE hospitals transformed a core dataset from their electronic medical records (EMR), called the Minimal Essential Description of Cancer (MEDOC), into local OMOP databases to establish the first pan-cancer European hospital OMOP network for federated analysis¹. Patients with a diagnosis from one of 11 cancer groups

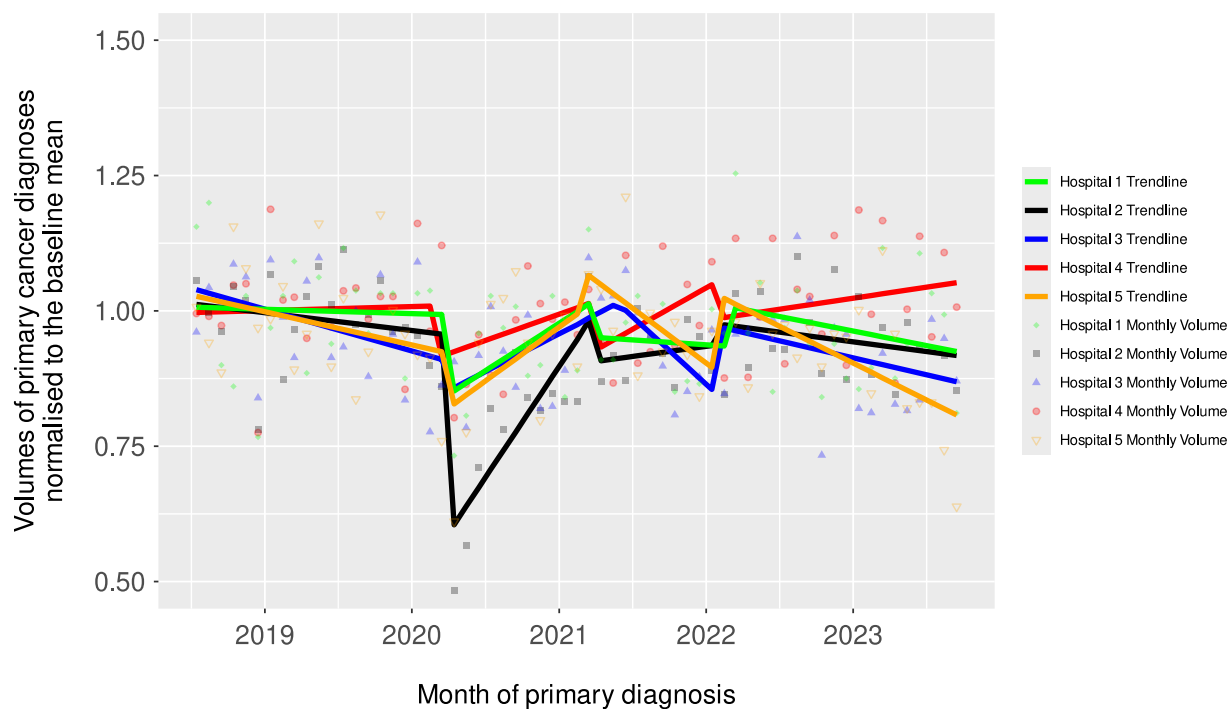
(breast, prostate, lung, colorectal, upper gastrointestinal, hematological, gynecological, head and neck, non-prostate urological, melanoma, brain) between July 2018 and September 2023 were eligible for this study. The number of new diagnoses by cancer group, sex, and age at index date were described by month of diagnosis. 12-month survival was described for patients with a 12-month follow up opportunity and grouped into three-month cohorts (quarterly) based on index date. Interrupted time-series analysis using generalized least squares was applied to assess changes in the volume of cancer diagnoses at each center as well as overall as a network for each cancer group. Given the variation in lockdown start and end dates between countries, the country-specific dates of transition from baseline to hard lockdowns, limited restrictions and no restrictions were set as the three intervention points. Due to high variation across countries in the lesser restriction start dates, network-level analysis only considered two intervention points, from baseline to lockdown (encompassing hard lockdown and lesser restrictions) and no restrictions.

Results:

The overall cohort size across the five DigiONE hospitals was 124,682 patients, of which 50.13% were male and the average age at index date was 63.9 years. There is variation in hospital sizes, with a fourfold difference in the average number of study eligible primary cancers diagnosed monthly between the smallest hospital and the largest hospital, diagnosing a monthly average of 172 patients and 763 patients, respectively.

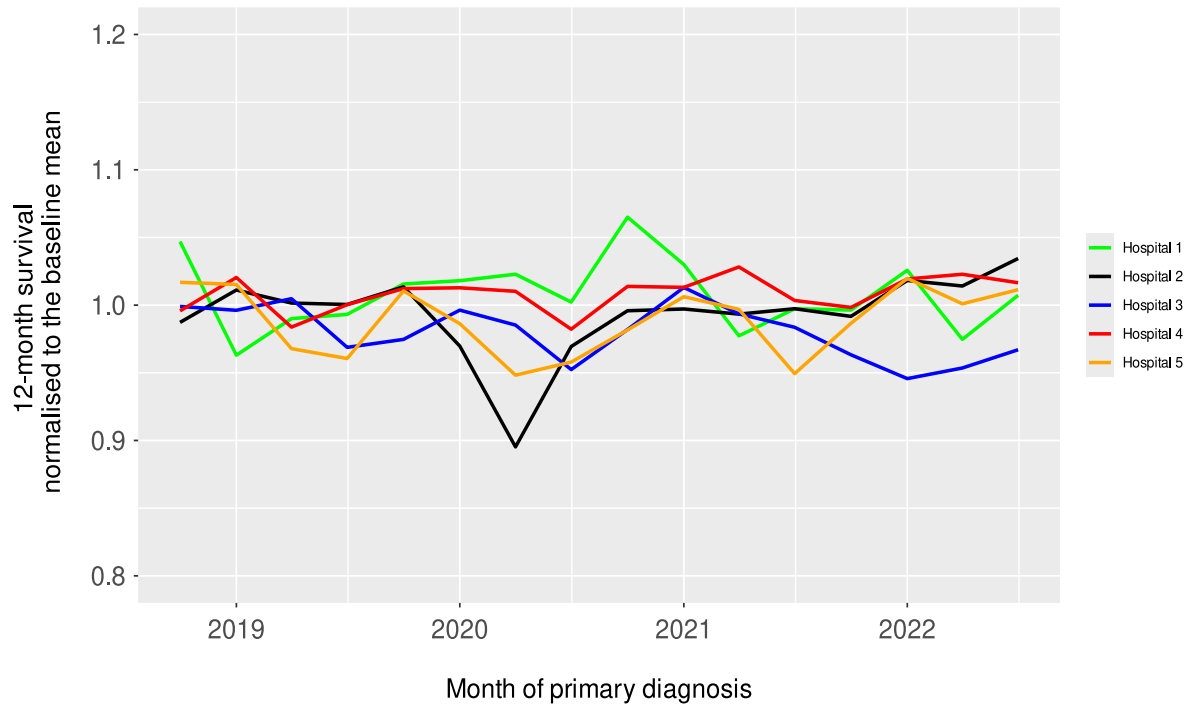
In the region of all five participating hospitals, substantial restrictions for most citizens ('hard lockdown') were implemented in March 2020. Hospitals 1 – 4 showed a statistically significant decline in the volumes of primary cancers diagnosed each month from baseline to hard lockdowns. Hospitals 2 and 4 also showed a statistically significant step change moving from hard lockdown to lesser restrictions between end of March to mid-April 2021 (**Figure 1**).

Figure 1: Change in monthly volumes of primary cancers (diagnoses from Jul 2018 to Sep 2023), normalized to baseline mean (Jul 2018 to Jun 2019).



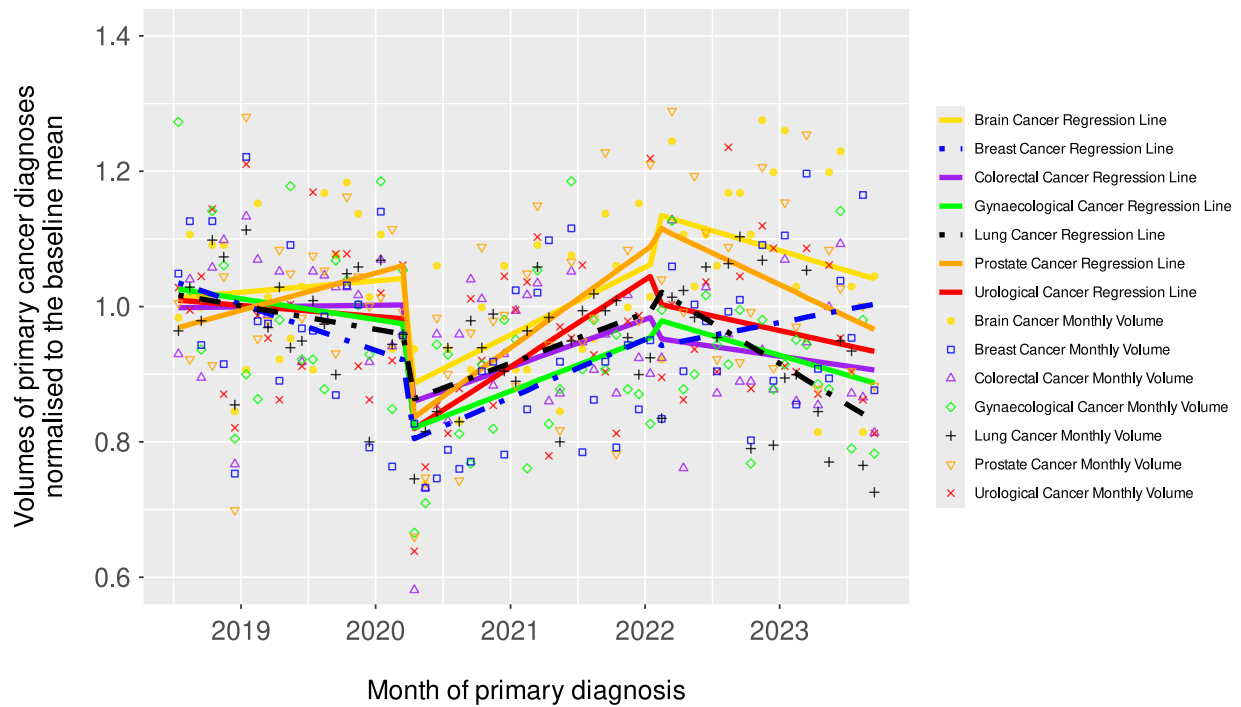
Proportion of newly diagnosed cancer patients surviving 12 months mirrored the drop in volume of primary cancer diagnosis from baseline to hard lockdown, particularly in Hospital 2, 3 and 5 (**Figure 2**). The trend of poorer survival during hard lockdowns which returns to pre-pandemic levels by the end of the study period was observed in four hospitals. Nevertheless, the lack of data collected on disease stage and cause of death, including COVID-19 related deaths, limits the interpretation of the current survival data and its association with the volume of primary cancer diagnoses.

Figure 2: Change in proportion of cohort surviving to 12 months from index date (diagnoses from Jul 2018 to Sep 2022), normalized to baseline mean (Jul 2018 to Jun 2019).



The overall number of primary cancer diagnoses significantly decreased from baseline to hard lockdown across the network. Statistically significant declines were observed in 5 distinct cancer groups with 2 other cancer groups showing a trend towards significance ($p < 0.08$ in dashed trendlines, **Figure 3**).

Figure 3: Change in the volume of new primary cancer diagnoses by cancer groups across the network, normalized to respective baseline mean.



Conclusion

This first pan-cancer study from the DigiONE network showcases the ability of five European hospitals to standardize and harmonize data in OMOP for over 120,000 patients collectively, and to collaborate on data analysis in a privacy-preserving manner without transfer of patient level data. The results presented in this study underscore the potential of harmonized data within the DigiONE network for comparative analyses of care practices and outcomes across different countries, as well as at the European network level.

References

1. Mahon P, Chatzitheofilou I, Dekker A, Fernández X, Hall G, Helland A, Traverso A, Van Marcke C, Vehreschild J, Ciliberto G, Tonon G. A federated learning system for precision oncology in Europe: DigiONE. *Nat Med.* 2024 Feb; 30(2):334-337.