



## Original Research

## Defining care trajectories: The example of endometrial cancer



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## ABSTRACT

**Background:** The era of patient-centered care might lead to the conclusion that there are as many configurations of healthcare utilization within episodes of care as there are patients. However, variability among episodes of care is limited by factors such as local resources or patient characteristics. As a result, the differences among episodes of care are reduced, and a limited number of care trajectories are expected.

**Objective:** The aim of this study was to investigate the ability to identify clinically significant care trajectories using data on healthcare services used by patients with endometrial cancer.

**Methods:** A retrospective review of sixteen healthcare services used by 394 patients newly diagnosed with endometrial cancer was undertaken. Latent class analysis was used to investigate care trajectories.

**Results:** The analyses segregated patients into six care trajectories: 1) surgery without hospitalizations and emergency room [ER] visits; 2) surgery with hospitalizations and ER visits; 3) surgery, radiation therapy, and chemotherapy, without hospitalizations and ER visits; 4) surgery, radiation therapy, and chemotherapy, with hospitalizations and ER visits; 5) surgery and radiation therapy; 6) surgery and chemotherapy, with hospitalizations and ER visits. Classification of patients in trajectories with versus without hospitalizations and ER visits could only partially be explained by age, cancer stage, and grade.

**Concluding statement:** Utilization of healthcare services can be grouped into a number of defined trajectories in endometrial cancer. Identifying care trajectories and parameters associated with care trajectories could have important clinical and administrative implications.

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## 1. Introduction

Episodes of care are series of temporally contiguous health-care services related to treatment of an illness [1]. In the era of patient-centered care, care services are tailored to patients' needs

[2], which might lead to the conclusion that there are as many configurations of healthcare utilization within episodes of care as there are patients. However, variability among episodes of care is limited by factors such as local resources, clinical practice guidelines, patient characteristics, and severity of the condition. As a result, the differences among episodes of care are reduced, and a limited number of care trajectories are expected. However, limiting an episode of care to healthcare utilization for a single health condition leaves out significant parts of healthcare utilization for other health conditions within the same time period. Care trajectories can therefore be understood as the layout of a series of grouped and contiguous healthcare services (medical visits, interventions, prescriptions, etc.) for all conditions occurring within a time period whereby a single health issue evolves from diagnosis to discontin-

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uation of treatments for this issue, and carried out in a healthcare environment [3].

Identifying care trajectories as well as parameters associated with trajectories (that is, their correlates) could have important clinical and administrative implications, such as treatment planning and allocation of resources.

Two studies have investigated care trajectories in cancer [4,5]. The two studies, conducted among patients presenting with breast cancer, identified a variety of trajectories using data mining approaches. Healthcare services were restricted to active oncology treatments or hospitalizations in those two studies, and did not include other types of services such as emergency room (ER) visits or contacts with health professionals. In addition, trajectory correlates were not investigated.

The aim of the current study was to investigate the ability to identify clinically significant care trajectories using data on healthcare services used by patients with endometrial cancer. An operational definition of care trajectories is proposed, a methodological procedure to evaluate care trajectories is tested, and trajectory correlates are investigated.

## 2. Materials and methods

### 2.1. Data collection

The data for this study were obtained from seven databases registering mandatory medical activities in a cancer center affiliated to an academic hospital in Montreal, Canada (see [Supplementary Table 1](#)). Data pertaining to diagnosis and healthcare service utilization were collected from patients' digital files. The study includes all consecutive patients, above the age of 18, newly diagnosed with endometrial cancer from 2008 to 2012 ( $N=394$ ). The study was approved by the center's research ethics committee.

### 2.2. Measures

#### 2.2.1. Cancer

Tumor histology was categorized into endometrioid tumor and alike, clear cell and serous carcinoma, carcinosarcomas, and other. Endometrial cancer stage (I to IV) was according to the FIGO (International Federation of Gynecology and Obstetrics) classification [6], and cancer grade was categorized into well-differentiated, moderately differentiated, poorly differentiated, undifferentiated, and not determined/missing.

#### 2.2.2. Healthcare services

Utilization of sixteen healthcare services (see [Table 1](#)) was collected from the databases. The services were classified into five domains: (i) active oncology treatment (surgery, radiation therapy, chemotherapy); (ii) outpatient contacts with a healthcare professional in oncology for medical exams or follow-ups; (iii) outpatient contacts with a healthcare professional in family medicine or in medical specialties other than oncology for medical exams or follow-ups; (iv) hospitalizations; and (v) ER visits.

A dummy variable was created for each of the sixteen services, representing whether or not patients used the services. In our sample, almost every patient had visits with a gynecologic oncologist (94%) and almost no patients had visits with a surgical oncologist (2%). These variables were excluded from the analyses as they could unlikely discriminate between trajectories. In addition, those receiving radiation therapy were invariably seen by radiation oncologists, so the latter variable was removed from the analyses.

**Table 1**

Characteristics of 394 patients newly diagnosed with endometrial cancer included in the analyses.

Characteristics	N (%)	Mean (SD)
Age at inception		64.9 (12.3)
Tumor histology		
Endometrioid tumor and alike	341 (86.6)	
Clear cell and serous carcinoma	37 (9.4)	
Carcinosarcomas	12 (3.1)	
Other	4 (1.0)	
Cancer stage		
Stage I	272 (69.0)	
Stage II	31 (7.9)	
Stage III	62 (15.7)	
Stage IV	20 (5.1)	
Not determined, missing	9 (2.3)	
Cancer grade		
Well-differentiated	155 (39.3)	
Moderately differentiated	99 (25.1)	
Poorly differentiated	125 (31.7)	
Undifferentiated	5 (1.3)	
Not determined, missing	10 (2.5)	
Healthcare services		
Surgical treatment for cancer	339 (86.0)	
Radiation therapy	146 (37.1)	
Chemotherapy	123 (31.2)	
Medical oncologist	66 (16.8)	
Oncology nurse navigator	201 (51.0)	
Oncology/radiation oncology nurse	167 (42.4)	
Oncology allied health	83 (21.1)	
Surgical specialist	73 (18.5)	
Medical specialist	145 (36.8)	
Nursing and allied health	121 (30.7)	
Obstetrics/gynecology specialist	71 (18.0)	
Hospitalizations	100 (25.4)	
ER visits	126 (32.0)	
Surgical oncologist	8 (2.0)	
Radiation oncologist	187 (47.5)	
Gynecologic oncologist	371 (94.2)	

NOTE: SD = Standard deviation.

### 2.3. Operationalization of episodes of care

In this study, the episode of care began with the diagnosis of endometrial cancer and was deemed completed when no active cancer treatments (*i.e.*, cancer surgery, chemotherapy, or radiation therapy) were provided for a period of at least four months. This timeframe was selected as it represents the time period between routine follow-up visits during the first two years following remission in our institution. Care trajectories were identified using data on all healthcare services utilized at the hospital during the first episode of care. Healthcare utilization was followed from the time of diagnosis up to March 31, 2014.

### 2.4. Statistical analyses

To investigate individual trajectories, longitudinal calendar grids [7] were constructed using the SAS software (version 9.3). Day-to-day healthcare utilization (*e.g.*, type of service, duration, name of the healthcare professional) was mapped in the grids.

Latent class analysis [8,9] was used to group the sample into categories of individuals (the trajectories) who are similar within a category but different from individuals in other categories [10]. In latent class analysis, competing models presenting different numbers of trajectories are compared with fit indexes to determine the model that best fits the data. Criteria to decide on the number of trajectories used in this study were: (i) low Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC) and adjusted BIC; (ii) a significant Lo-Mendell-Rubin (LMR) test; (iii) a significant parametric bootstrapped likelihood ratio test (BLRT) [11]; and (iv)

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