

Potentially Avoidable Hospital Readmissions in Patients With Advanced Cancer

P. Connor Johnson, MD¹; Yian Xiao, MD²; Risa L. Wong, MD³; Sara D'Arpino¹; Samantha M.C. Moran¹; Daniel E. Lage, MD¹; Brandon Temel¹; Margaret Ruddy¹; Lara N. Traeger, PhD¹; Joseph A. Greer, PhD¹; Ephraim P. Hochberg, MD¹; Jennifer S. Temel, MD¹; Areej El-Jawahri, MD¹; and Ryan D. Nipp, MD¹

QUESTION ASKED: What are the rates and predictors of potentially avoidable readmissions (PARs) among patients with advanced cancer, and what are the associations among PARs, patient characteristics, and self-reported symptom burden?

SUMMARY ANSWER: We found that a substantial proportion of hospital readmissions are potentially avoidable. We reviewed 277 total hospital readmissions and identified 108 (39.0%) of these as PARs. We observed that married patients were less likely to experience PARs and that those with higher physical symptom burdens were more likely to experience PARs. The most common reasons for PARs were premature discharge from prior hospitalization and failure of timely follow-up.

METHODS: We enrolled patients with advanced cancer who had an unplanned hospitalization and assessed their patient-reported symptom burdens at time of admission. For 1 year after enrollment, we reviewed patients' health records to determine the primary reason for every hospital readmission, and we classified readmissions as PARs using adapted Graham's criteria. We examined predictors of PARs using non-linear mixed-effects models with binomial distribution.

BIAS, CONFOUNDING FACTORS, DRAWBACKS: We conducted this study at a single site with limited racial and socioeconomic diversity, and GI cancers represented the most common cancer type; therefore, our findings may not generalize to other populations.

REAL-LIFE IMPLICATIONS: We demonstrated that a substantial proportion of hospital readmissions are potentially avoidable among patients with advanced cancer and identified salient factors associated with PARs within this population. Collectively, our findings underscore the importance of addressing patients' social support needs and physical symptoms when attempting to decrease potentially avoidable health care utilization. In addition, we found that premature discharge and failure of timely outpatient follow-up were the most common reasons for categorizing readmissions as PARs, thus reflecting the need for efforts to improve care transitions in patients with cancer. By demonstrating the remarkably high prevalence of PARs among patients with advanced cancer and identifying predictors of these unwanted outcomes, we highlight the need for future work to develop and test intensive supportive care interventions in this highly symptomatic population.

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abstract

PURPOSE Patients with cancer often prefer to avoid time in the hospital; however, data are lacking on the prevalence and predictors of potentially avoidable readmissions (PARs) among those with advanced cancer.

METHODS We enrolled patients with advanced cancer from September 2, 2014, to November 21, 2014, who had an unplanned hospitalization and assessed their patient-reported symptom burden (Edmonton Symptom Assessment System) at the time of admission. For 1 year after enrollment, we reviewed patients' health records to determine the primary reason for every hospital readmission and we classified readmissions as PARs using adapted Graham's criteria. We examined predictors of PARs using nonlinear mixed-effects models with binomial distribution.

RESULTS We enrolled 200 (86.2%) of 232 patients who were approached. For these 200 patients, we reviewed 277 total hospital readmissions and identified 108 (39.0%) of these as PARs. The most common reasons for PARs were premature discharge from a prior hospitalization (30.6%) and failure of timely follow-up (28.7%). PAR hospitalizations were more likely than non-PAR hospitalizations to experience symptoms as the primary reason for admission (28.7% v 13.0%; $P = .001$). We found that married patients were less likely to experience PARs (odds ratio, 0.30; 95% CI, 0.15 to 0.57; $P < .001$) and that those with a higher physical symptom burden were more likely to experience PARs (odds ratio, 1.03; 95% CI, 1.01 to 1.05; $P = .012$).

CONCLUSION We observed that a substantial proportion of hospital readmissions are potentially avoidable and found that patients' symptom burdens predict PARs. These findings underscore the need to assess and address the symptom burden of hospitalized patients with advanced cancer in this highly symptomatic population.

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INTRODUCTION

Patients with advanced cancer often experience numerous symptoms and stressors that can affect their quality of life.¹⁻³ In addition, patients with cancer frequently require hospitalizations to help with the management of troubling symptoms, but hospital stays may cause additional distress for this population.⁴ Patients with cancer often wish to maximize their time away from the hospital⁵⁻⁷; however, those with cancer often experience frequent hospitalizations and readmissions, some of which may be potentially avoidable.⁸⁻¹⁰ Potentially avoidable readmissions (PARs) are hospital readmissions that might have been avoided because of either a preventable condition or treatment that was possible as an outpatient.⁸ To date, research investigating PARs among patients with advanced cancer is lacking; therefore, a critical need

exists to understand the prevalence and predictors of PARs in this population with high health care utilization.

Much of the existing data on potentially avoidable hospital admissions originate from the general medicine literature, which suggests remarkably high rates of potentially avoidable health care utilization. In this population, studies demonstrate that nearly 30% of hospital admissions are potentially avoidable.¹⁰⁻¹⁴ Currently, the data in oncology suggest that nearly one third of hospitalizations may be potentially avoidable¹⁵⁻¹⁹; however, researchers, to date, have not studied the prevalence and predictors of subsequent readmissions that may be potentially avoidable. In addition, the current literature in oncology investigating potentially avoidable health care utilization has been conducted using data that lack patient-reported

ASSOCIATED CONTENT

Data Supplement

Author affiliations and support information (if applicable) appear at the end of this article.

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outcomes. Inclusion of patient-reported outcomes could help to deepen our understanding of the relationship between patients' symptoms and potentially avoidable health care utilization. Of importance, hospitalized patients often experience worse symptom burdens than those in the outpatient setting,²⁰ and the association between hospitalized patients' symptom burdens and PARs is currently unknown. Thus, additional research is needed to help understand the predictors and characteristics of PARs among hospitalized patients with cancer as well as to investigate associations with patient-reported symptom burden.

In the current work, we sought to conduct a comprehensive study focused on identifying rates and predictors of PARs among patients with advanced cancer. Specifically, we aimed to examine associations among PARs, patient characteristics, and self-reported symptom burden. We anticipate that these findings will inform the development of future interventions targeting PARs in patients with advanced cancer.

METHODS

We prospectively enrolled consecutive hospitalized patients with advanced cancer in a previously described longitudinal cohort study.²¹ For the current study, we investigated patients with unplanned hospital admissions at Massachusetts General Hospital from September 2, 2014, to November 21, 2014. We identified and recruited patients by screening the daily in-patient oncology census. We obtained written, informed consent from eligible patients on the first weekday after admission, which was within 2 to 5 days of hospitalization, and then asked participants to complete a symptom burden questionnaire. We received approval for this study from the Dana-Farber/Harvard Cancer Center institutional review board.

Participants

Eligible patients included those who were age 18 years or older and admitted to Massachusetts General Hospital with a known diagnosis of advanced cancer, defined as patients not undergoing treatment with curative intent. We determined curative intent by reviewing the chemotherapy order entry treatment intent designation and clinical documentation in the electronic health record. We excluded patients who were unable to read and respond to study questionnaires in English or with minimal assistance from an interpreter, as well as those with elective or planned hospital admissions, defined as hospitalizations for chemotherapy administration, including desensitization, and scheduled surgical procedures.

Study Measures

Sociodemographic and Clinical Factors. For all participants, we obtained sociodemographic information from the electronic health record, including date of birth, sex, race, relationship status, education, and religion. We reviewed

patients' oncology clinic notes to ascertain Charlson comorbidity index, date of diagnosis with advanced cancer, and cancer type. We reviewed the electronic medical record to obtain information from a standardized questionnaire that was conducted by nurses within 1 day of admission to assess whether patients had impaired mobility.^{22,23}

Patient-Reported Symptom Burden. We used the self-administered Edmonton Symptom Assessment System Revised (ESAS-r) to assess patients' symptom burden at the time of index hospital admission.^{21,24,25} The ESAS-r asks patients about symptoms, such as pain, fatigue, drowsiness, nausea, appetite, dyspnea, depression, anxiety, and well-being, over the prior 24 hours. We also included constipation as a result of the pervasiveness of this symptom among patients with advanced cancer.²⁶ With the ESAS-r, patients report their symptom severity on a scale of 0 to 10 (0 indicating the absence of the symptom and 10 indicating the worst possible severity). Consistent with prior work, we categorized ESAS scores as follows: none (0), mild (1 to 3), moderate (4 to 6), and severe (7 to 10).²⁷ We also created a composite ESAS physical symptom variable that incorporates pain, fatigue, drowsiness, nausea, appetite, dyspnea, and constipation. The ESAS physical symptom score is well validated and has been previously used in oncology research.^{21,25,28}

Reasons for Hospital Readmissions. We conducted a comprehensive chart review to obtain information on all hospital admissions for patients from the time of enrollment (index hospitalization) to 1 year after enrollment. We adapted a coding schema previously developed in patients with leukemia to determine reasons for hospital readmission.¹⁶ The reasons for hospital readmission in the schema for our study included symptoms, GI bleeding, hemoptysis, fever without a source, febrile neutropenia, confirmed infection, GI or biliary obstruction, dehydration/electrolyte abnormalities, planned hospitalization, hospitalization as a result of a noncancer medical condition, cancer progression, and end-of-life care.¹⁹ Two coders, both physicians, independently reviewed patient medical records and used this coding schema to identify the primary reason for hospital readmission. A consensus panel of two board-certified oncologists reviewed each of the admissions from the initial coders to clarify any discrepancies.

PARs. To identify and characterize PARs, we used an adaptation of Graham's criteria, which is consistent with prior work.^{14,19,29} PAR categories in our study included inadequate medical management, premature discharge from prior hospitalization, failure of timely outpatient follow-up, social problems leading to admission, patient non-adherence to medical care, inadequate rehabilitation, patient receiving hospice or supportive care alone, and potential for outpatient management of medical issue. We reviewed each hospital readmission using a two-stage review process, as previously used in studies that involved

patients with leukemia and GI malignancies.^{15,19} The first stage involved two coders, both physicians, who independently reviewed the medical record for each readmission to determine and classify PARs via adapted Graham's criteria. When coding PARs, we achieved 77.3% agreement ($\kappa = 0.54$; 95% CI, 0.44 to 0.65), which is a moderate level of agreement. In the second stage of review, a consensus panel that consisted of the first two coders and two board-certified oncologists reviewed any readmission considered to be potentially avoidable by at least one coder for a final consensus determination of PARs.

Statistical Analysis. We used descriptive statistics to summarize patients' sociodemographic and clinical characteristics, the primary reason for hospital readmission, and PAR classification. To account for patients who had multiple hospital readmissions in our sample, we used non-linear mixed-effects models with binomial distribution to assess associations among patient characteristics, self-reported symptom burden, and PARs. In these models, we investigated age, sex, marital status, comorbidities, cancer type, months since advanced cancer diagnosis, impaired mobility, and ESAS physical symptoms as predictors of PARs. We performed statistical analyses using STATA software (version 14.2; STATA, College Station, TX; Computing Resource Center, Santa Monica, CA).

RESULTS

Among 232 eligible patients, we enrolled 200 (86.2% enrollment rate). For these 200 patients, 117 (58.5%) had at least one readmission in the year after their index hospitalization. For these 117 patients with at least one readmission, we reviewed 277 total hospital readmissions to investigate rates of PARs (Fig 1). Of the 117 patients with at least one readmission, patients (mean age, 63.80 years; standard deviation [SD], 13.04 years) were primarily white (94.0%), married (70.9%), and educated beyond high school (66.7%; Table 1). Patients had a mean time since diagnosis of advanced cancer of 18.04 months (SD, 24.11 months). Mean time from index hospitalization discharge to first readmission was 1.93 months (SD, 2.07 months). GI cancer was the most common cancer type (42.7%). We found that the most common reasons for patients' hospital readmissions were infections (26.0%) and symptoms (19.1%; Table 2).

We identified 108 readmissions (39.0%) as potentially avoidable. The most common reasons for classifying a readmission as a PAR were premature discharge from a prior hospitalization (30.6%) and failure of timely outpatient follow-up (28.7%; Table 2). Of note, PAR hospitalizations were more likely to have symptoms as their primary reason for hospital readmission compared with non-PAR hospitalizations (28.7% v 13.0%; $P = .001$).

Using nonlinear mixed-effects models, we identified factors associated with PARs (Table 3). Specifically, we found that

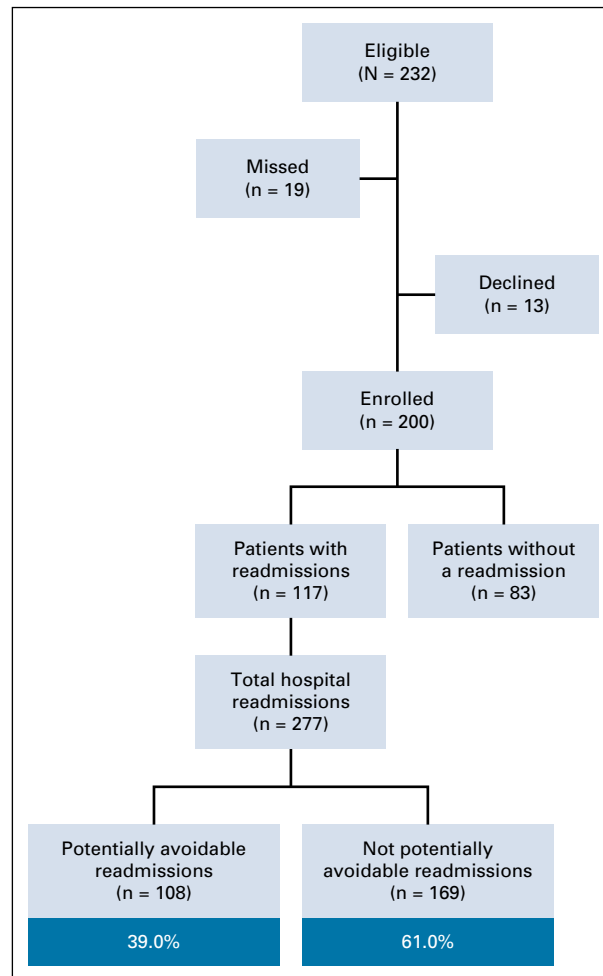


FIG 1. Flow diagram.

being married was associated with a lower likelihood of experiencing a PAR (odds ratio, 0.30; 95% CI, 0.15 to 0.57; $P < .001$). In addition, we found that a higher physical symptom burden was associated with a greater likelihood of having a PAR (odds ratio, 1.03; 95% CI, 1.01 to 1.05; $P = .012$).

DISCUSSION

Our analysis is a comprehensive study that identifies and characterizes PARs in patients with advanced cancer. Of note, we found a remarkably high rate of PARs, with more than one third of readmissions in our cohort classified as PARs. Premature hospital discharge and failure of timely outpatient follow-up were the most common reasons that a readmission was characterized as a PAR. We also investigated predictors of PARs, observing that marital status and physical symptom burden were significantly associated with PARs. Collectively, these findings highlight the need for targeted interventions to reduce PARs and help to elucidate the characteristics of patients who are at greatest risk for PARs and may benefit from such interventions.

Of importance, we identified the most common reasons for categorizing readmissions as PARs. Specifically, we found

TABLE 1. Patient Characteristics (N = 117)

Characteristic	No. (%)
Mean age, years (SD)	63.80 (13.04)
Sex	
Male	72 (61.5)
Female	45 (38.5)
Race/ethnicity	
White	110 (94.0)
Black	4 (3.4)
Hispanic	2 (1.7)
Asian	1 (0.9)
Relationship status	
Married	83 (70.9)
Single	18 (15.4)
Divorced	9 (7.7)
Widowed	7 (6.0)
Education	
Beyond high school	78 (66.7)
High school and below	30 (25.6)
Declined	9 (7.7)
Religion	
Catholic	51 (43.6)
Christian, non-Catholic	40 (34.2)
Jewish	12 (10.3)
Muslim	11 (9.4)
None	3 (2.6)
Impaired mobility*	36 (31.0)
Mean Charlson comorbidity index (SD)	0.85 (1.21)
Cancer type	
GI	50 (42.7)
Lung	16 (13.7)
Genitourinary	16 (13.7)
Melanoma	7 (6.0)
Gynecologic	7 (6.0)
Head and neck	5 (4.3)
Hematologic malignancies	5 (4.3)
Breast	4 (3.4)
Sarcoma	4 (3.4)
Cancer of unknown primary	3 (2.6)

Abbreviation: SD, standard deviation.

*One patient had missing data for impaired mobility.

that premature discharge from a prior hospitalization and failure of timely outpatient follow-up after hospital discharge were the most common reasons for a readmission to be categorized as a PAR. This underscores the importance of hospital discharge as a key transition point for patients with cancer.²³ Specifically, these findings suggest that efforts to

prevent PARs should focus on the care transition that occurs as patients leave the hospital and resume care in the outpatient setting with their cancer team, which could be adapted from care transition efforts in the general medicine population, such as the development of discharge checklists or the use of health care professionals as patient aids in care transitions.^{30,31} In addition, patients with limited support may have more difficulty with the logistics of follow-up care and hospital discharge transition. This likely puts those patients with limited social support, a predictor of PARs in our study, at high risk for readmission around the time of discharge. Taken together, our findings support the need to focus clinical resources on increasing support for patients around the time of discharge as a potential strategy for reducing PARs within oncology care.

To our knowledge, this study is the first to demonstrate a relationship between symptom burden and the risk of experiencing a PAR among patients with cancer. Although previous research has demonstrated relationships between patient-reported symptom burden and health care utilization,^{21,32} investigators, to date, had not studied the association between patients' symptom burden and PARs. In prior work, we found that hospitalized patients with advanced cancer experience a remarkably high symptom burden, which is associated with their hospital length of stay, risk for readmission, and discharge location.^{21,23} In the current study, we expand on our prior work to demonstrate that a higher physical symptom burden at the time of the index hospitalization predicted for greater risk of PAR. Clinicians may struggle to fully address all the physical and psychological symptoms of their patients,³³⁻³⁶ and our data suggest that this can place patients at risk for experiencing a subsequent PAR. Our findings underscore the need for additional research that focuses on identifying effective methods for monitoring and addressing the symptom burden of patients with advanced cancer postdischarge to reduce PARs. Recent data have demonstrated that patient-reported symptom monitoring interventions can improve quality of life, decrease health care utilization, and potentially enhance survival in patients with cancer.^{32,37} Thus, interventions that focus on patients' symptom burden, a potentially modifiable risk factor, have the potential to affect these individuals' health care utilization and diminish the prevalence of PARs among this population with high symptom burdens.

In addition, we found that patients who were married were less likely to experience a PAR. Marital status likely represents a proxy for social support. Of note, patients with limited support can struggle to manage their health care needs, especially when facing burdensome symptoms, functional decline, and the logistical demands that accompany a cancer diagnosis. Our findings suggest that patients without social support who have an unplanned hospital admission may benefit from interventions to provide additional support, such as patient navigation, more

TABLE 2. Reason for Hospital Readmission and Classification of PAR

Primary Reason	No. (%)
Readmission (n = 277)	
Infection	72 (26.0)
Symptoms	53 (19.1)
Planned hospitalization for chemotherapy, procedure, or expedited work-up	39 (14.1)
Noncancer medical condition	25 (9.0)
Cancer progression	18 (6.5)
Other (blood clot, abnormal laboratories, tachycardia, or complication after procedure)	16 (5.8)
Fever no source	15 (5.4)
Bleeding (GI tract)	12 (4.3)
Dehydration/electrolyte abnormalities	11 (4.0)
Bowel obstruction	7 (2.5)
Biliary obstruction	4 (1.4)
Febrile neutropenia	3 (1.1)
Bleeding (lung/hemoptysis)	1 (0.4)
End-of-life care	1 (0.4)
Classification of PAR (n = 108)	
Premature discharge from prior hospitalization	33 (30.6)
Failure of timely outpatient follow-up	31 (28.7)
Patient nonadherence	10 (9.3)
Patient on hospice	10 (9.3)
Inadequate medical management	8 (7.4)
Patient could have been managed in the outpatient setting	8 (7.4)
Patient on supportive care alone but admitted to the hospital	7 (6.5)
Social problems leading to admission	1 (0.9)

Abbreviation: PAR, potentially avoidable readmission.

intensive social work involvement, or care transition programs after hospital discharge.³⁸ By identifying patients who are at higher risk for experiencing PARs, our work has the potential to inform efforts that target the specific care needs of patients with cancer to align their care with their

preferences and maximize their time away from the hospital.

Addressing PARs in oncology represents an important goal in the changing landscape of health care delivery. The complexity and cost of oncologic care has led to the development of such programs as the Oncology Care Model, which was created to generate incentives toward promoting high-value care.³⁹ A reduction in PARs experienced by patients with cancer is a goal well suited to the concepts in the Oncology Care Model, as it can promote improved value by enhancing the quality of care while also lowering costs. Moreover, augmenting the efficiency of outpatient follow-up after discharge and addressing the symptom burden of oncology patients are both strategies that may affect PARs while achieving the broader goals of delivering high-value cancer care.

Our study has several limitations worth considering. First, we conducted this study at a single site with limited racial and socioeconomic diversity, and GI cancers representing the most common cancer type; thus, our findings may not be generalizable to other populations. Second, we did not have information about patients' hospital admissions outside of our health system and our rates of hospital admissions and PARs may therefore underestimate the true rates. Third, we included all consecutive patients with a hospitalization during our study period, rather than only those with an initial hospitalization, and patients with multiple prior admissions may differ from those with an initial admission with respect to their symptoms and risk of readmission. In addition, we tracked all hospital readmissions from the time of index hospitalization to 1 year after the index admission. Patients' treatment course and symptom burdens may have fluctuated throughout this time, which could affect their risk of PARs. Fourth, we assessed patients' symptoms at a single time (within 2 to 5 days of hospitalization) to better understand the association between initial symptom burden and future PARs. However, by assessing symptoms only once during the hospitalization, we lack information about changes over time and differences between the inpatient and outpatient settings. In addition, other important symptoms, such as diarrhea and fever, were not captured in our study. Finally, the reason for admission and classification of PARs both have inherent subjectivity and were determined by medical record review, including the discharge summary, which may be reflected in the moderate agreement observed in our κ statistics. Moreover, we recognize that the reasons for admission can be complex and evolving throughout each readmission, which may not be easily captured in a single coding. We attempted to maximize objectivity with a structured approach, but this remains an inherent limitation.

In conclusion, we have demonstrated that a substantial proportion of hospital readmissions are potentially avoidable among patients with advanced cancer. We also identified salient factors associated with PARs within this

TABLE 3. Multivariable Model of Predictors of Potentially Avoidable Readmissions

Variable	Odds Ratio (95% CI)	SE	P
Age	1.02 (0.99 to 1.05)	0.01	.121
Female	1.22 (0.67 to 2.22)	0.37	.524
Married	0.30 (0.15 to 0.57)	0.10	< .001
Charlson comorbidity index score	1.11 (0.82 to 1.50)	0.17	.508
GI cancer	0.87 (0.46 to 1.66)	0.29	.678
Months since diagnosis to admission	1.00 (0.99 to 1.02)	0.01	.492
Impaired mobility	0.81 (0.38 to 1.73)	0.31	.582
ESAS physical symptoms	1.03 (1.01 to 1.05)	0.01	.012

Abbreviation: ESAS, Edmonton Symptom Assessment System.

patient population. Of note, we observed that being unmarried and having a higher physical symptom burden were significantly associated with greater odds of experiencing a PAR. Collectively, our findings underscore the importance of addressing patients' social support needs and physical symptoms when attempting to decrease potentially avoidable health care utilization. In addition, we found that premature discharge and failure of timely outpatient follow-up

were the most common reasons for categorizing readmissions as PARs, thus reflecting the need for efforts to improve care transitions in patients with cancer. By demonstrating the remarkably high prevalence of PARs among patients with advanced cancer and identifying predictors of these unwanted outcomes, we highlight the need for future work to develop and test intensive supportive care interventions in this highly symptomatic population.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST AND DATA AVAILABILITY STATEMENT

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Potentially Avoidable Hospital Readmissions in Patients With Advanced Cancer

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