Accurately counting cancer patients: An epidemiologic model to estimate the prevalence of epithelial ovarian cancer (EOC) while accounting for cure

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BACKGROUND

- The number of cancer survivors has grown significantly, with over 18 m people living with a cancer diagnosis in the U.S., projected to reach 22.5 m by 2032.[1]
- There are no clear guidelines regarding adjustment for cured patients; such that total patient counts may include patients who do not currently require treatment or monitoring for a disease that is no longer active
- Removing cured patients from total prevalence counts can provide a clearer picture of the cancer burden of patients in current need of cancer care, enabling better decision-making in healthcare planning, resource allocation, and research[2,3]
- An epidemiological model for prevalence over time was developed to combine incidence, survival, and cure data to estimate the prevalent population size with and without cure adjustment, using epithelial ovarian cancer (EOC) as an example[4]

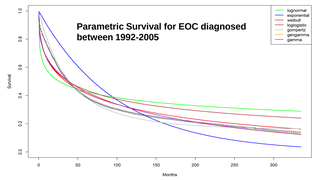
OBJECTIVE

- The objective was to develop an epidemiological model for EOC using Surveillance Epidemiology and End Results (SEER) data,[5] that factors in incidence, survival, and cure likelihood and timing, to calculate an overall prevalence estimate of EOC with and without cured patients included

METHODS

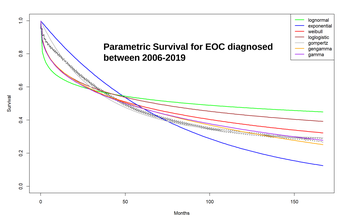
Model Overview & Data Source

- Data from the SEER database (1992-2019) were used to estimate incidence and survival for EOC patients over time[6]
  - All incident primary ovarian cancers (C56.9), regardless of lifetime sequence, diagnosed between 1992-2019 were included in the analysis
  - Cases of non-epithelial histology,[5] diagnosed through autopsy, with 0 days of survival and with unknown survival time were excluded
- For each annual incident cohort, a year-specific survival prognosis was estimated, reflecting the improved survival for EOC cases diagnosed in later years.
  - Kaplan Meier (KM) curves were available through the end of 2019[6]
  - Parametric extrapolation was used for projecting survival from 2020 to 2022.[7]
    - Based on visual inspection of the KM curves, separate parametric models were fit for cases diagnosed between 1992-2005 and 2006-2019, respectively
    - All standard parametric curves were fit, and generalized gamma was found to be the best-fitting curve, based on the AIC values[7]



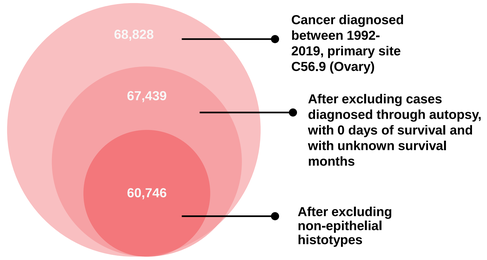
Characterization of EOC cure

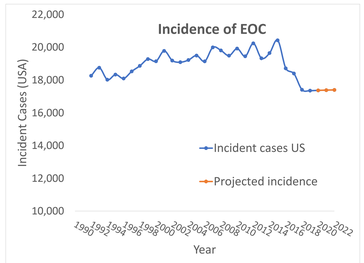
- Involved three parameters:
  - a) Time point post-diagnosis at which a proportion of survivors are assumed to be cured; b) proportion of survivors assumed to be cured at this time c) the time point post-diagnosis at which all survivors are assumed to be cured
- In the absence of the treatment-related data in SEER, the parameters of cure timing were derived from literature;[8] while proportion cured were calculated with conditional survival analysis:
  - A proportion of patients were assumed to be cured, at 9y post-diagnosis, based on the reported timing of the low-risk period during which annualized mortality stabilizes in all ovarian cancer patients[9]
  - All surviving patients were assumed to be cured at 14y post-diagnosis, the time point at which annualized mortality stabilizes in patients with distant ovarian cancer[9]. An alternative value of 12y was analyzed in sensitivity analysis[10]
  - Proportion cured was estimated as the proportion who remained alive at 14y post-diagnosis (12y in sensitivity analysis) among those who were alive at 9y[11]



RESULTS

- SEER included data on 68,828 cancer cases with a primary site in ovaries, diagnosed between 1992-2019. After applying the exclusion criteria, 60,746 cases were eligible for the analysis
- Annual incidence of EOC ranged from 17,354 in 2019 to 20,428 in 2015.

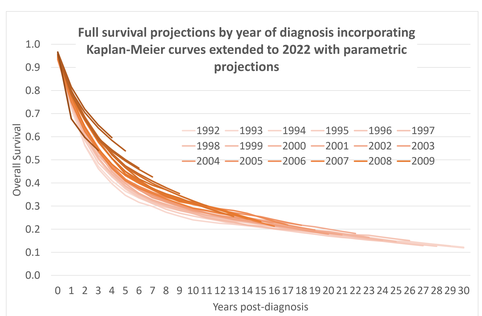




Histological subtypes and diagnostic codes of EOC

Histology subtypes	ICD-O-3 morphology/behavior codes
Carcinoma, NOS	8010/3, 8046/3, 8140/3, 8230/3, 8440/3
Carcinosarcoma	8575/3, 8950/3, 8951/3, 8980/3, 8981/3
Clear cell	8290/3, 8310/3, 8313/3, 8443/3, 8444/3
Endometrioid	8380/3, 8381/3, 8382/3, 8383/3, 8482/3, 8570/3
Malignant Brenner Carcinoma, NOS	9000/3
Mixed	8255/3, 8323/3
Mucinous	8470/3, 8471/3, 8472/3, 8480/3, 8481/3, 9015/3
Serous	8020/3, 8021/3, 8022/3, 8050/3, 8120/3, 8130/3, 8260/3, 8441/3, 8442/3, 8450/3, 8460/3, 8461/3, 8462/3, 8463/3, 9014/3
Carcinoma, NOS	8010/3, 8046/3, 8140/3, 8230/3, 8440/3

- Conditional survival analysis of SEER data estimated that, of patients surviving 9y post-diagnosis, 81% further survived to 14y, at which point cure was assumed for all patients.
  - In the scenario analysis, 87% of patients alive 9y post-diagnosis survived beyond 12y.
- The unadjusted estimate of prevalent EOC patients in 2022 was 181,379.
- When patients were removed for cure beginning at 9y post-diagnosis, the estimated number of active disease cases in 2022 was 106,549; a reduction of 41.3%.
  - In the scenario analysis, the estimated prevalence was 103,533.



LIMITATIONS

- SEER does not include data on disease status or treatment over time, thus prevalence estimate is based solely on survival data and assumptions regarding maximum survival time for cured vs. uncured patients. To mitigate this limitation, a conservative estimate for the time point at which all survivors were have been cured was used.

CONCLUSION

- Adjusting prevalence counts to remove cured patients led to a substantial decrease in the estimated number of EOC patients
  - The estimated number of individuals actively living with EOC in the US (i.e., the non-cured prevalence) is estimated to range from 103,533 to 106,549 across sensitivity analyses explored
  - The methods described here can be applied to other curable cancers
- In addition to the ability to adjust for cure, the methods described here represent a robust prevalence estimation technique that uses survival curves to represent a range of survival trajectories, as opposed to the standard *incidence x duration* calculation for prevalence (where duration is represented by a single mean or median value that may not accurately represent the influence of long-term survivors)[1]

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DISCLOSURES

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